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A HOLISTIC ANALYSIS ON THE EFFECT OF CRITICAL THINKING PRACTICES IN EDUCATION ON ATTITUDE: A MIXED-META METHOD

Research article

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Abstract

The aim of this study is to analyze the effectiveness of applied research on the effect of critical thinking skills, which is very important in the epistemology of the Information Age, on student attitudes. The study was conducted with a mixed-meta method, based on document analysis and consisting of meta-analysis (quantitative) and meta-thematic (qualitative) dimensions. In this context, studies on the effect of critical thinking on student attitudes covering the years 2003-2021 were scanned in Turkish and English sources. Depending on the inclusion criteria in accordance with the relevant methodology, five studies were analyzed with the CMA data analysis program and the effect size of critical thinking on attitude was calculated as g = 0.738 at a "medium level". Accordingly, it can be said that critical thinking skills have a positive effect on students' attitudes towards the course. Within the scope of the meta-thematic analysis process, 12 studies were reached within certain criteria. These studies were examined with the content analysis method and certain themes and codes were reached. As a result, the themes of "the impact of critical thinking practices on individual development", "the impact on 21st century skills" and "the impact on the learning process" were obtained. By consulting an expert opinion, it was confirmed that these themes and codes were compatible. As a result of the study, it was determined that the results of the meta thematic analysis supported the results of the meta-analysis. In the study, this situation was evaluated as critical thinking practices not only have positive effects on students' attitudes, but also support students' academic development in cognitive terms.

Keywords: Critical thinking, Attitude, Meta-analysis, Meta-thematic

1. Introduction

In a rapidly changing world, individuals are exposed to too many stimuli. By understanding the data coming from these stimuli and quickly passing them through mental processes and filters and structuring them, determining the reactions that individuals should give has become more frequent and uncontrolled. Some difficulties and dangerous situations that arise with the widespread use of communication technologies also have an impact on this (Spitzer, Eisenberg & Lowe, 1998). Nowadays, individuals are exposed to a lot of messages, stimuli and information through this communication tool. If this situation is not managed well, it can lead to uncertainty in perception management. Therefore, an important competence that individuals must have today is to use their thinking skills effectively. Because perception management affects our perception of the world, our thoughts and judgments (Paul, 1984). In

such an environment, the psychological, social and physical health of individuals stands out as an important problem. Therefore, in the Information Age called the 21st Century, there has been a need for education to raise individuals holistically in terms of mental, psycho-social and physical aspects (Tutkun & Aksoyalp, 2010: 158). Because the development in this aspect regarding perception management is considered among the basic requirements of the Information Age (Çiftçi, Sağlam & Yayla, 2021). It is stated that individuals who receive and react to all the messages they receive without questioning will be exposed to serious threats and dangers in this age (Söylemez, 2016). Critical thinking skills are an important competence in confronting these threats and dangers.

Critical thinking is very important for individuals to have a healthy perception management against the uncontrolled communication and messages of the 21st century (Eryılmaz & Uluyol, 2015). In order to better understand the concept of critical thinking, which is considered a critical competence from education to business life today, it is useful to look at its etymology. The word critical is derived from the Latin words "kriticos", meaning discriminative judgment, and "kriterion", meaning standard, and etymologically, it means "the authority to make decisions based on standards" (Paul, Linda, Bartell, 1997 cited by: Önal, 2020: 32). Critical thinking has many different definitions in the literature; It is defined as the individual's ability to analyze, understand and express messages, stimuli and information in different ways. In these definitions, it is pointed out that critical thinking means perceiving a phenomenon with its negative or positive aspects (Keçeci & Kavukçu, 2023: 19). The components of critical thinking are listed as follows: Looking at the sources and evidence of information, selecting, separating, comparing and determining alternatives, recognizing prejudices and logical fallacies, defending and making inferences (Saçmalıoğlu, 2019: 10). Critical thinking, broadly defined as questioning the source and content of the message and therefore being able to make valid decisions, is among the basic cognitive skills that an educated individual should have today (NCEE, 1988). Because this skill is actually the individual's form of defense in today's complex information environment (Epstein, 1999). Because this skill prevents individuals from making wrong decisions based on uncertain information. In this respect, critical thinking is important not only for holding on to the 21st century, but also for peace in social life and a democratic society. Critical thinking is also valuable in 21st century education in terms of preparing individuals for a quality life with their academic development (Baykul, 2003). This is why today, in many educational approaches and educational philosophy, critical thinking is accepted as an indispensable part of the teaching process (Norris, 1985).

2. Conceptual Framework

2.1. Concept of Critical Thinking

Like many contemporary concepts that are the subject of education, there are different approaches and definitions about critical thinking. However, despite this, there are some definitions that are agreed upon as a framework and a serious literature based on these definitions. Critical thinking, which is very important for healthy perception and decision-

making of individuals exposed to the complex information of the 21st century, has attracted the attention of many scientists (Akar, 2007). Although the philosophical background of the concept of critical thinking dates back to ancient times, Socrates and Plato, it is known that it was also used by Descartes and subsequently Dewey in the modern period. The etymological basis of the word "criticism", which is the backbone of this concept, is the Latin word "criticus". This word has been used in a general sense as "the art of judgment" (Virlan, 2021: 255). By definition, critical thinking is the ability of students to put into practice the knowledge they have acquired and recorded and to change their previous learning by seeing their own thoughts as valuable (Norris, 1985). In this definition, critical thinking is considered as mental flexibility. İpşiroğlu (1989) also defined critical thinking as "the most developed of thinking skills", and in this definition, a relationship is established between critical thinking and metacognition. Paul (1995) considers critical thinking in the context of the perfection of thought and refers to the individual's self-directed way of thinking that disciplines the mind. According to Semerci (2000), critical thinking is the individual's ability to question and evaluate the stimuli that reach him/her, rather than accepting them as they are, and making a judgment. Similarly, Cüceloğlu (2001) states that critical thinking; He sees it as being aware of one's own thinking processes. According to the author, critical thinking is when an individual operates an active and organized mental process. Mayer (2002), who deals with the subject in the context of independent thinking, states that critical thinking is the individual's ability to make sense of what he has learned through his own efforts. A commission selected from US and Canadian scientists under the leadership of the American Psychological Association (APA) defines critical thinking as "the individual making analytical and evaluative conscious judgments and expressing these judgments in order to decide what to do and what to believe" (Evancho, 2000).

2.2. Studies in the Field of Critical Thinking

Critical thinking, which has a philosophical background dating back to ancient times and is used by modern scientists, is still considered among the 21st century skills (Yalçın, 2018). In this regard, it can be stated that critical thinking skill is actually a concept that has always been respected as a measure of mental development or the reasoning power of the mind. In this respect, many studies continue to be carried out on critical thinking today. When we look at the issue in the context of our country, it is noteworthy that the research on critical thinking in Turkey is mostly related to economic sciences and education. The reason for this is that critical thinking, which is very important for an individual's qualified perception, thinking and decision-making, can be gained through education. For example, in Akınoglu's (2001) research on fourth-grade primary school students, it was observed that students' attitudes towards the course and their success in the Science Course, which was taught based on critical thinking skills, were higher compared to the traditional approach. Similarly, Şahinel (2001) found that critical thinking skills were more effective on the development of integrated language skills, students' total achievements and attitudes towards the Turkish course, compared to the traditional method. In the study conducted by Güzel (2022), he examined the effect of teaching critical thinking skills on the critical thinking skills of 5th grade students. As

a result of the study, it was determined that this teaching positively affected students' critical thinking skills in many ways, such as decision-making, different thinking abilities, understanding the plot of a given event, understanding the cause and effect relationship in events, discovering and making evaluations, that is, reaching conclusions. In another study conducted by Arısoy (2017), the effect of the mathematics course implemented using critical thinking teaching on students' critical thinking skills and attitudes towards the course was investigated. As a result of the study, it was concluded that critical thinking positively affected students' thinking styles, that is, their thinking skills increased, their interest in mathematics lessons increased, they were more easily motivated and their course success increased. In his study, Babacan (2017) examined the effect of critical thinking on primary school students' practices in the field of social skills in the science curriculum, and as a result of the research, it was determined that these two skills affected each other. In a study conducted on teachers, it was determined that teachers' competencies in problem solving, decision making, asking questions, and critical and creative thinking skills increased with critical thinking (Gelen, 1999). In the study conducted by Semiz (2011), the suitability of the questions and activities in the textbooks of 4th and 5th grades for critical thinking was examined by consulting teachers' opinions from various aspects. As a result of this study, teachers stated that the suitability of the activities in the textbooks for critical thinking was at a medium level. In a study similar to this research, Kanik (2010) aimed to evaluate classroom teachers' understanding of critical thinking and the methods, homework, etc. they used during the lesson. For this purpose, teachers' opinions were taken. As a result of the study, it was revealed that these teachers had perspectives about themselves that were against critical thinking. Munzur (1999) examined the contributions of the questions and activities in the textbooks to teaching critical thinking. According to this research, current textbooks are not sufficient to provide students with creative thinking, problem solving and critical thinking skills. Considering these studies, it can be said that critical thinking skills provide more conscious perception and learning, increase the level of students' answers to questions, and raise students' awareness.

2.3. The Effect of Critical Thinking on Attitude

In addition to providing cognitive support to students academically, critical thinking mentioned above can also make a significant contribution to affective characteristics such as attitude. The fact that academic success has cognitive, affective and behavioral dimensions (Akpınar, 2017) also makes the relationship between critical thinking and attitude important. Another factor that makes attitude important is that this feature is among the main variables of the teaching and learning process (Karatay & Kartallıoğlu, 2016). Another point that makes the phenomenon of attitude important in academic development is that attitude is important in knowing the individual and knowing the individual is critical in education. In this regard, the relationship between critical thinking and attitude can be seen as an important field of study in education.

The concept of attitude, which means "adaptation" or "ready for action" in Latin, is defined as mental tendencies towards an object, event, person or situation (Mıdık, 2018). Attitude, which can be defined in different ways depending on the historical process and context of consideration, is, in the most general sense, the way an individual takes a stance

towards objects or issues that have a psychological value (Kırnaz, 2010: 21). In other words, attitude is the positive or negative behavior of someone towards any object, event or situation (Turanlı, Türker & Keçeli, 2008). Attitudes are a psychological structure that includes cognitive, affective and action processes that are developed later and continue for a while (Akdemir, 2006). The relationship between attitude and the concept of critical thinking is not only because they affect each other, but also because they are interconnected. Because in order for an individual to be described as a "critical thinker", this individual must be able to use critical thinking skills effectively, which depends on attitude. It is the individual's positive attitude towards this competence that turns critical thinking into a continuous response. According to Halpern (1989), no one can become a better thinker by reading books. The use of these skills is related to attitude. Therefore, the basis of critical thinking skill is an attitude towards critical thinking. Based on this, as a result of examining the critical thinking attitude, clues about the individual's basic life skills can be obtained. For example, based on the individual's ability to think critically, it can be determined that this individual is interested in maintaining this ability and that this individual also has problem-solving skills (Kazancı, 1989). On the other hand, an individual's problem-solving skills can be considered an indicator of his/her critical thinking competence. Because critical thinking is a process and bundle of skills, including problem solving, consisting of attitudes, knowledge and skills based on personal judgments (Duchscher, 1999; Hickman, 1993).

3. Method

The general purpose of this study is to analyze the effectiveness of applied research on the effect of critical thinking skills, which are very important in the epistemology of the Information Age, on student attitudes. Within the framework of this general purpose, answers were sought to the following questions:

In the studies used in the analysis, what is the impact level of critical thinking practices on student attitudes?

What is the impact of critical thinking practices on students' individual development?

What is the impact of critical thinking practices on students' 21st century skills?

The motivation for the study, which was carried out through meta-analysis and meta-thematic analysis processes based on literature review within the framework of the documentary analysis method, is the partial gap in the literature. As a matter of fact, academic success, attitude (Munzur, 1999; Akınoğlu, 2001; Güzel 2022) and tendencies regarding critical thinking (Bökeoğlu & Yılmaz, 2005; Bulut, Ertem & Sevil 2009; Serap 2012) have been extensively examined in critical thinking and surveys. Additionally, there are studies in the literature about teachers' understanding of critical thinking (Korkmaz 2009; Polat 2017; Şengül & Üstündağ, 2009) and their reflection of this in teaching (Seferoğlu & Akbıyık, 2006; Kurnaz 2019; Çalışkan 2019). On the other hand, the effects of learning styles on critical thinking are also among these studies (Beşoluk & Önder, 2010; Çelik 2015; Güven and Kürüm, 2006). From the perspective of in-class academic development, there are studies such as the development of critical thinking skills (Semerci 2003; Özdemir 2005) and the relationship between problem-solving skills and critical thinking (Erdem & Genç, 2015; Türnüklü &

Yeşildere, 2005). However, in these studies, there are very few meta-thematic and meta-analysis studies that approach critical thinking holistically (Çolak, Anasız & Yorulmaz, 2019; Sezer, Küçüktepe, Yıldız, 2022; Ay & Orhan, 2020). This situation can be considered as an indication of the importance of related research.

3.1. Research design

This study, which aims to determine the effect of critical thinking on student attitudes, was conducted with the mixed meta method, which is within the framework of documentary analysis and has meta-analysis and meta-thematic analysis dimensions. In this context, the effect of critical thinking on attitude was used in a quantitative meta-analysis and as a complement to this, a qualitative meta-thematic analysis. As a matter of fact, the mixed-meta method based on document analysis (document scanning) management is a holistic method that provides analysis by considering both quantitative and qualitative data together. This means that the mixed-meta method is used to analyze quantitative data (meta-analysis) with analysis programs such as CMA/MetaWin; It is stated that qualitative findings (meta-thematic) is a method that helps to access comprehensive and rich content by analyzing them with programs such as Nvivo/Maxqda (Batdı, 2020: 3). The stages applied with the mixed-meta method in the study are explained in detail below:

3.2. Meta-Analysis Process

The meta-analysis process was used to determine the effect of critical thinking on attitude, which is the quantitative dimension of the research. Meta-analysis is the combination of the findings of quantitative studies conducted independently on a certain subject in a single study by passing them through appropriate statistical processes (Çetin, İlhan & Şahin, 2021: 121). Crombie and Davies (2009: 3) describe the meta-analysis process as a statistical technique that involves the combination and reinterpretation of the results of independent quantitative studies on a certain subject. In meta-analysis, the findings of studies in the literature are used as the data source. In the meta-analysis process, first studies on the subject are accessed through literature review. In order for the studies to be included in the meta-analysis, they must contain certain statistical data and meet the criteria determined by the researcher (Çetin, İlhan & Şahin, 2021: 121).

3.3. Collection of Data

In the literature review on the effects of critical thinking on student attitudes, keywords such as "Critical thinking, critical thinking practices, critical thinking in education, the effect of critical thinking on attitude" were used in order to reach the relevant studies. In this context, YÖK and ProQuest databases were used. The scanned studies were included in the study considering certain criteria. These criteria are that the studies reached are related to critical thinking skills and the effect of critical thinking on attitude, that they are national and international publications, that the studies are published between 2005-2023, that they are written in Turkish and English, and that they contain statistical data (x, n, ss). Finally, for the

meta-analysis process, a total of five studies that met these criteria were deemed appropriate to be included in the analysis. The process of including studies in meta-analysis and meta-thematic analysis is given with the help of the PRISMA flow diagram in Figure 1 below.

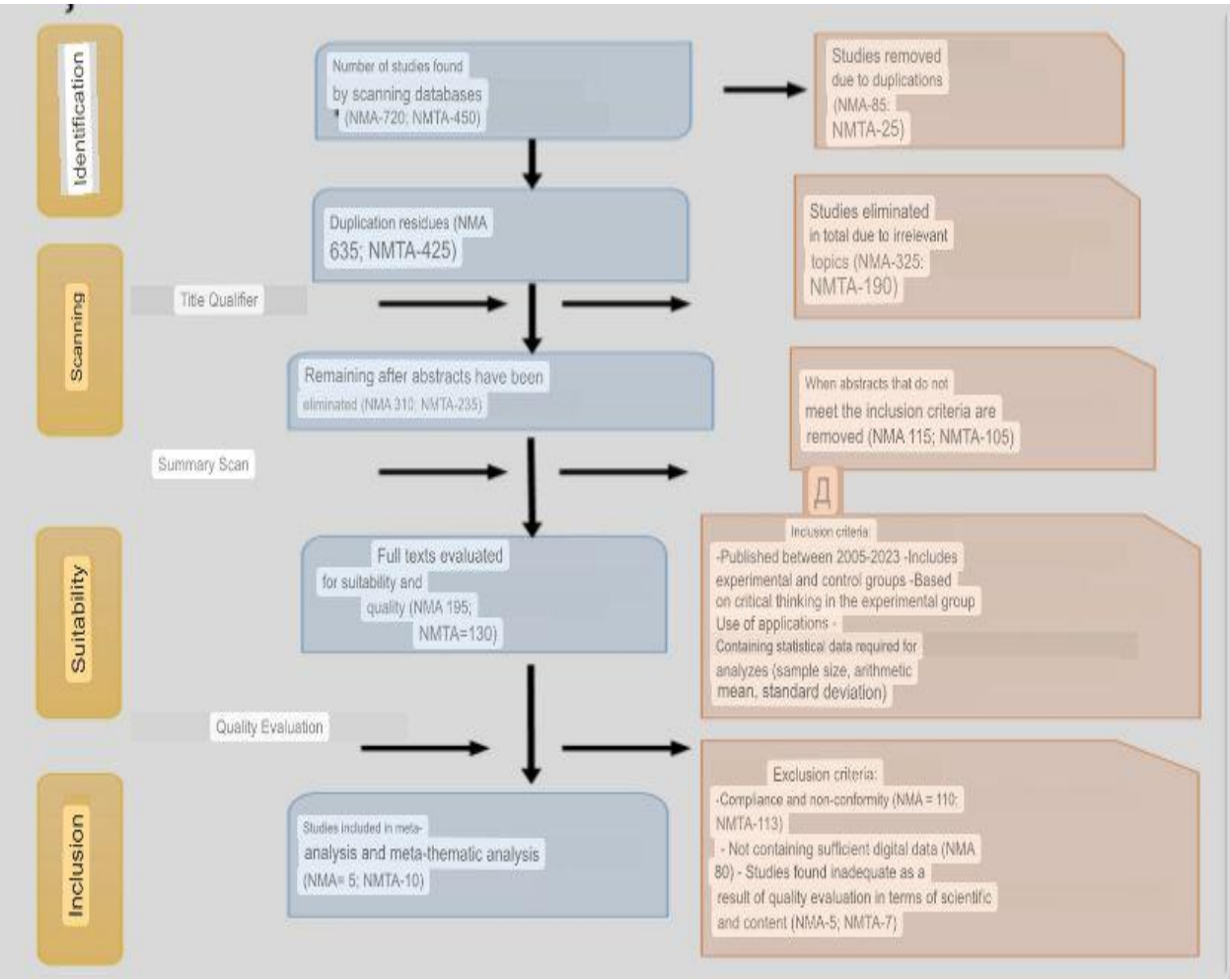


Figure 1. *Studies included in the analysis*

Note: * NMA=Meta-analysis, NMTA=Number of studies included in meta-thematic analysis

After scanning the databases, 720 studies on critical thinking were found within the scope of meta-analysis and 450 studies within the scope of meta-thematic analysis. Considering the inclusion criteria, 5 suitable studies remained for meta-analysis and 7 suitable studies for meta-thematic analysis, as shown in Figure 1.

3.4. Analysis of Data

In the study, CMA program was used to calculate the effect size of the research and perform graphical operations. Thalheimer & Cook's (2002: 4-9) level classification was used to interpret the value of the effect size. Additionally, the random effects model (REM) was used to analyze the studies included in the meta-analysis process of the study. Within the scope of the mixed-meta method, the effect size reached during the meta-analysis process is an important element. Effect size is also called “effect width”. Effect size is used to determine the effect value of an independent variable on a dependent variable (Cohen, 1994; Vacha-Haasse

& Thompson, 2004). It can also be said that this is an indicator of the significance level of the research results. "Cohen's d" and "Hedge's g" coefficients are used to calculate the effect size value.

3.4.1. Meta-Thematic Analysis Process

The second dimension of the study consists of qualitative studies. Meta-thematic analysis was used to analyze qualitative research data. Within the framework of meta-thematic analysis, which is the second dimension of the mixed-meta method, it is aimed to obtain research results that include a broader scope and obtain rich data by evaluating and combining the results of qualitative studies conducted on a specific research topic. In other words, meta-thematic analysis can be explained as an analysis process that includes accessing qualitative studies through document analysis and creating themes and codes by re-evaluating the findings in the studies (Batdı, 2019:11; 2020: 3). As a result of this analysis, it is aimed to reach conclusions containing more general and holistic data by bringing together the findings of the re-evaluated studies. In the meta-thematic analysis process, the most distinctive feature can be stated as obtaining research outputs with high reliability by accessing raw data in qualitative studies (Batdı, 2019: 11).

In this research, meta-thematic analysis was used to determine the effects of critical thinking on student attitudes. In this context, qualitative studies, including participant opinions, were obtained using the document analysis method in order to determine the effect of critical thinking on individual development, 21st century skills and learning processes. Document analysis includes the analysis of written materials containing the data intended to be researched. Corbin and Strauss (2008) define document analysis as a planned process that enables detailed examination of written and electronic resources and making sense of the information obtained from these examinations. However, the sources accessed during the document analysis phase should be recorded without any intervention from the researcher (Bowen, 2009). In the study, qualitative data regarding critical thinking collected based on document analysis were analyzed through content analysis. The main process performed in content analysis is to bring together similar and common data within the scope of certain concepts and themes and organize them in a way that the reader can understand (Yıldırım & Şimşek, 1999: 187).

Therefore, during the meta-thematic analysis process of this study, various themes and codes obtained as a result of the content analysis were reinterpreted. In this context, common aspects were found by examining the contents of the studies that met the criteria. Additionally, to ensure reliability, verification and justification, and excerpts from the statements in the research, including themes and codes, are provided. Direct quotes are given without comment. To increase the reliability of the study, these quotations are given with codes and page numbers. In short, based on qualitative document analysis, the data of studies related to applications containing raw data were reinterpreted through content analysis. In this process, Maxqda-11 qualitative data analysis program was used for the studies included in the analysis.

3.4.2. Coding

Coding of data has an important place in the meta-thematic analysis process. Coding ensures semantic integrity in the data and makes conceptualization easier (Keller, 1995). For this reason, the studies within the scope of the research were subjected to a coding process for understanding. In order to ensure the consistency of the findings, it is important that the meaningfulness and consistency of the codes and themes create integrity. Merriam (2009) stated that the coding process can be done both manually, that is, with a keyboard, or using a computer program. Maxqda-11 program was used in this study. While coding the studies used in the research, T1, T2…, codes were used for thesis studies. The themes obtained are given under three headings: impact on individual development, impact on 21st century skills and impact on learning processes. In the process of creating these themes and codes, codes and themes were created by another researcher other than the researcher. The studies in the analysis process were evaluated independently by the researchers. After this process was completed, the harmony between the codes and themes determined by the researchers was examined. For themes and codes that were different from each other, the researchers discussed and reached a common decision. At this stage, the reliability coefficient between data coders, Cohen Kappa coefficient of fit (Cohen, 1960. 38-39), was calculated. The kappa value is between +1 and -1, and the closer it gets to 1, the better the fit (Sim & Wright, 2005: 259). In the current research on relevant themes, harmony values, the effect of critical thinking practices on individual development are ".809"; Its contribution to learning processes was calculated as ".826" and its impact on 21st century skills was calculated as ".897". Landis and Koch (1977: 165) stated that values above .800 can be interpreted as "perfect fit". Therefore, it can be said that the harmony of the relevant themes in the current research is at a "very good level".

3.4.3. Reliability in the Meta-Thematic Analysis Process

In qualitative studies, it may be more appropriate to use the concept of credibility instead of the word reliability (Guba & Lincoln, 1982). Since meta-thematic analysis is a type of qualitative research, it is more appropriate to use the concept of credibility. However, credibility in qualitative research is not objective, fixed and static as in quantitative research (Batdı, 2019). Because qualitative research is versatile and constantly changing. For this reason, there are situations that need to be done to strengthen credibility. One of these situations is diversification. Diversification means that research conducted from data sources includes more than one data source, different data collection tools and analysis methods (Yıldırım & Şimşek, 1999: 94). With this situation, close and different data were accessed and comprehensive data was obtained. In addition, repeated inquiries, repeated examination of databases, and checking of the existence of new studies at different times were carried out, which would have a positive impact on the credibility of the meta-thematic analysis. This double-checking process was beneficial in including studies that were overlooked or added later (Batdı, 2019). In addition to these procedures, direct quotations were made from the data used in the meta-thematic analysis in the process of creating themes and codes, thus contributing to the reliability, that is, credibility, of the research. As a matter of fact, it is clearly known that direct quotations are a source of raw data in qualitative studies (Labuschagne, 2003). Sutton and Austin (2015) emphasized that codes and themes should be supported by taking participant opinions through direct quoting.

4. Findings

In this part of the study, the findings obtained within the scope of the mixed meta method of critical thinking practices are presented. Here, the quantitative findings are meta-analyzed; Qualitative findings are presented under the title of meta-thematic analysis.

4.1. Findings Regarding the Meta-Analysis Process

The results of the studies included in the meta-analysis are given as effect sizes (EB) and other findings according to the Fixed Effects Model and Random Effects Model. According to these findings, the effect size of critical thinking practices attitude scores according to REM was found to be 0.738 [.082;1.395].

Table 1. Meta-analysis findings

Model	n	EB	95%Confidence Interval Top Level		Heterogeneity		
					Q	p	I^2
SEM	6	0,514	0,320	0,709	55,421	0,000	90,978
REM	6	0,738	0,082	1,395			

According to the research results, the effect size was found to be "medium level", considering Thalheimer and Cook's (2002: 3) level classifications. According to this result, it can be said that critical thinking practices positively affect student attitudes. When the heterogeneity test in Table 1 is examined as a result of the analysis, it is seen that the effect size of attitude (Q=55.421; p<.05) shows a heterogeneous distribution.

In meta-analysis studies, publication bias should also be considered in addition to effect size. Publication bias occurs when researchers focus on a specific result and scan a very narrow area (Rothstein, Sutton, & Borenstein, 2005). The publication of studies whose researchers reach statistically significant results is high when the effect size is high (Kurşun, 2019). In this study, "Funnel Plot" and "Classic Fail Safe N" analyzes were applied to evaluate publication bias.

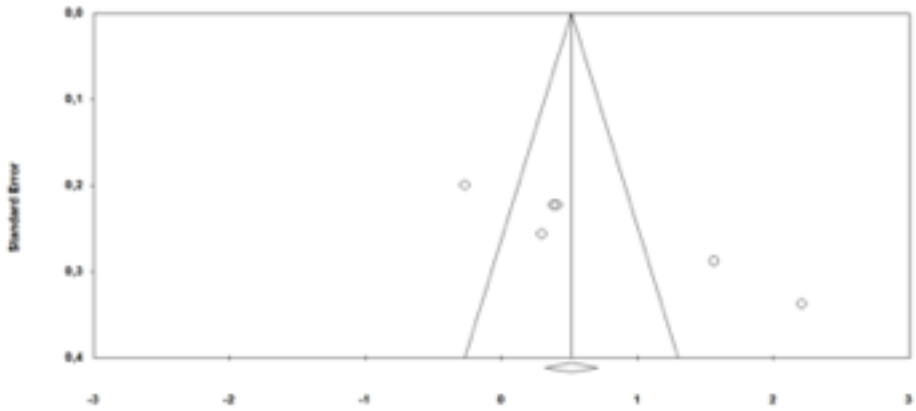
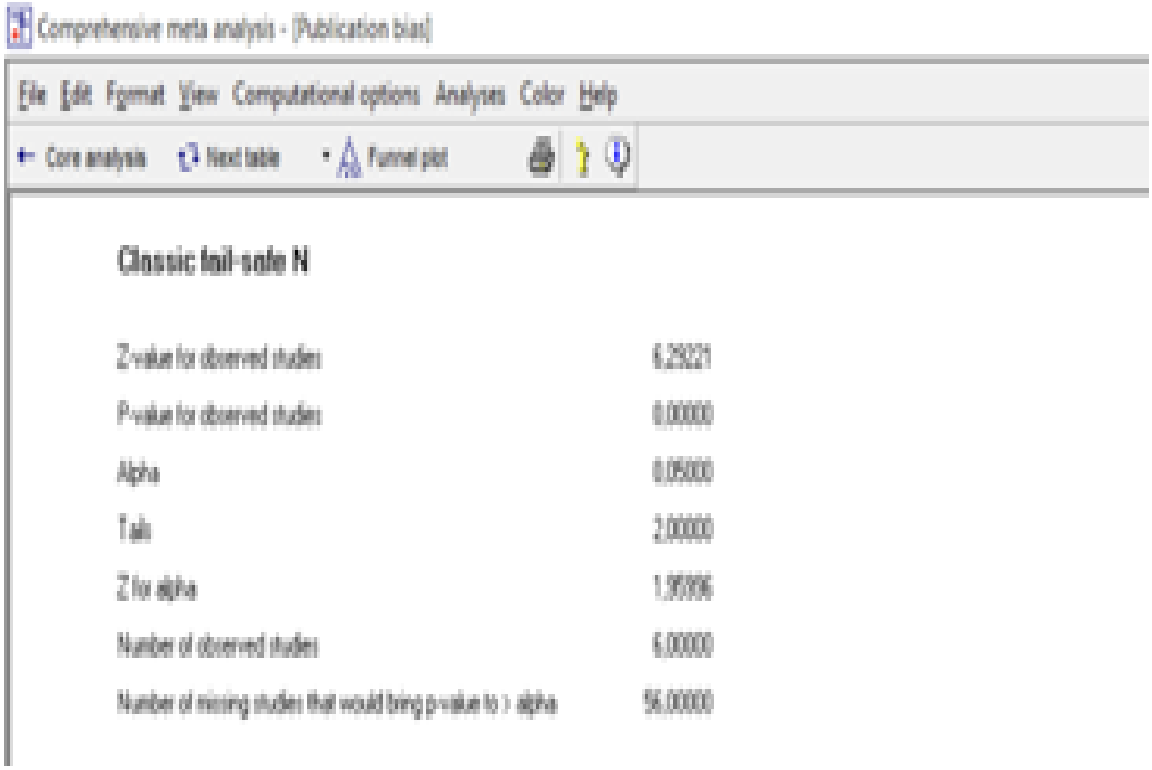


Figure 2. *Funnel plot* (funnel chart)

The “Funnel Plot” seen in Figure 2 shows the relationship between the size of the study and the effect size (Borenstein et al., 2013). According to the above data obtained from the CMA data analysis program, it can be stated that the studies included in the research are symmetrically distributed on both sides of the general effect. In this case, it can be said that there is no publication bias. Since the funnel chart analysis can be subjective and may lead to deviations, “fail safe N” results were also examined (Rothstein, Sutton and Borenstein, 2006: 278).

Data regarding this are included in Table 2.

Table 2. Classic fail-safe n values of the research



According to the data obtained from the CMA data analysis program, the fail safe N value was calculated as "56" with a confidence interval of .05. According to this finding, there must be at least 56 studies in the literature that would invalidate the findings of this meta-analysis. When the literature was examined, no such number of studies could be found between 2003 and 2021, which had values opposite to the findings at hand. This supports that there is no publication bias in the research findings based on the error protection number and that the findings are valid (Rothstein, Sutton, & Borenstein, 2006, p.278).

4.2. Findings Reached Within the Scope of Meta-Thematic Analysis

During the meta-thematic analysis process of the research, themes and codes were obtained from studies covering critical thinking practices. These data obtained are defined as codes belonging to the themes of "the effect of critical thinking on individual development",

"its effect on 21st century skills" and "its effect on learning processes" and are presented in the form of a table (Table 3).

Table 3. The effect of critical thinking practices on individual development

Effect on Individual Development	Ability to look at events independently of one's thoughts
	Paying attention to other thoughts
	Getting a broad perspective
	Ability to comment
	Be respectful of opposing views
	Original thinking
	Making the right decisions
	Being able to see goals and results
	Be tolerant of other views
	Ability to analyse events
	Ability to evaluate from different perspectives
	Ability to turn skills into habits
	Ability to expand horizons
	Ability to plan
	Developing a sense of responsibility
	Being honest
	Ability to transfer what you have learned to life
	Ability to defend one's opinions based on evidence
	Contributing to general cultural knowledge
	Raising awareness
	Ability to develop democratic attitude
	Being able to get out of the comfort zone
	Ability to use reasoning skills
	Being able to know yourself
	Being aware of your surroundings
	Building self-confidence

In Table 3, codes regarding the effects of critical thinking practices on individual development are given. Examples include the following codes: "Being respectful of opposing views, Being able to develop a sense of responsibility, Being able to think in an original way, Being able to get out of your comfort zone, and Being able to know yourself." As a reference for these codes, the study coded T3s143 can be given as an example: "The number of attempts to listen to someone else's ideas and explain the points that are against them within the rules of discussion has increased...". Again, from the study coded T3s143, "... Because this way, we got to know each other better and our sense of responsibility developed more.". From the study coded T9s117: "The most difficult thing for me was that it took so long while I was thinking about the problem step by step. Thinking in such detail and a few new concepts I learned…" However, from the research coded T9s110, "…I started to like mathematics more. I felt like a detective. "We think and examine everything thoroughly." quotations can be given as examples.

Table 4. The impact of critical thinking practices on 21st century skills

Impact on 21st Century Skills	Ability to think about an issue from its positive and negative aspects
	Questioning his-her thoughts
	Not accepting an idea as it is
	Ability to criticize yourself
	Being creative
	Being open to new ideas
	High level thinking
	Questioning the source of information
	Ability to evaluate
	Being able to base your thoughts on evidence
	Ability to use research skills
	Ability to think deeply
	Ability to think objectively
	Being able to express your ideas
	Being open to collaboration
	Ability to interact with peers
	Ability to develop argumentation and defence skills
	Enabling the student to acquire the skill
	Ability to develop different skills together

Table 4 shows the codes regarding the impact of critical thinking practices on 21st century skills. For example, the codes "Ability to use research skills, express ideas, interact with peers, and enable students to acquire the skill" can be given. As a reference to these codes, an example can be given from the study coded T3s141: "Because asking thought-provoking questions pushed them to gather in-depth information about the subject..." Additionally, from the study coded T8s161, "…these activities improve our thinking. It provides helpful elements to our thinking skills. "We also share our thoughts with our friends." While giving an example, from the research coded T9s116, "... It was about a subject that I did not understand, I had a hard time, but I learned it thanks to my friends." That's why I love group work so much." and from the study coded T3s146, "...I believe that I learned a lot in your course, where we covered the topics we prepared and presented with questions, with your participation and contributions." quotations can be given as examples.

Table 5. The effect of critical thinking practices on learning processes

Effect on Learning Processes	**Understanding topics logically**
	Requesting to attend the course
	Providing motivation for the lesson
	Ensuring permanent learning
	Ability to transfer across disciplines
	Understanding the subject more easily
	Ensuring permanence
	Being interested in the lesson
	Curiosity about the formation of formulas
	Providing a positive effect on mental processes
	Providing the query
	Ability to make inferences

	Ability to produce different solutions
	Identifying the cause of problems
	Being aware of the problem
	Being able to express the meaning of concepts
	Increasing belief in success
	Ensure caution
	Ability to put problem solving skills to work
	Being willing to ask questions

In Table 5, codes regarding the effects of critical thinking practices on learning processes are given. For example, the codes "Ability to transfer across disciplines, ensuring memorability, Ability to produce different solutions and Increasing belief in success" can be given. From the study coded T6s159, on which these codes are based, he said: "I think it will contribute not only to the physics course, but to all courses. Especially in geography class, for example. Because this mining issue is a subject covered in geography, it will be useful not only in physics but also in general terms." An example can be given again from the study coded T6s159: "…. It felt very different to me, it was something I never expected. "I think it was very lasting because it was both visual and auditory, and it was very enjoyable." While an example can be given, from the study coded T9s109, "Students working in groups argued among themselves from time to time and stated that this problem could have different results. The groups presented different results and different solutions." An example can be given. Finally, from the study coded T9s111, "… I am afraid of making mistakes and my friends laughing… I questioned my thoughts. Statements such as "I realized that my friends listened to me in class and that I too could achieve something" can be given as examples.

5. Conclusions

In this section, the results obtained as a result of the meta-analysis process and meta-thematic analysis within the scope of the mixed-meta method are included. The data obtained as a result of the analysis and the research results in the literature were discussed comparatively. In the first step of the study based on document analysis, quantitative data were presented using the meta-analysis method, and in the second step, the data obtained through meta-thematic analysis were presented using qualitative data. When the data obtained as a result of the meta-analysis were examined, the effect size of critical thinking practices on student attitudes was calculated as g = 0.738 and was positive. When studies on the subject were examined, Kurnaz (2007) determined that critical thinking teaching methods positively affected critical thinking attitudes, according to the results of his study. Similarly, Yıldırım (2010) implemented critical thinking teaching to nursing students and it was observed that these practices increased attitudes towards critical thinking and problem-solving skills. Regarding the subject, Yıldırım & Şensoy (2011) also found that students' attitudes towards critical thinking increased in the science course where critical thinking was taught at the center. Another study conducted by Kurnaz (2007) showed that the critical thinking skills and attitudes of students in groups where critical thinking activities were applied in the fifth grade Social Studies Course of primary school were positively affected. All of these can be evaluated as critical thinking practices in the teaching process have a positive impact on students' attitudes. One of the themes obtained

as a result of the meta-thematic analysis, which is the qualitative dimension of the research, is about the effect of critical thinking practices on individual development. In this context, codes containing skills such as being respectful to different opinions, developing a democratic attitude, analyzing events, and developing self-confidence were reached. In line with these results, it can be concluded that critical thinking practices improve one's perspective and way of thinking in social life. Similar to this result, as a result of the practices in Özkaya's (2018) study included in the research, it was concluded that the participants were open to new ideas, their self-confidence increased and they were more planned. However, Aybek (2006) concluded in his study that participants were able to transfer their skills to daily life as a result of critical thinking practices. It has also been found that as students' critical thinking tendencies increase, their self-efficacy skills also increase, and there is a significant relationship between these two variables (Özsoy-Güneş, Çıngıl-Barış & Kırbaşlar, 2013). Another theme reached from critical thinking practices is 21st century skills. Among these skills, codes such as being able to do research, being creative, being open to collaboration, and learning to learn have been reached. Supporting this, Aydede (2009) concluded that collaborative group work supports critical thinking. In a study he conducted on prospective teachers, Semerci (2010) found that critical thinking skills improved by using the discussion and question-answer method. Another theme obtained from the applications is the effects on the learning process. In this context, there are codes such as better understanding the subjects, ensuring memorability, being interested in the course and ensuring interdisciplinary transfer. Supporting this result, Gheith's (2007) study concluded that the use of different learning techniques based on critical thinking increased students' awareness and interest in the course. Similarly, Alkaya (2006) determined in his study that activities in which the student is at the center positively affects learning. In another study (Sezer, 2008), it was observed that students' interest in the course increased and their feelings of failure decreased in the mathematics course taught with critical thinking instruction. At the end of all this, it can be concluded from the studies conducted on the relevant subject that the use of critical thinking skills in the teaching and learning process contributes to the cognitive (problem solving, 21st century skills) and affective (attitude) development of students.

6. Conflict of Interest

The author declares that there is no conflict of interest.

7. Ethics Committee Approval

This article does not contain any studies with human participants performed by of the author. The author confirms that the study does not need ethics committee approval according to the research integrity rules in her country.

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