

Exploring the Relationship between Critical Thinking Perceptions and Academic Success in 4th Grade Primary School Students

İsa Aydoğdu¹

Erzincan Provincial Directorate of National Education, Erzincan, Turkey
isaydogdu24@gmail.com

Abstract

This study examines the relationship between critical thinking perceptions and academic achievement of primary school students in fourth grade. The study utilized a relational screening model, one of the screening models. The research sample consisted of fourth-grade students (n=500) studying in 14 schools in the central district of Erzincan province. The research data were collected through the "Critical Thinking Perception Scale." The data were analyzed using Pearson correlation and regression analysis tests. As a result of the research, it was found that there was a moderately significant relationship between students' critical thinking perceptions and academic achievement. It was concluded that the sub-dimensions of reasoning, thinking in detail, and interpretation predicted academic success, but the sub-dimension of flexibility did not.

Keywords: *Critical thinking perceptions, Elementary education, Student success, Cognitive skills*

1. Introduction

The modern approach to education aims to teach students how to access and use information, not to burden them with knowledge. When we look at current programs, the aim is to teach the essential skills that people of the 21st century need to have. When examining the programs in Turkey, these skills have the same purpose and were determined as "critical thinking, creative thinking, communication, research-questioning, and problem-solving, using information technologies, entrepreneurship and correct, effective and beautiful use of the Turkish language" [1]. In recent programs, great importance has been given to acquiring Critical Thinking Skills (CTS), and achievements and activities have been prepared to acquire CTS. Undoubtedly, individuals can't develop the targeted skills only through program changes. Teachers must also be trained to teach CTS to make students learn CTS [2]. Students must actively develop their thinking to learn effectively in teaching-learning processes. Therefore, students must also be taught how to use the information provided. In this context, critical thinking training will positively impact students' academic success, outlook on life, and professional life. Thanks to these achievements, students will learn to

Article history:

Received (July 25, 2024), Review Result (September 2, 2024), Accepted (October 25, 2024)

* This study was produced from the author's master's thesis titled "Investigation of the Relationship between Critical Thinking Perceptions and Academic Successes of Primary School 4th Grade Students"

demonstrate positive social behavior, act more consciously, and question and find the truth [3].

Thanks to CTS, students can acquire skills such as establishing relationships between information, making inferences by reasoning, making conscious choices, predicting, thinking in detail, working out solutions to problems, making interpretations, making the right decision, and questioning. These skills are also the skills that make it easier for the student to learn and study. In the literature, it has been found that students who acquire CTS and use these skills can learn effectively [4]. Individuals with CTS can evaluate the information they have learned from many perspectives, establish cause-effect relationships, and find logical relationships by reasoning between the information and concepts they have learned instead of accepting them as they are. Therefore, thanks to CTS, individuals do not have to memorize what they have learned but contribute to their learning by understanding [5]. In this respect, critical thinking is one of the high-level cognitive skills that the student must acquire in the teaching-learning process and is among the targets of today's education programs [6].

At present, efforts are being made in many developed and developing countries to equip individuals with critical thinking skills and promote these skills through educational institutions. Individuals with developed CTS can compare information coming from different sources. They can easily recognize which information they access is correct and unbiased and which is incorrect and biased, and they can quickly obtain the information they need from all sources. These individuals can acquire knowledge independently and are not negatively affected by the information different sources try to impose on them for their purposes [7]. We must understand that critical thinking is a method to solve daily challenges because these challenges require logical reasoning, interpretation, analysis, and evaluation of accurate information to reach acceptable and reliable conclusions [8]. Individuals with CTS do not accept events without questioning; they can analyze the connections between events, look at the situations they encounter from a broad perspective, and know other people's ideas and perspectives. They can check the accuracy of information, test information, make accurate observations, and conclude from observations. They have abilities such as reasoning inductively and deductively and recognizing evidence in arguments [9].

Critical thinkers, who can think thoroughly, question, interpret, offer options, and view events from broad perspectives are essential for all countries, including Turkey. Students need to acquire critical thinking skills starting from primary school to raise individuals who do not accept everything they hear or learn as accurate, who question, who can make their own decisions, and who are aware of their responsibilities. Primary school education plays a vital role in a child's adaptation to society and personality development. Because what is learned in primary school is the most permanent learning and shapes the information that will be discovered later. For this reason, raising primary school students as critical thinkers at an early age is an important issue to be focused on. In actuality, the results of the intervention studies support the impact of critical thinking on academic performance. In the study by Hu et al. [10] on 158 Chinese primary school students, it was proved that the program of critical thinking skills increased the study motivation and academic success of children. Another study conducted in Iran revealed that training essential thinking skills significantly affects children's educational success [11].

In current literature, studies have proved a relationship between critical thinking and students' success in various fields [4][6][9][12][13][14][15][16]. In addition, research on children studying at different educational levels reveals a strong relationship between critical thinking and academic success [17][18][19][20]. However, it was found that the studies generally focused on secondary school and college students due to the lack of measurement

tools that could measure the critical thinking skills of primary school students. No studies examine whether there is a relationship between essential perceptions of thinking (CTP) and the academic achievements of primary school students. In this regard, the gap in this field can be filled by examining whether there is a relationship between CTP and the academic achievement of primary school students in 4th grade and by developing a scale that evaluates the critical thinking perceptions of primary school students.

1.1. Purpose of the research

This research examines the relationship between critical thinking perceptions and academic achievement of primary school students in 4th grade.

1.2. Problem statement

What is the relationship between critical thinking perceptions and academic achievement of primary school students in 4th grade?

1.3. Sub problems

1. Is there a relationship between critical thinking perceptions and the academic success of primary school students in 4th grade?
2. Can critical thinking perceptions of primary school students in 4th grade predict their academic success?

2. Method

2.1. Research method

The study used a survey model, one of the quantitative research methods, to determine the relationship between critical thinking perceptions and academic achievements of primary school students in 4th grade. Since data on multiple features were collected in the study and the relationship between them was examined, the relational screening model, one of the screening model types, was used. This screening model is a research model that aims to determine the existence and degree of change between two or more variables [21].

2.2. Population and sample

The research population consisted of primary school students in 4th grade (2016 students) studying in 50 primary schools in the city center of Erzincanin in the 2018-2019 academic years. The sample consisted of 4th-grade students (n=500) studying in 14 primary schools. They were selected from the study population with a stratified sample (low, middle, and high socioeconomic level) in line with the data received from the Turkish Statistical Institute (TUIK). After completion of the application, 38 students who answered the scale items incompletely more than once and showed extreme values in the normality analysis were excluded from the research, and the research was continued with 462 students. 50.4% (n=233) of the children participating in the study were girls and 49.6% (n=229) were boys.

2.3. Data collection tool

The study used the "Critical Thinking Perception Scale" to measure students' critical thinking perceptions. The achievement scores at the end of the year were used to determine students' academic performance.

2.4. Critical thinking perception scale

The scale was developed to measure the critical thinking perceptions of children. The scale consisted of four subscales and 15 items: reasoning (4 items), flexibility (4 items), thinking through (4 items) and interpretation (3 items). In the reasoning dimension of the scale, expressions aimed to explain the importance of what students have learned, establish relationships, and organize and predict information. Regarding flexibility, expressions about considering different results and openness to ideas were included. At the level of thinking in detail, expressions about thinking about the consequences and considering the opinions of others were used. In the interpretation dimension, there were expressions aimed at determining students' interpretive perceptions. The scale was in Likert type, and the questions were answered with "Always," "Sometimes," or "Never." As a result of the analyses, it was proven that the validity and reliability of the scale were ensured. The maximum score on the scale was 45, and the minimum score was 15. When examining the exploratory factor analysis results, it was found that there were five factors with eigenvalues greater than 1, and the total variance explained by these factors was 44.82%. As a result of the validity study, it was found that the factor loadings of the scale items were .40 and above. This result showed that the item quality was appropriate. When examining the reliability analysis results of the Critical Thinking Perception Scale, it was seen that the internal consistency coefficient (Cronbach Alpha) was .65, which proved that the scale was reliable [22].

2.5. Theoretical structure of the scale

Firstly, a literature review on critical thinking was conducted during the development phase of the scale [23, 24, 25, 26]. However, the "Critical Thinking Perception Scale" and CTP areas (interpretation, analysis, evaluation, inference, explanation, and self-regulation) were mainly formed by the consensus of experts in the "Delphi Project" conducted with the support of the "American Philosophical Association" and the participation of 46 experts in their fields under the chairmanship of Facione were developed and taken into account. In this context, scale items were created, and criteria such as interpretation, analysis, evaluation, inference, open-mindedness, and flexibility were considered. A draft scale that consisted of 45 items and was thought to include the determined criteria was prepared. The opinions of three experts in program development were consulted regarding the prepared criteria and items covering critical thinking skills.

2.6. Evaluation of academic success

To determine the student's academic success, year-end success scores were obtained from the schools where the application was made at the end of the academic year. End-of-year success scores include students' average grades from all courses (Turkish, mathematics, science, social studies, foreign language, visual arts, music, play, and physical activities) during a year.

2.7. Data collection process

The “Critical Thinking Perception Scale” developed to determine the critical thinking perceptions of primary school students in 4th grade was applied to 500 students studying in 14 primary schools in the city center of Erzincan in the 2018-2019 academic year. Before the application, permission (ethics committee) was obtained from the Erzincan Binali Yıldırım University Ethics Committee (03/04/2019), and necessary permissions were obtained from the Erzincan Provincial Directorate of National Education to carry out the application. After all the required permissions for the research were obtained, the application was carried out in the previously selected schools. During the application, the instructions were given to the students before filling out the scale; sufficient time (approximately 10 minutes) was given, and the students were asked to answer the scale items honestly and appropriately. To determine the student's academic success, year-end success scores were obtained from the schools where the application was made at the end of the academic year.

2.8. Analysis of data

The data obtained within the scope of the research were analyzed with The Statistical Package for the Social Sciences (SPSS) program. After the data were transferred to the SPSS 25 program, a normality analysis was performed to determine whether the data had a normal distribution. In this context, the values of skewness and kurtosis were first examined. As a result of this analysis, the values of skewness and kurtosis were re-examined, and the values for the reasoning dimension were -.521 (skewness) and -.097 (kurtosis), and the values for the flexibility dimension were -.229 (skewness) and -.391 (kurtosis). It was determined that the values of skewness and kurtosis for the thinking dimension were -.781 (skewness) and -.189 (kurtosis), and the values for the interpretation dimension were -.345 (skewness) and -.460 (kurtosis). As a result of the analysis, it was found that the data showed a normal distribution since there were no extreme values, and the coefficients of the skewness and kurtosis for the dimensions were between -1 and +1 [27]. "Pearson Moment Product Correlation" was used to determine the relationship between students' critical thinking perceptions and academic achievement because each data series was independent of the other and exhibited a normal distribution. Only one relationship was observed between the data series. Multiple Linear Regression Analysis was used to determine the predictive power of students' critical thinking perceptions on academic success because it was the examination of the relationship between a series of (predictor) variables that affected a predicted variable and this (predicted) variable [28]. The significance level in the research was accepted as 0.5.

3. Results

Pearson moment product correlation was examined to determine whether there was a relationship between the critical thinking perceptions and academic achievement of primary school students in 4th grade. The results are shown in Table 1 below.

Table 1. Results of Pearson product-moment correlation performed to determine the relationship between critical thinking perceptions and academic achievement of primary school students in 4th grade

		CTP	Academic Success
Critical Thinking Perceptions (CTP)	Pearson Correlation	1	.415**
	Sig. (2-tailed)		.000
	N	462	462

** $p < 0.05$

Table 1 shows a positive relationship between students' critical thinking perceptions and academic success ($p < 0.05$). However, since the correlation value of the two variables was between 0.40 and 0.59 ($r = .415$), it was determined that the relationship was at a medium level [29].

The Pearson moment product correlation results indicate the relationship between the critical thinking perceptions (reasoning, flexibility, thinking in-depth, and interpretation) of primary school students in 4th grade and their academic achievement, as shown in Table 2 below.

Table 2. Results of Pearson product-moment correlation performed to determine the relationship between critical thinking perceptions (sub-dimensions) and academic achievement of primary school students in 4th grade

		Reasoning	Academic Success
Reasoning	Pearson Correlation	1	.246**
	Sig. (2-tailed)		.000
	N	462	462
		Flexibility	Academic Success
Flexibility	Pearson Correlation	1	.098
	Sig. (2-tailed)		.036
	N	462	462
		Thinking through	Academic Success
Thinking through	Pearson Correlation	1	.368**
	Sig. (2-tailed)		.000
	N	462	462
		Interpretation	Academic Success
Interpretation	Pearson Correlation	1	.292**
	Sig. (2-tailed)		.000
	N	462	462

As shown in Table 2, the Pearson moment product correlation was conducted to determine whether there was a relationship between the flexibility perceptions and academic achievements of fourth-grade primary school students; it could be seen that there was a positive relationship between the students' flexibility perceptions and their academic achievements ($p < 0.05$). However, since the correlation value of the two variables was less than 0.20 ($r < 0.20$), it was determined that the relationship was at a very low level [29].

The Pearson moment product correlation was conducted to determine whether there was a relationship between the perceptions of comprehensive thinking and academic achievements of fourth-grade primary school students; it could be seen that there was a positive relationship between the students' perceptions of thorough thinking and their academic achievements ($p <$

0.05). However, since the correlation value of the two variables was between 0.20 and 0.39 ($r = .368$), it was determined that the relationship was at a low level [29].

The Pearson moment product correlation was conducted to determine whether there was a relationship between the interpretation perceptions and academic achievements of primary school students in fourth grade; it could be seen that there was a positive relationship between the students' interpretation perceptions and their academic achievements ($p < 0.05$). However, since the correlation value of the two variables was between 0.20 and 0.39 ($r = .292$), it was determined that this relationship was at a low level [29].

The results of the multiple linear regression analysis indicating the rate at which the critical thinking perceptions of primary school students in 4th grade predict their academic success are shown in Table 3 below.

Table 3. Results of multiple linear regression analysis on critical thinking perceptions of primary school students in 4th grade predicting their academic achievement

Predictor Variable	R	R2	Corrected R2	Standard error
Critical Thinking Perceptions (CTP)	,473	,224	,217	10,54081

Table 3 shows the predictor variable (critical thinking perceptions) to explain the change in the predicted variable (academic success), which was $R^2 = .224$. In this context, primary school students' essential thinking perceptions (predictor variable) in 4th grade explained 22% of their academic achievement changes.

The results of multiple linear regression analysis revealing whether there was a significant relationship between the critical thinking perceptions (predictor variable) and academic achievement (predicted variable) of primary school students in 4th grade are shown in Table 4 below.

Table 4. Results of multiple linear regression analysis revealing whether there was a significant relationship between the critical thinking perceptions and academic achievement of primary school students in 4th grade

	Sum of Squares	df	Mean Squares	F	p
Regression	14652,064	4	3663,016	32,968	,000

According to Table 4, it can be said that there is a significant relationship between the predictor variable and the predicted variable ($p < 0.05$).

The results of the analysis to determine which sub-dimensions are the predictive variables are shown in Table 5.

Table 5. Results of multiple linear regression analysis conducted on whether there is a significant relationship between 4th grade primary school students' critical thinking perceptions (sub-dimensions) and academic achievement

Variables	β	Standard error	t	p
Reasoning	1,171	,418	2,804	,005
Flexibility	,206	,346	,597	,551
Thinking through	2,609	,414	6,305	,000
Interpretation	2,325	,344	6,754	,000

Table 5 shows that the perceptions of reasoning, thinking in detail, and interpretation were less than 0.05 ($p < 0.05$). However, the p-value for flexibility perception was observed to be greater than 0.05 ($p > 0.05$). Thus, it was determined that the perceptions of reasoning, thinking in detail, and interpretation of primary school students in 4th grade significantly predicted their academic success, but their perception of flexibility did not.

4. Discussion

It was determined that there was a moderate positive relationship between CTS and academic achievement of primary school students in 4th grade. When the findings regarding the relationship between CBT and the academic success of primary school students in 4th grade were considered, it was determined that there was a low level of relationship between students' reasoning, thinking, and interpretation perceptions and their academic success. However, it was determined that there was a very low level of relationship between students' flexibility perceptions and academic success. It had been observed that the literature also supported this result. The study by O'Hare and McGuinness [30] investigated the relationship between critical thinking skills, non-verbal intelligence, and academic performance. However, other research highlighted the relationships between flexibility and academic success. Compared to those with poor resilience, individuals with greater resilience could select and activate positive approaches to learning, which could result in better academic achievement [31][32]. This connection has not been verified in various national samples; therefore, further cross-cultural research taking into account potential contextual modifiers such as societal culture [33] is needed. As a result of the study, it was determined that there was a moderate relationship between critical thinking, non-verbal intelligence, and academic performance. In the study by Villavicencio [15], the relationship between critical thinking and success was examined on 220 engineering students. The results showed that critical thinking was positively related to success. Ip et al. [34] investigated the relationship between students' essential thinking tendencies and academic success in their research on 122 nursing students studying at the Chinese University of Hong Kong. In the research, it was determined that students had a negative tendency to think critically. It was concluded that a positive relationship existed between students' academic success and their critical thinking tendencies. This result points to the vital relationship between academic success and critical thinking. Critical thinking skills contribute to children's questioning, problem-solving, and developing different solution skills. These skills can indirectly support academic success.

In this context, critical thinking skills should be considered in the curriculum to increase students' academic success. As a matter of fact, in the study conducted by Alkaya [35] to determine the effect of CBT-based science teaching on the academic achievement of students, the results showed that CBT teaching used with the success division technique was more effective on students' academic achievement and critical thinking skills than traditional teaching. Güzel [36] compared social studies teaching based on CBT with social studies teaching based on the conventional approach regarding the academic success of fourth-grade primary school students and their attitude towards the course and CBT. As a result of the research, it was determined that there was a significant difference between the experimental group and the control group, favoring the experimental group in terms of students' academic achievements, CBT, attitudes, and permanence in learning. Again, in the study conducted by Chukwuyenum [37], the effect of critical thinking on the mathematics achievement of secondary school students was examined. The study used a quasi-experimental design. Training on essential thinking skills was given to the experimental group in 80-minute

sessions twice a week for eight weeks; the control group continued their normal education, and no study was conducted with the control group. As a result of the research, it was determined that there was a significant difference between the mathematics achievements of the children in the experimental group, and the scores of the CBT and control groups were in favor of the experimental group. When the literature was examined, it could be seen that students with high critical thinking skills also have high academic success. In addition, research has found that the academic success of students who received training in critical thinking would increase. According to the findings of the study conducted by Reed and Kromrey [38], the CBT of students who received critical thinking training increased.

When the effect of critical thinking perceptions on the academic achievements of primary school students in 4th grade was considered, it was determined that the student's essential perceptions of thinking could predict their academic achievements. It was determined that critical thinking perceptions explained 22% of academic success and perceptions of reasoning, thinking in-depth, and interpretation were significant predictors of academic success. Accordingly, as the perception of reasoning, consideration in detail, and interpretation of student's increases, their academic success will also increase. Despite this, it was determined that the perception of flexibility was not a significant predictor of academic success. When the results are examined, the academic success of students who have developed skills in making inferences by reasoning, establishing connections between information, considering all thoughts, and interpreting events will increase. The study by Özcan [14] examining the relationship between mathematics achievement and CBT showed that CBT was related to mathematics achievement and was a predictor of mathematics achievement. Therefore, it can be said that the results of this study are similar to those of the literature. As a result, it can be said that critical thinking skills are an essential factor in increasing academic success. However, it can be said that there are other factors besides critical thinking in improving academic success. The results of this research prove that critical thinking is an essential factor.

5. Recommendation

The study observed a significant relationship between the perceptions of reasoning, thinking in detail, and interpretation and academic success of primary school students in 4th grade. To achieve success, critical thinking skills should be given due importance. Critical thinking training can be provided to teachers and students in this context. Additionally, teachers should ensure that a democratic environment is created in the classroom, encourage students to think by asking open-ended questions during the teaching-learning process, and allow all students to speak. Teachers should provide students with activities to develop critical thinking during extracurricular time and homework. Researchers can examine the relationships between teachers' perceptions of critical thinking and their students' perceptions of critical thinking. Additionally, studies that reveal the relationship between critical thinking skills and academic achievements of students studying at different levels can be conducted.

6. Limitations

The research has limitations on its participants, 462 students studying in the central district of Erzincan province. This limits the generalizability of the research. Subsequent research can be conducted by applying it to students studying in different regions and to larger groups. This study measured children's critical thinking perceptions based on students' self-reports. Subsequent research can be conducted by obtaining additional information from teachers and

parents. Children's academic success is not only affected by their perception of critical thinking. This study did not consider the personal characteristics of children, educational practices of schools, qualifications of teachers, and other factors, which also limits the generalizability of the results.

7. Conflict of interests

The author declares no conflicts of interest in preparing this article.

8. Funding

This research received no external funding.

References

- [1] Ministry of Education, Primary school Turkish course curriculum, (2005). Available at: <https://web.deu.edu.tr/ilyas/ftp/turkce2009.pdf>
- [2] Ö. Demirel, Program development in education from theory to practice, Ankara: Pegem Akademi Publishing, (1999)
- [3] B. Selçuk, "Investigation of the relationship between special area abilities of Turkish teachers and their tendency toward critical thinking skills (Muğla sample)," Master's thesis, Sıtkı Koçman University, Institute of Educational Sciences, Muğla, (2013)
- [4] S. S. Seferoğlu and C. Akbıyık, "Teaching critical thinking," Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, vol.30, no.30, pp.193–200, (2006)
- [5] S. Açıkgöz Ayrancı, "Relationship between the critical thinking skills and mathematics achievements of primary students," Master's thesis, Ankara University, Institute of Educational Sciences, Ankara, (2011)
- [6] A. Karbalaei, "Critical thinking and academic achievement," Revista De Lenguaje Y Cultura, vol.17, no.2, pp. 121-128, (2012). DOI:10.17533/udea.ikala.10948
- [7] E. Görücü, "Investigation of the relationship between the reading habits and critical thinking skills of sixth, seventh, and eighth-grade students," Master's thesis, Yeditepe University, Institute of Social Sciences, İstanbul, (2014)
- [8] N. Mafarja, H. Zulnaidi, and H. M. Fadzil, "Using reciprocal teaching strategy to improve physics students' critical thinking ability," Eurasia Journal of Mathematics, Science and Technology Education, vol.18, no.1, Article em2069, (2022). DOI:10.29333/ejmste/11506
- [9] C. Akar, "Critical thinking of elementary school students," Doctoral thesis, Gazi University, Institute of Educational Sciences, Ankara, (2007). Available at: <https://tez.yok.gov.tr/UlusalTezMerkezi/tezSorguSonucYeni.jsp>
- [10] W. Hu, X. Jia, J. A. Plucker, and X. Shan, "Effects of a critical thinking skills program on the learning motivation of primary school students," Roeper Review, vol.38, no.2, pp.70–83, (2016). DOI:10.1080/02783193.2016.1150374
- [11] M. Sharifi, J. Fathabadi, A. Karimi, and M. Sharifi, "The effectiveness of teaching critical thinking skills on students' academic achievement in mathematics and science: A study in Tims's framework," Iranian Journal of Learning and Memory, vol.1, no.1, pp. 21-30, (2018). DOI:10.22034/iepa.2018.77431
- [12] H. Karabacak, "Critical thinking skills of primary school students and level of critical thinking of fifth graders (sample from Erzurum province)," Master's thesis, Atatürk University, Institute of Educational Sciences, Erzurum, (2011)
- [13] A. Orhan, "Critical thinking dispositions and decision making as predictors of high school students' perceived problem-solving skills," The Journal of Educational Research, vol.115, no.4, pp.235–245, (2022). DOI:10.1080/00220671.2022.2113498

- [14] Z. Ç. Özcan, “Critical thinking skills and mathematics performance of middle school students,” *Medeniyet Eğitim Araştırmaları Dergisi*, vol.1, no.1, pp.43–52, (2017)
- [15] F. T. Villavicencio, “Critical thinking, negative academic emotions, and achievement: A mediational analysis,” *The Asia-Pacific Education Researcher*, vol.20, no.1, pp.118–126, (2011)
- [16] A. Zulfqar and A. Hayat, “Think how to think: Studying the relationship between critical thinking skills and academic achievement of learners at higher education,” *Journal of Social Sciences Review*, vol.3, no.2, pp.640–650, (2023). DOI:10.54183/jssr.v3i2.305
- [17] F. A. D’Alessio, B. E. Avolio, and V. Charles, “Studying the impact of critical thinking on the academic performance of executive MBA students,” *Thinking Skills and Creativity*, vol.31, pp.275–283, (2019). DOI:10.1016/j.tsc.2019.02.002
- [18] A. Ghanizadeh, “The interplay between reflective thinking, critical thinking, self-monitoring, and academic achievement in higher education,” *Higher Education*, vol.74, no.1, pp.101–114, (2017). DOI:10.1007/s10734-016-0031-y
- [19] J. León, J. L. Núñez, Z. Ruiz-Alfonso, and B. Bordón, “Music academic performance: Effect of intrinsic motivation and critical thinking,” *Revista de Psicodidáctica*, vol.20, no.2, pp.377–391, (2015). DOI:10.1387/RevPsicodidact.12673
- [20] J. Siburian, A. D. Corebima, and M. Saptasari, “The correlation between critical and creative thinking skills on cognitive learning results,” *Eurasian Journal of Educational Research*, vol.19, no.81, pp.99–114, (2019)
- [21] N. Karasar, *Scientific research method* (28th ed.), Ankara: Nobel Akademik Publishing, (2015)
- [22] K. Özdamar, *Statistical data analysis with package programs-1* (5th ed.), Kaan Publishing, (2004)
- [23] R. H. Ennis, “A logical basis for measuring critical thinking skills,” *Educational Leadership*, vol.43, no.2, pp. 44–48
- [24] P. A. Facione, *Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction (The Delphi Report)*, California State University
- [25] D. Kökdemir, “Decision making and problem solving under uncertainty,” *Doctoral thesis*, Ankara University, Institute of Social Sciences, Ankara: National Thesis Center, (2003)
- [26] N. Semerci, “Scale of critical thinking,” *Education and Science*, vol. 25, no.16, pp.23–26, (2000). Available at: <https://egitimvebilim.ted.org.tr/index.php/EB/article/view/5275/1438>
- [27] S. Büyükköztürk, *Multivariate statistics for social sciences: SPSS and LISREL applications* (25th ed.), Ankara: Pegem A Publishing, (2019)
- [28] A. Can, *Quantitative data analysis in the scientific research process with SPSS* (5th ed.), Ankara: Pegem A Publishing, (2017)
- [29] D. Öztuna, A. İ. Elhan, and N. Kurşun, “Relationship used in health research coefficients,” *Türkiye Klinikleri Journal of Medical Sciences*, vol.28, pp.160–165, (2008)
- [30] L. O’Hare and C. McGuinness, “Measuring critical thinking, intelligence, and academic performance in psychology undergraduates,” *The Irish Journal of Psychology*, vol.30, no.3–4, pp.123–131, (2009). DOI:10.1080/03033910.2009.10446304
- [31] H. Asikainen, T. Hailikari, and M. Mattsson, “The interplay between academic emotions, psychological flexibility and self-regulation as predictors of academic achievement,” *Journal of Further and Higher Education*, vol.42, no.4, pp. 439–453, (2018). DOI:10.1080/0309877X.2017.1281889
- [32] Ç. Toraman, H. F. Özdemir, A. M. Aytuğ Koşan, and Ş. Orakçı, “Relationships between cognitive flexibility, perceived quality of faculty life, learning approaches, and academic achievement,” *International Journal of Instruction*, vol.13, no.1, pp. 85–100, (2020). DOI:10.29333/iji.2020.1316a
- [33] W. Zheng, P. Akaliyski, C. Ma, and Y. Xu, “Cognitive flexibility and academic performance: Individual and cross-national patterns among adolescents in 57 countries,” *Personality and Individual Differences*, vol.217, Article 112455, (2024). DOI:10.1016/j.paid.2023.112455

- [34] W. Y. Ip, D. T. Lee, I. F. Lee, J. P. Chau, Y. S. Wootton, and A. M. Chang, "Disposition towards critical thinking: A study of Chinese undergraduate nursing students," *Journal of Advanced Nursing*, vol.32, no.1, pp.84–90, (2000). DOI:10.1046/j.1365-2648.2000.01417.x
- [35] F. Alkaya, "The effect of science education based on critical thinking skills on prospective science teachers' problem-solving skills," Master's thesis, Mustafa Kemal University, Institute of Social Sciences, Hatay: National Thesis Center, **(2006)**
- [36] S. Güzel, "The effect of critical thinking skills based on social studies to fourth-grade students at primary education on learning outcomes," Master's thesis, Mustafa Kemal University, Hatay, **(2005)**
- [37] A. N. Chukwuyenum, "Impact of critical thinking on performance in mathematics among senior secondary school students in Lagos state," *IOSR Journal of Research & Method in Education*, vol.3, no.5, pp.18–25, (2013). DOI:10.9790/7388-0351825
- [38] J. H. Reed and J. D. Kromrey, "Teaching critical thinking in a community college history course: Empirical evidence from infusing Paul's model," *College Student Journal*, vol.35, no.2, pp.201–215, **(2001)**