

## What are the dimensions of thinking skills in Turkish literature: a content analysis study?

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### ABSTRACT

New world needs thinking generation. However, growing thinking generation is very difficult because there are many discrepancies in defining of thinking and thinking skills. Without defining thinking and its dimensions, it is nearly impossible to grow such generation. For having thinking generation, thinking and its dimensions should be described. In the past 20 years, there have been many different definitions with regard to thinking and thinking skills. But, three different approaches for defining thinking skills and needed basic cognitive operations were commonly accepted. Aim of this study whether these three approaches for defining thinking skills were accepted in Turkish literature or not. For this aim, 14 studies, selected from Turkish database, related to thinking skills were analyzed. According the content analysis results, Turkish literature follows these three movements for defining thinking skills except for belonging to specific areas.

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## 1. INTRODUCTION

Teaching thinking has become a slogan for more than three decades for educators. In order to reach this goal, many countries have changed their curriculums [1]-[11]. However, dimensions of the thinking skills or what should be thought for thinking generations has not been decided. Up to 1990s, thinking skills has not been clearly defined. After that the main three approaches for defining thinking skills emerged. The first one is Costa's [12]. In order to define thinking skills, Costa collected data from 60 experts and labelled dimensions of thinking skills as critical thinking, problem solving, creativity and decision making in the study "Developing Minds: A Resource Book for Teaching Thinking" [1], [12]. The second definition is by [13], [14] whose definitions have one more dimension for thinking skills.

### 1.1. Critical thinking

Critical thinking is purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, inference, synthesis, and evaluation of the concepts. This judgment is based on explanation of the evidential, conceptual, methodological, contextual considerations [15]-[18]. Therefore, critical thinker has the capacity of making predictions and formulating hypotheses, distinguishing fact from the opinion, determining bias reliability of evidence, relating causes and effects, being honest in facing personal biases, willing to reconsider, being reasonable in the selection of criteria, avoiding to reach premature conclusions, searching for meaning, determining the real aim, revisiting the alternatives and data processing [15]-[22].

### 1.2. Problem solving

Problem solving is the second dimension of thinking skills. It is an attempt to reach previously defied goal. In order to be a problem solver, one should break the problem into manageable parts, using

special cases, and working backwards [23]. Problem solvers identify which pieces of data are relevant when faced with a mass of data, construct relationships between data and reach new solution/s, collect new data for new options, compare the options and decide one or more solutions for the defined goal [24]. Besides, good problem solvers are generally creative and flexible people and scientific reasoning, evaluating options and data processing [1], [14], [19], [22], [23]. Problem solving starts with identifying the problem and then continues generating and assessing possible solutions and implementing the problems. In all these steps, problem solvers need critical thinking [14], [20], [23].

### 1.3. Creativity

Creativity is another dimension. It is act of synthesis or gathering thoughts in order to get new or different ideas or to find hidden patterns, to find correlations between seemingly unrelated phenomena, and to generate solutions; namely, it is generating ideas for solving a problem or reaching previously defined goals [5], [14], [20]. Creative people have different perspectives than others and ready to take risks and use ordinary tools in unusual ways to solve problems or reach their goals [1], [2]. Creativity requires flexibility and being playful with ideas. Creative people are also good problem solvers. So, creative people have most of the qualification of problem solvers.

### 1.4. Decision making

Decision making is last dimension of thinking skills in [12]. Decision making is closely related to problem solving; in fact, the distinction between the two is sometimes hard to make. Decision making is centrally concerned with the process by which alternatives are evaluated and options selected for getting an aim, namely it is a kind of weighing up pros and cons [24], [25]. For good decision making, one should identify why this decision is needed, which means identifying the problem (analyses), generating options (synthesis), preparing a plan, predicting likely results or options, choosing one of these options and reanalyzing this preference [19], [22]. If one wants to reach the best decision, she/he needs to be aware of available choices. So, good decision makers are also creative and good problem solver ones.

The second definition belongs to [13]. In this definition, thinking skills has five dimensions as looking for meaning, critical thinking, problem solving, creativity and decision making. Apart from [12], one more dimension, looking for meaning [13]. This dimension includes such cognitive skills as; sequencing, ordering, ranking, comparing and contrasting, classifying, analyzing, identifying parts and holes, finding patterns and relations [7], [13]. In this classification, these entire five dimensions are related to metacognitive skill which includes planning, monitoring, redirecting and evaluating (Figure 1).

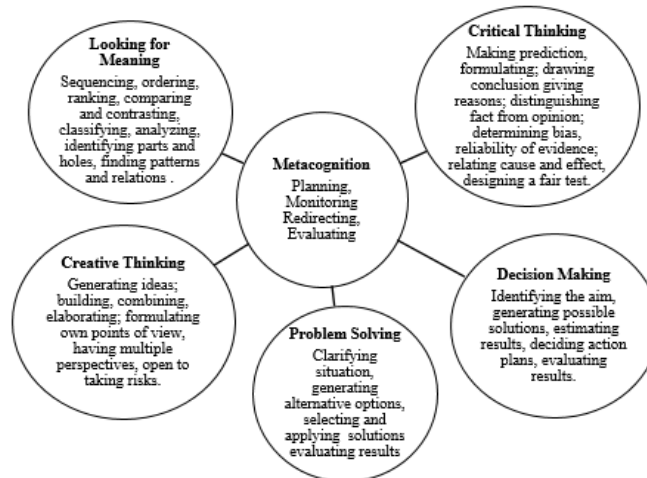


Figure 1. ACTS II sustainable thinking classrooms [13]

The third common definition is done by Swartz and Parks [14]. In their definition, the four major dimensions are indicated, critical thinking, problem solving, creativity and decision making and one more dimension called as clarification and understanding is also added [12], [13]. Under the clarification and understanding dimension, there are some cognitive skills such as comparing and contrasting, classification, sequencing under the analyzing ideas and finding relations, uncovering assumptions under analyzing

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argument [14]. However, in this framework creative, critical thinking and clarification and understanding skills are at the bottom level of the flow chart of thinking skills. These three are inevitable steps for reaching the second step where making decision or problem solving dimensions are found (Figure 2).

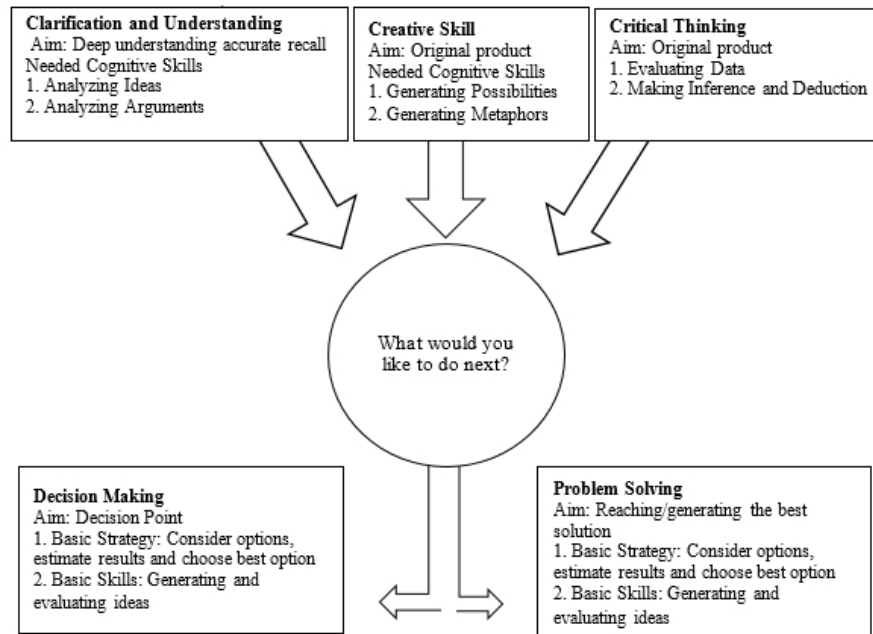


Figure 2. Infusing the teaching of critical and creative thinking into content instruction [14]

In fact, all of these dimensions are strictly connected with each other. But the results of these dimensions are different from each other. Critical thinking is concerned with critical examination and evaluation of beliefs or actions. Critical thinkers make judgment based on reliable data. Creative thinking is concerned with thinking that is unusual or original. Critical thinking involves the production of some kinds of complex product. Critical thinking and creative thinking overlap because creative thinking requires critical thinking while generating and evaluating new and original works. Although creative thinking results in an original product, critical thinking does not. Similarly, decision making and problem solving have many mutual points. However, decision making ends with choosing one or more option/s. But, problem solving is more than choosing one of the options. It includes generating options and choosing one or more of them. From this respect, problem solving includes decision making. However, without decision making skills, problem solving may not yield with intended result. Although one generates many ways to solve the problem, she/he may not choose the best alternative. Aim of decision making is to reach decision point but problem solvers try to reach solution [1], [5].

As it was seen in Table 1, four of these dimensions of thinking skills have some mutual needed basic cognitive skills. However, the aim is different from each other. Having such mutual points causes the problem of defining thinking skills and its dimension. For this reason, aim of this study is to analyze and synthesize how thinking skills are defined in the studies during two last decades in Turkish literature.

Table 1. Relationships among dimensions of the thinking skills

Dimensions of thinking skills	Aim	Needed basic cognitive skills	Main relationships among the dimensions
Critical Thinking	To reach critical judgment	Defining aim	Problem solving: to evaluate possible solutions.
		Evaluating options	
Problem Solving	To reach one or more solution/s for the problem	Establishing cause and effect relationships	Making decision: to check and ensure reliability of the data and other alternatives.
		Making inquiry	Creativity: to decide and formulate the aim
		Grouping, classifying and analyzing the obtained data	
		Distinguishing fact from opinion	
Creativity/Creative thinking	To reach original idea/product	Drawing conclusion, logical thinking	Critical thinking: collecting data, formulating problems, establishing cause and effect relationships.
		Critical thinking, data processing, creative thinking, implementing of the planed actions, generating alternatives,	
Decision Making	To select one or more of the alternatives	Critical thinking, flexibility, defining options, collecting data, analyzing problem, generating ideas and possibilities, seeing multiple perspective	Making decision: deciding which of the options are effective
		Critical thinking, creative thinking, problem solving, generating options, predicting likely consequences	Critical thinking: evaluating new ideas or product, establishing new relationships among the patterns. Problem solving: creativity starts from problem solving Decision making: Selecting one of original product or idea Critical thinking: collecting data and evaluating options. Problem solving: formulating and analyzing problem. Creativity: proposing new alternatives.

## 2. RESEARCH METHOD

### 2.1. Research design

In this study, qualitative content analysis is used. Content analysis is defined as a research method for the subjective interpretation of the content of text data through the systematic classification, process of coding and identifying themes or patterns. In this research directed content analysis approach was chosen because the goal of a directed approach to content analysis is to validate a theoretical framework or theory [26].

### 2.2. Coding process

Firstly, related parts of each study included in the research were read in details and noted and grouped according to the indicated cognitive skills according to the dimensions. Later, indicated cognitive skills overlapping in more than one dimension were identified. Furthermore, each study was coded as K1, K2 ... K14 and these codes were used in the research.

### 2.3. Validity and reliability of the research

For validity and reliability during the coding process, studies were examined by two expert academicians one of whom was an expert on assessing and evaluation in education and the other was an expert on educational sciences.

### 2.4. Data collection and inclusion criteria

In this study 14 researches were selected form the Turkish data base called Turkish Academic Network and Information Center (ULAKBİM). ULAKBİM data base covers the journals published in Turkey. However, ULAKBİM has strict selection criteria for indexing the journals, such as publication history, transparent reviewing process, at least having extended abstract in second language and some other criteria related to formatting. For collecting data 'thinking skills, higher ordering thinking skills' terms were used both in Turkish and English. In the first step, 872 studies were listed including these two terms. Firstly, title of the studies was analyzed. As this study aimed at the definition of thinking skills as a whole, 727 studies including only one dimension of thinking skills such as critical thinking or scientific thinking skills were excluded. The rest 145 researches' summaries were analyzed in the second step. At this step, 113 studies were excluded again as all dimensions of thinking skills weren't defined or being related to computational thinking, thinking in drama and art. In the final step, 18 studies were excluded after the analyzing the whole study because of lacking of well-grounded definition or defining only one or two

dimensions of thinking skills dimensions. At the end, totally 14 researches, 9 of them were qualitative and 5 of them quantitative, were found including thinking skills dimensions for defining thinking skills. Researches on thinking skills included in this study were shown in Table 2.

Table 2. Researches on thinking skills included in the study

Study Code	Study Name	Method
K1	Temel, S., Dinçol Özgür, S. & Yılmaz, A. (2012). The effect of learning cycle model on preservice chemistry teachers' understanding of oxidation reduction topic and thinking skills. <i>Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education</i> , Vol. 6(1), 287-305.	Quantitative study
K2	Gelen, İ. (2011). Determination of the level of acquisition of some common skills concerning thinking in the curriculum of social studies. <i>Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi</i> , Vol. 30(1), 83-106.	Quantitative study
K3	Ekinci, N. & Canses, T. (2017). Classroom teachers' epistemological beliefs and their classroom practices for teaching thinking skills. <i>İnsan ve Toplum Bilimleri Araştırmaları Dergisi</i> , Vol. 6(3), 1747-1773.	Quantitative study
K4	Tok, E. & Sevinç, M. (2010). The effects of thinking skills education on the critical thinking and problem solving skills of preschool teacher candidates. <i>Pamukkale Üniversitesi Eğitim Fakültesi Dergisi</i> , Vol. 27, 67-82.	Quantitative study
K5	Yenilmez, K. (2011). In-service and pre-service mathematics teachers' opinions about teaching of thinking skills. <i>Educational Research Association the International Journal of Research in Teacher Education</i> , Vol. 2(3), 17-28.	Quantitative study
K6	Aydın, F. (2011). Evaluation of high school geography course in terms of thinking skills. <i>Eastern Geographical Review</i> , Vol.25, 162-182.	Quantitative study
K7	Mutlu, E. & Aktan, E. (2011). Okul öncesi öğretmenlerinin düşünme eğitimi ile ilgili tutumlarının incelenmesi. <i>Türk Eğitim Bilimleri Dergisi</i> , Vol. 9(4), 799-830.	Quantitative study
K8	Aslan, S. (2017). An investigation of primary school teachers' perceptions of self- efficacy towards teaching thinking skills in terms of several variables. <i>PAU Eğitim Fakültesi Dergisi</i> , Vol.41, 61-73.	Quantitative study
K9	Ülger K. (2015). Sanat eğitiminin düşünme becerileri üzerine etkisi. <i>Milli Eğitim</i> , Vol. 206 (2), 135-147.	Quantitative study
K10	Baysal Z. N., Çarıkçı, S., & Yaşar, E. B. (2016). Classroom teachers' awareness of teaching thinking skills. <i>Eğitimde Nitel Araştırmalar Dergisi - Journal of Qualitative Research in Education</i> , Vol. 5(1), 7-28.	Qualitative Study
K11	Büyüktaşkapu Soydan, S. & Dereli, H. M. (2014). A comparative examination of strategies aiming to improve thinking skills of children used by preschool teachers in different countries. <i>Kastamonu Eğitim Dergisi</i> , Vol. 22(2), 475-496.	Qualitative Study
K12	Akbaba, A. & Kaya, B. (2015). Teachers' opinions about cognitive skills development of children at kindergarten. <i>Elektronik Sosyal Bilimler Dergisi (Electronic Journal of Social Sciences)</i> , Vol.14 (55), 148-160.	Qualitative Study
K13	Doğan Altun, Z. & Ekinci Vural, D. (2017). Thinking skills in early childhood: teachers' perspective. <i>The Journal of Buca Faculty of Education</i> , Vol. 44, 214-224.	Qualitative Study
K14	Akbiyık, C. & Kalkan AY, G. (2014). Perceptions' of Pre-school administrators and teachers on thinking skills instruction: A case study. <i>Hacettepe Üniversitesi Eğitim Fakültesi Dergisi (H. U. Journal of Education)</i> , Vol. 29(1), 01-18.	Qualitative Study

### 3. RESULTS AND DISCUSSION

After the analyses of 14 articles, 23 cognitive skills were found and labelled under the 4 dimensions but five cognitive skills were not included in neither [12], [14], [19], frame work related to thinking skills dimensions. These dimensions and cognitive skills are given in Figure 3.

According to Figure 3, 23 different cognitive skills were used to define thinking skills. Except one study (K1) critical thinking (shown in red) and problem solving dimensions were defined as thinking skill referring the studies of [12]-[14], [27]. Creativity/creative thinking was defined another dimension of thinking skills in thirteen researches (K2, K3, K4, K5, K6, K7, K9, K12, K13, K14) [7], [28]. In the research reports, decision-making skill, labeled as one of the dimensions of the thinking skills in five researches (K7, K8, K10, K11, K13). In two (K8, K11) of these five studies cited, [28], in one (K7) of them cited [29] again in one (K10) of these five studies cited McGuiness [7] and in one (K13) of these five studies cited Burke, [30] for defining thinking skills. These four dimensions had the highest frequency.

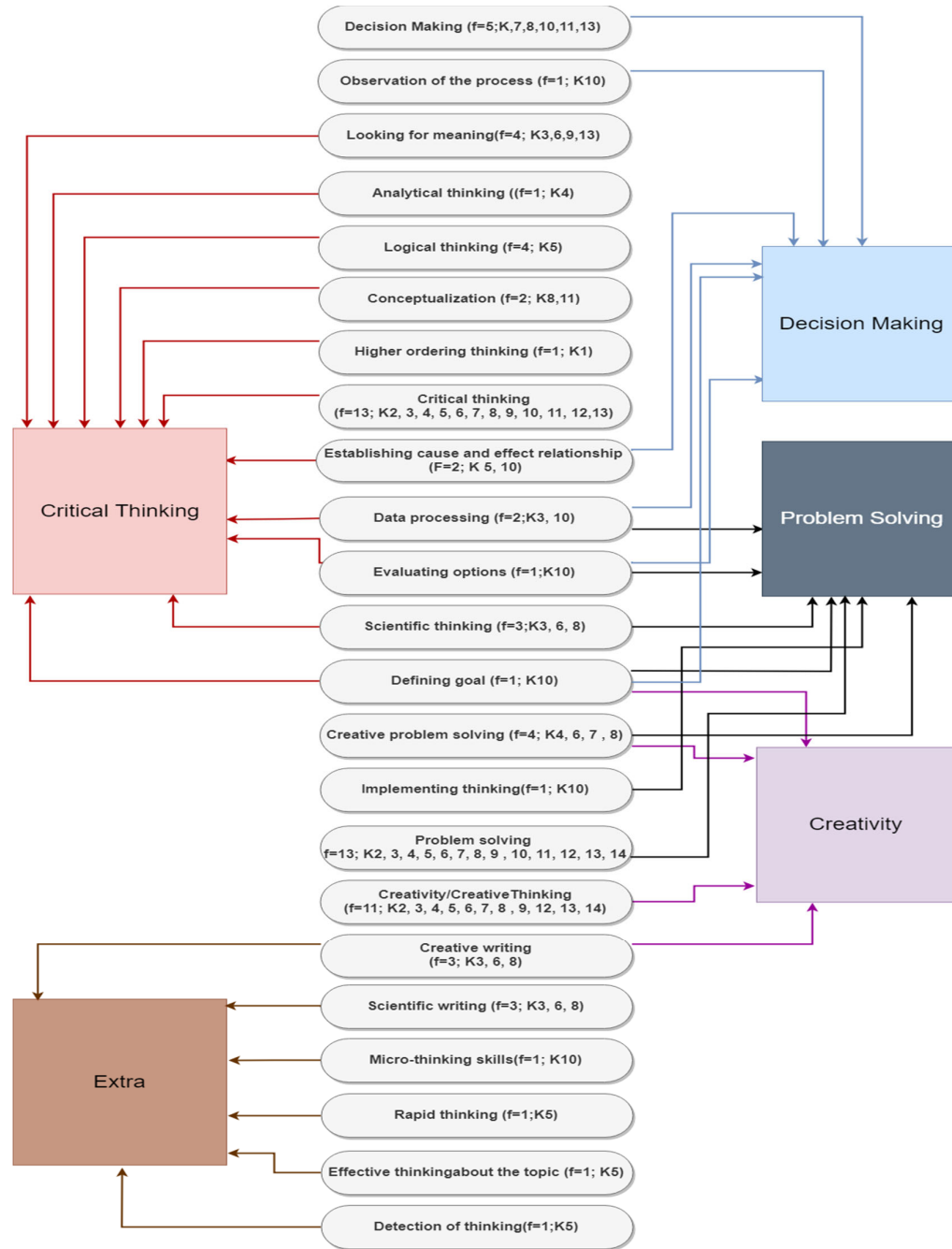


Figure 3. Dimensions of thinking skills and related cognitive skills *the teaching*

Other skills, looking for meaning in the studies coded as K3, K6, K8, K13, scientific thinking, creative writing and scientific writing K3, K6, K8, creative problem solving in K3, K6, K7, and K8 were accepted as the dimensions of thinking skills by citing the definition of thinking skills [29]. Data processing and evaluating options (K8, K10), implementing thinking and defining goal, observation of the process/implementation (K10) were defined as the component of thinking skills [7]. Micro thinking skills (K11), conceptualization (K8, K11) were labelled as a part of thinking skill [28]. Rapid thinking, effective thinking about the topic, detection of thinking, logical thinking (K5) were defined as thinking skills [31]-[34]. Establishing cause and effect relationship is one of the other skill accepted as thinking skills (K5, K10) [7], [31]-[34]. Analytical thinking was defined as one of the component of thinking skills in K4 [35]. Higher

ordering thinking skills were accepted as thinking (analyzing, synthesizing and evaluating) skills in one study (K1) [36].

In these studies, decision making, observation of the process, establishing cause and effect relationship, data processing, evaluating options, defining goal called as cognitive skills and collected under the decision making theme (K5, K7, K8, K10, K11, K13). In nine studies, there weren't found any cognitive skills related to decision making domain.

Under the problem solving theme (shown in black) seven cognitive skills as data processing, evaluating options, scientific thinking, creative problem solving, implementing thinking, problem solving and defining goal were collected (K2, K3, K4, K5, K6, K7, K8, K9, K10, K11, K12, K13, K14). It wasn't found any term or cognitive skill related to problem solving in one study (K1). Under creativity/creative thinking dimension, (shown in purple) four cognitive skills defining goal, creative problem solving, creativity/creative thinking and creative writing were collected (K3, K6, K7, K8, K10). Creativity or creative thinking was taken into account in five studies for defining thinking skills. The rest ten studies did not include any terms which may be related to this skill. Critical thinking skill (shown in red) was found as a most common term in the definitions of the thinking skills. In all fourteen studies, eleven cognitive skills were directly or indirectly collected under the critical thinking skills. These cognitive skills were looking for meaning, higher ordering thinking (analyzing, synthesis, evaluating) analytical thinking, logical thinking, conceptualization, higher ordering thinking, critical thinking, establishing cause and effect relationship, data processing, evaluating options, scientific thinking defining goal. In the definition of thinking skills (shown in brown), scientific writing, micro thinking skills, rapid thinking, effective thinking about the topic, and detection of thinking were labelled as thinking skills; however, as these cognitive skills weren't defined in detail, they were collected under the extra skills theme (K3, K5, K6, K8, K11). Under the decision making (shown in blue) skills six skills were collected, but four of them were overlapped more than one dimension.

Besides, some cognitive skills were overlapped more than one dimension. Establishing cause and effect relationship was shared by two dimensions, making decisions and critical thinking. Scientific thinking skill was shared by two dimensions, problem solving and critical thinking. Data processing and evaluating options were shared by three dimensions as critical thinking, problem solving and making decision. Creative problem solving was labelled under both creativity and problem solving. And defining goal was shared by four dimensions as decision making, critical thinking, decision making and creativity. Creative writing and creativity were collected under creativity domain.

As it is stated in many studies, defining thinking skills is still very difficult and there is no concrete idea commonly shared by most of the experts in the world [1], [2], [6], [7], [16], [26], [37]. For example, Costa defined four main dimensions as creativity, problem solving, critical thinking and decision making and cognitive skills for each of them. On the other hand, one more main dimension called searching for meaning likewise clarification and understanding dimension [13], [14]. These two frame works [29], which has many mutual points with these two, were generally accepted by in Turkish literature. Thinking skills in five main dimensions as searching for meaning, creative thinking, critical thinking, problem solving and decision making and they add cognitive skills; for example, data processing under the critical thinking, defining goal under the decision making [13], [14]. However, in Turkish literature these cognitive skills weren't collected under main skills such as critical or creative thinking. Furthermore, in K5 and K11, which were based on thinking skills for special disciplines, the new cognitive skills scientific writing, micro thinking skills, rapid thinking, effective thinking, detection thinking were accepted as a part of thinking skills. Except in one study (K1) critical thinking skill was accepted thinking skills. In K1, analyses, syntheses and evaluation were accepted as thinking skills. In fact, these cognitive skills are accepted as the part of critical thinking [38]. So, we can say that all studies accepted critical thinking as thinking skill. Problem solving is the most second item used to describe to thinking skill. These two findings are similar to generally preferred description of thinking skills. Creativity is another term commonly used to describe thinking skills. Although decision making is indicated as thinking skill in three accepted frameworks [12]-[14], in Turkish literature only five researches described decision making as thinking skills. Instead of including decision making in the description, these studies included cognitive skills of decision making such as data processing, defining goal. In four studies, looking for meaning was defined as thinking skills [14], [19]. Scientific and creative writing were two other terms used to describe thinking skills [29]. Critical thinking and problem solving were the most two terms which were included in the definition of thinking skills and five cognitive skills were mutually mentioned in both dimensions. Establishing cause and effect relationship skill was mutually collected under two dimensions as critical thinking and decision making. Data processing, evaluating options, scientific thinking and defining goal cognitive skills were labelled under three skills as critical thinking, decision making and problem solving theme. These skills were shared by three dimensions depending on the aim. Whether individual's aim is to decision making, problem solving or critical thinking, he/she should use these cognitive skills. Critical thinking is at the top in all studies. Because, for making decision, being

creative or problem solving one needs to collect and process data, establish cause and effect relationships which are the basic cognitive skills of critical thinking. From this respect critical thinking may be called as the first step of thinking. Other cognitive skills or thinking skills dimension change in respect for the aim. Namely, the difference of the cognitive skills classification may be because of the reaching point at the end of the process. The codes, scientific writing, micro thinking skills, rapid thinking, effective thinking about the topic, detection of thinking, collected under the theme extra. When these studies analyzed, this researches focus on the very specific ability in math discipline. From this respect, it can be said that transfer of these abilities to different disciplines or very specific areas is possible. This result is similar to Siegel [39].

#### 4. CONCLUSION

As a conclusion, describing thinking skill and its dimensions generally have mutual points with common frameworks in Europe and America, but cognitive skills related to thinking skills dimensions were classified differently in different studies. These differences among these studies support final aim of this study. Furthermore, some cognitive skills differentiate for specific fields in some studies in Turkish literature.

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