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Examination of Critical Thinking Skills of Prospective Classroom Teachers

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Abstract

This study aims to determine the critical thinking skills of prospective classroom teachers. In this context, the study compares the average scores of prospective classroom teachers' critical thinking skills and their related sub-dimensions according to gender and grade variables. For the data collection, the study utilizes the survey model, one of the quantitative research approaches, as a basis and applies the Critical Thinking Appraisal Test as a data collection tool. The study was carried out in the fall semester of the 2019-2020 academic year, and 671 prospective classroom teachers participated in the study. According to the results, the average scores of prospective classroom teachers' critical thinking skills are calculated as 0.63. This value suggests that the prospective classroom teachers have an intermediate level of critical thinking skills. Additionally, when the average sub-dimension scores of critical thinking skills are calculated, it is concluded that while the prospective classroom teachers are highly skilled at interpreting and performing deductions, they are only slightly skilled at making inferences. A large effect size is obtained for both of these effects. It is also found that the average critical thinking skill scores of female prospective classroom teachers are higher than those of male teacher candidates with a small effect size. Moreover, the average rank scores of the sub-dimensions of the Awareness of Assumptions and Interpretation scale are higher for female teacher candidates than they are for male teacher candidates, with a small effect size. It is observed that the average rank scores of critical thinking skills of the prospective classroom teachers who are in the second grade are the highest, while the average rank scores of critical thinking skills of the prospective classroom teachers who are in the fourth grade are the lowest. It is further found that the critical thinking skill levels decrease for prospective classroom teachers in third and fourth grades, with a large effect size. Considering the results of the study, the findings of the present study can be seen as an opportunity for the arrangement of the course curricula to be made by the education faculties in 2021. In particular, it is suggested that the undergraduate education process is discussion and practice-oriented, and away from memorization-based strategies. In this way, prospective classroom teachers' experience of different activities in their professional training can both contribute to their professional development and increase their students' critical thinking tendencies by enhancing their critical thinking skills.

Keywords: Critical thinking skill; reasoning; prospective classroom teachers

1. INTRODUCTION

Since the last century, information has been constantly increasing, and it has become important to present this information to students in order for them to adapt to the current times. However, one of the main problems has to do with the understanding of the presented information by the student and the realization of effective learning by creating a behavioral change. Students' ability to critically evaluate events and situations in a multi-faceted manner, to take into account the opinions of others, and to make decisions by filtering them through their own thinking can ensure a good learning experience. This way, students can access other information necessary to understand what is being taught to them, through their critical thinking skills (Altıntaş, 2009). Critical thinking refers to a skill set including the ability to analyze facts, make comparisons, generate and organize thoughts, defend opinions, evaluate arguments, and solve problems (Chance, 1986). Dewey defines critical thinking as one of the high-level skills that an individual should have and states that it is necessary to benefit from information sources efficiently and to produce appropriate solutions (MEB, 2016). For example, it requires building a higher-level ability such as the ability to think critically, alongside the simpler and easier reading and comprehension skills to critically analyze a text (Sağlam & Büyükuysal, 2013).

The most comprehensive study to define critical thinking is the Delphi report prepared by scholars. In this report, critical thinking is defined in terms of two structures, which are judgment and decision making. While making judgments or decisions, elements such as proofs, methods, concepts, contexts, and criteria are explained, interpreted, analyzed, evaluated, and inferred (Facione, 1990). Watson and Glaser (1964), define critical thinking in terms of a process. They state that a combination of factors such as perceiving the existing problem, the attitude of the investigator to prove its accuracy, the abil-

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ity to acquire knowledge, and the use of knowledge constitutes this process. In the critical thinking process, an individual reaches objective conclusions by taking into account all factors after evaluating the premises and evidence rigorously and benefiting from valid logic methods (Oğuzkan, 1993). There is a questioning approach based on skepticism in critical thinking. Subjects are examined, comments are made and decisions are made (Yıldırım & Şensoy, 2017). Thus, events and situations are better understood and effective learning becomes easier.

The critical thinking skill is not considered a hereditary characteristic, but rather it is defined as a learnable, teachable, and developable skill (Göbel, 2013). Skills such as reasoning, deep thinking, and focusing form critical thinking skills by complementing one another. First, inferences are made about events and situations that are based on valid evidence, and reasoning takes place. Thereafter, the thoughts of others are evaluated by providing deep thinking. Finally, a decision is made by focusing (Mcknown, 1997). Reasoning is defined as a method in which evidence is collected and analyzed, connections between concepts and theories are formed, and scientific knowledge production occurs, by establishing the beginning of critical thinking. (Schen, 2007). Reasoning skills are frequently used in daily life, from predicting what the weather will be like the next day to calculating how much fuel will be spent based on the distance traveled (Sağlam & Çoban, 2018). Thinking practices about knowledge and scientific knowledge take place, and an inquiry-based thinking system is formed through reasoning skills (Hogan & Fisherkeller, 2005). The reasoning skill enables individuals to identify and evaluate problems, and to find and analyze necessary information to reach a proper result (Watson & Glaser, 2012). The use of reasoning skills contributes both to the training of individuals who keep up with the rapidly developing science and technology in daily life, and to the creation of a scientifically literate individual profile (Sağlam & Çoban, 2018). Thus, important steps have been taken to raise individuals who gain critical thinking skills.

In the education approach of the twenty-first century, instead of educating students who accept knowledge without researching and questioning; it is aimed to raise students who research, question, analyze, construct concepts in their minds, learn to learn, and can use the knowledge learned in daily life (Yıldırım & Şensoy, 2017). Thus, it is aimed to raise students who keep up with the age and can keep up with the developments. The most important factor in this regard is the teachers that are raising students as individuals who can think and question critically. In order to raise individuals who can think critically, teachers themselves must have critical thinking tendencies and skills, and they should be trained well enough to engage with teaching activities that can help students gain thinking skills (Alkın Şahin & Gözütok, 2013; Palavan, Gemalmaz & Kurtoğlu, 2015; Sağlam & Büyükuysal, 2013). Walsh and Paul (1998) stated that in order to develop students' critical thinking skills, teachers should be trained in this area first and that it is necessary to give them pre-service and post-service critical thinking cognitive skills courses. Thus, teachers can be exemplary thinking models for students. The elementary school period also forms the basis for the educational process. It is ensured that students can adapt to the world and scientific developments from a young age, and gain the skills of questioning and interpreting events through learning-teaching activities. (Özelçi, 2012). Teachers are expected to ask high-level questions that allow students to develop their thinking skills, express their opinions confidently, criticize and convey their knowledge (Doğan, 2020). The most important factor that will contribute to the development of primary school students as individuals who can think critically, and that will enable them to acquire this skill is the classroom teachers who organize activities and implement the curriculum. Because teachers' support for critical thinking in learning environments will contribute to the development of individuals' cognitive characteristics and will positively increase students' critical thinking attitudes (Yıldırım & Şensoy, 2017). At this point, classroom teachers play a critical role in diversifying the lessons with rich learning environments and raising students who gain critical thinking skills.

It is important for students to develop their reasoning skills, and use their critical thinking skills (Sağlam & Çoban, 2018). Benford & Lawson (2001) reported that teachers with higher levels of reasoning skills can offer their students more effective learning environments based on inquiry. Classroom teachers should have sufficient knowledge about critical thinking, use their critical thinking skills effectively in classroom activities, and have a positive attitude towards critical thinking (Yeşilpınar, 2011). For instance, some behaviors and attitudes of teachers are of particular importance, such as the tolerance shown to students in response to different questions from the students, the inadequate answers given to the students' questions, the expectation that students obey what is said unconditionally, whether students are included in active learning environments or not. These behaviors and attitudes have an impact on the development of critical thinking skills, which are obtained by students through the use of reasoning power (Sağlam & Çoban, 2018). Therefore, it is considered important that primary school teachers should be able to use their reasoning power before starting the profession, have critical thinking skills in the education-teaching process, and that this skill affects their behaviors and attitudes. Although there are studies examining prospective teachers' critical thinking skills in the relevant literature (Kürüm, 2002; Gündoğdu, 2009; Beşoluk & Önder, 2010; Sağlam & Büyükuysal, 2013; Şahin & Gözütok, 2013; Yüksel, Uzun & Dost, 2013; Bayat, 2014; Bayındır; 2015; Palavan,

Gemalmaz & Kurtoğlu, 2015; Ocak, Emir, January, 2016; Yıldırım & Şensoy; 2017; Sağlam & Çoban, 2018; Durnacı & Ültay, 2020; Ökmen, Şahin & Kılıç, 2020; Baydar, 2021), there is no study in the literature that examines the sub-dimensions of critical thinking skills in terms of various variables, especially the study group consisting of prospective classroom teachers. In a study (Karakaş, 2018) on the development of the critical thinking levels of the prospective classroom teachers, it has been considered important by the researcher to examine the critical thinking skill levels, and their relevant sub-dimensions, of prospective classroom teachers according to different variables. Thus, the study was thought to contribute to the current literature. Similarly, this study aims to determine the critical thinking skills of prospective classroom teachers. In this context, the study aims to determine the critical thinking skills of prospective classroom teachers. For this purpose, the study seeks to answer the following questions:

1- What is the average critical thinking skill score of the prospective classroom teachers?

   a. Do the average scores of prospective classroom teachers' critical thinking skills show any difference by gender?

   b. Do the average scores of the sub-dimensions of prospective classroom teachers' critical thinking skills show any difference according to grade levels?

2- What is the average score of the prospective classroom teachers in the sub-dimensions of critical thinking skills?

   a. Is there any difference between the average scores of sub-dimensions of prospective classroom teachers' critical thinking skills?

   b. Do the average scores of sub-dimensions of prospective classroom teachers' critical thinking skills show any difference according to gender?

   c. Do the sub-dimensions of prospective classroom teachers' critical thinking skills show any difference according to average score levels?

2. METHODOLOGY

In this part of the study, the research model, working group, data collection and data analysis will be mentioned. These sections are presented under subheadings.

2.1. Research Model

In this research, the survey model, which is one of the quantitative research approaches, is used. In this model, the researcher takes a sample from the population that is of interest, and respondents are asked one or more questions about their attitudes, perceptions, or behaviors (Stockemer, 2019). Then, the collected data are attempted to be described and interpreted (Balcı, 2013). In this study, the answers of the prospective classroom teachers were revealed with the help of a critical reasoning power scale, and the data were interpreted by descriptive and inferential statistics.

2.2. Working Group

Prospective teachers registered in the Department of Primary Education at the Education Faculty participated in this research. In determining the sample group of the research, the maximum variation sampling method, one of the purposive sampling methods, was preferred. In maximum diversity sampling, a relatively smaller study group is formed than the population, and this study group reflects the characteristics of individuals who may be a part of the population at the maximum level (Yıldırım & Şimşek, 2013). Thus, it is provided that the sample group represents the population in the best way possible. In this process, it was attempted by the researcher to select a sample group that reflects the prospective classroom teachers in the best way, and the data were collected in the fall semester of the 20192020 academic year. In this regard, universities were contacted in the three different regions of the country (Central Anatolia, Marmara, and Southeast Anatolia), and 671 prospective classroom teachers were directly reached. The fact that the 671 prospective primary school teachers were educated in different regions of the country, residing in different settlements and studying in different classes, was thought provide a structure that could reflect the profile of prospective classroom teachers in the country. In this way, maximum diversity was achieved in the sampling. The characteristics of prospective classroom teachers in the study are presented in Table 1.

Table 1. Characteristics of Prospective Classroom Teachers Participating in the Research

Features of the Working Group	f	%
Gender		
Female	467	69.06
Male	204	30.04
Total	671	100
Grade		
1st Grade	150	22.4
2nd Grade	185	27.6
3rd Grade	132	19.7
4th Grade	204	30.4
Total	671	100.0

2.3. The Data Collection

The "Critical Thinking Appraisal Test" is used as the data-gathering instrument of this study. The Critical Reasoning Strength Scale was developed by Goodwin Watson and Edward Glaser and was published as two parallel forms named YM and ZM in 1964 (Gültepe, 2011). The Critical Thinking Appraisal Test consists of dimensions

including some important skills for critical thinking and involves problems, situations, debates, and comments which can be come across in the daily life of an individual (Saçlı, 2008). In their study, Houle, Morse, and McCune found that the total scores obtained from tests measure the sufficiency of individuals in terms of critical thinking in a valid way (Çıkrıkcı, 1993). The scale measures individuals' ability to define problems and evidence, make inferences, evaluate abstract concepts and generalizations, and the relationship between all sub-dimensions (Demiral, 2014). The scale consists of a total of 100 items and five sub-dimensions. For the participants, instruction on how to answer the questions in each subsection, and the skill to be measured in that section are explained. The names of the sub-dimensions in the scale, their characteristics, and how to answer the items are briefly listed below (Çıkrıkçı, 1993):

- *Inference (Inference):* There are 20 items in this sub-dimension. The test items are presented in the form of a short text. The participants are asked to make inferences following the text by selecting one of the degrees of data choices consisting of right, possibly right, wrong, possibly wrong, and insufficient.
- *Recognition of Assumptions (recognition of assumptions):* There are 16 items in this subdimension. These items consist of assumptions inferred from one or more situations. The participants are asked to determine whether an assumption can be made under the given situation.
- *Deduction:* There are 25 items in this sub-dimension. Two consecutive suggestions are given to participants in the beginning. The participants are asked to determine whether the suggestions given in the items follow the two suggestions given at the beginning.
- *Interpretation:* There are 24 items in this sub-dimension. The participants are asked to determine whether logical results can be inferred unquestionably from the information given in the paragraph.
- *Evaluation of Arguments:* There are 15 items in this sub-dimension. Each item begins with one question statement that is open to discussion, and justified answers follow every statement. The participants are asked to determine whether the justified answers are strong or weak for the given discussion scenario.

The participants get 1 point for every right answer, and 0 for every wrong answer. The total score shows the critical thinking strength of an individual. The highness and lowness of the average or total scores indicate the goodness or weakness of critical thinking skills, respectively. The adaptation of the Critical Thinking Appraisal Scale (YM form) into the Turkish literature was made by Çıkrıkçı (1993). Since the reliability value was calculated using the Kuder-Richardson Formula 20 (KR-20) in the range of 0.60 < KR-20 < 0.80 in the studies applied to university students that were adapted to Turkish (Çıkrıkçı, 1996; Kaya, 1997; Özcan & Çelenk, 2007; Demiral, 2014), the scale was considered quite reliable (Büyüköztürk, et al., 2012). Hence, it was decided to use the Critical Reasoning Power Scale in this study conducted with prospective classroom teachers. The KR20 reliability coefficients for the sub-dimensions of the scale were also calculated with the data obtained from 671 prospective classroom teachers in the present study.

2.4. Data Analysis

The data collection forms were applied face-to-face in the classroom on a voluntary basis, following the briefing of the participants on how to fill in the data collection tool. The student's names were intentionally left blank on the forms. All collected data were randomly sorted, and SPSS and Excel package programs were used in the statistical analysis of the data. The Cashier Meyer Olkin (KMO) value of the scale was calculated with the data obtained from 671 classroom teachers, and the results of the Bartlett Sphericity Test were found to be significant ($p < 0.05$). This result shows that the data related to the scale are suitable for the factor analysis. Following these assumption checks, the KR20 reliability coefficient for the sub-dimensions of the whole scale was calculated (Table 2).

Table 2. Confidence Analysis Regarding Sub-Dimensions of Critical Reasoning Scale

Dimension	Number of Items	KR-20	Reliability
Inference	20	0.78	Highly Reliable
Recognition of Assumptions	16	0.86	Extremely Reliable
Deduction	25	0.73	Highly Reliable
Interpretation	24	0.55	Reliable
Evaluation of Arguments	15	0.96	Extremely Reliable
Aggregate Scale	100	0.57	Reliable

According to the reliability results of the sub-dimensions of the scale, the "Interpretation" sub-dimension, which was in the range of 0.50 < KR-20 < 0.59, was found to be reliable, the "Inference" and "Deduction" sub-dimensions in the range of 0.60 < KR-20 < 0.79 were found to be quite reliable, and the sub-dimensions of "Awareness of Assumptions" and "Evaluation of Counterarguments", which were in the range of 0.80 < KR-20 < 0.99, were accepted as highly reliable (Büyüköztürk et al., 2013). The KR-20 value for the whole scale was calculated as 0.57, and the data obtained from the Critical Reasoning Power Scale were accepted as reliable.

For the critical thinking skill average scores of prospective classroom teachers, the study takes the formula determined by Sağdıç (2008) and the pilot study conducted by Karakaş and Sarıkaya (2020) with the prospective classroom teachers as its basis. Based on these calculations, the levels determined according to the critical thinking skill averages of the prospective classroom

teachers were calculated. According to the average scores of the prospective classroom teachers, the scores were divided into top-end, high, medium, low, and bottom-end critical thinking levels. Accordingly, the 0.00-0.49 point range was determined as the bottomend, the 0.50-0.56 point range as the low, 0.57-0.69 point range as the medium, 0.70-76 point range as the high, and the 0.77-1.00 point range were determined as the top-end critical thinking skill levels.

Kolmogorov-Smirnov and Shapiro-Wilk tests were conducted for the normality of the data sets applied to the prospective classroom teachers. Considering the results obtained from the tests, it was determined that the data were not suitable for a normal distribution ($p < 0.05$). The equality of variances was evaluated with Levene's test performed for each variable, and it was determined that the data did not exhibit equal variances ($p < 0.05$). Thus, it was decided to use non-parametric tests in the analysis of the measurements. Percentage, frequency, and arithmetic averages were used in the analysis of the critical thinking skills and the average sub-dimension scores of the prospective classroom teachers. In the comparison of these mean scores according to gender and grade level variables, independent groups were analyzed with the Mann-Whitney U and Kruskal-Wallis H tests, and the effect size (eta squared (η^2) was calculated according to the variances between the scores. The effect size calculation was based on the calculations put forward by Cohen (*Cohen's f* and *Cohen's d*). The Cohen's d value was taken as a basis for gender variables, and the effect size was defined as small if it was less than 0.2, medium if it was 0.5, and large if it was higher than 0.8 (Kılıç. 2014). For the grade levels, the Cohen's f value was taken as a basis and the range of 0.10 to 0.24 was interpreted as small, 0.25 to 0.39 as medium, and greater than 0.40 as a large effect (Özsoy & Özsoy, 2013).

3. FINDINGS

In this study, research is carried out to determine the critical thinking skills of prospective classroom teachers. The findings related to the sub-objectives formed in line with the objective investigated are given below.

3.1. The Findings Related to the Average Critical Thinking Skill Scores of Prospective Classroom Teachers

The responses of prospective classroom teachers to the questions in the critical thinking appraisal test are analyzed, and the critical thinking skill average scores of the prospective classroom teachers are calculated (Table 3).

Table 3. The Mean Critical Thinking Skill Scores of Prospective Classroom Teachers

	N	Min.	Max.	Std.	Average
Mean Critical Thinking Skill	671	0.43	0.83	0.06	0.63

The average scores of prospective classroom teachers' critical thinking skills are calculated as 0.63. Since this average score is in the range of 0.57-0.69 it is determined as an *intermediate level*. This value calculated in this context shows that prospective classroom teachers have an *intermediate level* of critical thinking skill.

The average critical thinking skill scores of prospective classroom teachers are compared according to the gender variable with the Mann-Whitney U test in Table 4.

Table 4. Comparison of Critical Thinking Skill Average Scores by Gender Variable

Gender	N	Rank Average	Mann-Whitney U	z	p	$\acute{\eta}^2$
Female	467	346.23	42858.50	-2.07	0.038	0.21
Male	204	312.59				

Mann-Whitney U = 42858.500; z = -2.07; p = 0.038; $\acute{\eta}^2$= 0.21

An examination of Table 4 reveals that the difference between the average rank scores of prospective classroom teachers' critical thinking skills is statistically significant according to the gender variable. The effect size of the difference between the gender variable scores (η^2) is calculated as 0.21; thus, there is a medium effect since this value is in the range of $0.2 < d < 0.5$. The average rank scores of female prospective classroom teachers' critical thinking skills are higher than those of male prospective classroom teachers. This finding can be interpreted such that the critical thinking skill average scores of female prospective classroom teachers are higher than those of male prospective classroom teachers with a medium effect.

The average critical thinking skill scores of prospective classroom teachers are compared according to the grade level variable through the Kruskall-Wallis H Test in Table 5.

Table 5. Comparison of Critical Thinking Skill Average Scores by Grade Level

Grade Level	N	Rank Average	Chi-Square x^2	sd	p	$\acute{\eta}^2$	Significant Difference
1st Grade	150	301.65	109.737	3	0.000	0.45	2nd-3rd-4th Grade
2nd Grade	185	434.67					1st-3rd-4th Grade
3rd Grade	132	383.44					1st-2nd-4th Grade
4th Grade	204	241.07					1st-2nd-3rd Grade

$x^2(3, n = 671) = 109.737$; p = 0.000 $\acute{\eta}^2$= 0.45

In Table 5, the average critical thinking skill scores of the prospective classroom teachers are compared according to the grade level, and it is observed that the average critical thinking skill rank scores of prospective classroom teachers who are at second grade are the highest, while the scores of prospective classroom teachers who are at fourth grade are the lowest. The difference between the average scores is found to be statistically significant in terms of grade level ($p < 0.05$) with a large effect size since the effect size of the difference (Cohen's $f = 0.45$) is larger

than 0.40. According to these findings, it can be concluded that there is a significant difference between the average scores of the sub-dimensions of prospective classroom teachers' critical thinking skills according to grade level. It can be interpreted that the critical thinking skill levels of prospective classroom teachers decrease, with large effect size, in third and fourth grades.

3.2. The Findings Regarding the Average Sub-Dimension Scores of Prospective Classroom Teachers' Critical Thinking Skills

Prospective classroom teachers' responses to the questions regarding the subdimensions in the Critical Thinking Appraisal Test are analyzed, and the average scores of prospective classroom teachers' critical thinking skills are calculated as shown in Table 6.

Table 6. The Average Sub-Dimension Scores of Prospective Classroom Teachers' Critical Thinking Skills

Sub-Dimensions	N	Number of Items	Std.	Average	Level
Inference	671	20	0.12	0.44	Low-End Level
Recognition of Assumptions	671	16	0.12	0.65	Intermediate Level
Deduction	671	25	0.10	0.70	High Level
Interpretation	671	24	0.11	0.72	High Level
Evaluation of Arguments	671	15	0.12	0.59	Intermediate Level
Scale Total	671	100	0.06	0.63	Intermediate Level

The average sub-dimension scores of prospective classroom teachers' critical thinking skills are calculated. The sub-dimensions of *Interpretation* and *Deduction* are calculated as high level, the sub-dimensions of *Recognition of Assumptions* and *Evaluation of Arguments* are calculated as medium level, and the sub-dimension of *Inference* is calculated as a bottom-end level. The difference between the average sub-dimension scores of prospective classroom teachers' critical thinking skills is compared, using the Kruskall-Wallis H Test in Table 7.

The average sub-dimension scores of prospective classroom teachers' skills are compared in Table 7, and it is observed that the average rank scores of the Interpretation subdimension are the highest, and the average rank scores of the Inference sub-dimension is the lowest. It is detected that the difference between the average scores is statistically significant ($p < 0.05$), while the effect size of the difference, in terms of Cohen's *f*, is calculated as 0.45. The effect size is considered large since it is greater than a Cohen's *f* value of 0.40. In the direction of these results, it can be said that there is a significant difference between the average sub-dimension scores of prospective classroom teachers' critical thinking skills. It can be said that while the levels of interpretation and deduction abilities of prospective classroom teachers are high with large effect size, the level of inference ability is at the bottom-end level with a large effect size.

The average sub-dimension scores of prospective classroom teachers' critical thinking skills are compared according to the gender variable with the Mann-Whitney U test (Table 8).

The difference between the average rank scores of the sub-dimensions of prospective classroom teachers' critical thinking skills is compared according to the gender variable in Table 8. It is seen that the difference between the average rank scores of Recognition of Assumptions and Interpretation sub-dimensions is statistically significant according to the gender variable. The effect size of

Table 7. The Comparison of Average Scores of Sub-Dimensions of Critical Thinking Skill

Sub-Dimensions	N	Rank Average	Chi-Square x^2	sd	p	$\acute{\eta}^2$	Significant Difference
Inference (In)	671	616.34	1319.772	4	0.000	0.83	2-3-4-5
Recognition of Assumptions (R)	671	1863.55					1-3-4-5
Deduction (D)	671	2152.19					1-2-4-5
Interpretation (I)	671	2312.14					1-2-3-5
Evaluation of Arguments (E)	671	1445.77					1-2-3-4

In:1; R:2; D:3; I:4; E:5; $x^2(4, n = 671) = 1319.772$; $p = 0.000$ $\acute{\eta}^2 = 0.83$

Table 8. The Comparison of Average Scores of Sub-Dimensions of prospective classroom teachers' Critical Thinking Skill

Sub-Dimensions	Gender	N	Rank Average	Mann-Whitney U	z	p	$\acute{\eta}^2$
Inference	Female	467	327.93	43863.500	-1.646	0.100	-
	Male	204	354.48				
Recognition of Assumptions	Female	467	356.53	38048.000	-4.202	0.000*	0.34
	Male	204	289.01				
Deduction	Female	467	338.66	46392.500	-0.542	0.588	-
	Male	204	329.91				
Interpretation	Female	467	347.75	42144.500	-2.392	0.017**	0.25
	Male	204	309.09				
Evaluation of Arguments	Female	467	337.73	46827.500	-0.354	0.724	-
	Male	204	332.05				

*Mann-Whitney U = 38048.000; z = -4.202; p = 0.000; $\acute{\eta}^2 = 0.34$

** Mann-Whitney U = 42144.500; z = -2.392; p = 0.017; $\acute{\eta}^2 = 0.25$

the difference between the average scores of the gender variable in these two sub-dimensions is calculated as 0.34 and 0.25 in terms of η^2, and since these values are in the range of $0.2 < d < 0.5$, the effect sizes are medium. The average rank scores of female prospective classroom teachers regarding either Recognition of Assumptions or Interpretation sub-dimensions are higher than those of male prospective classroom teachers. This suggests that the average scores of female prospective classroom teachers regarding the recognition of assumptions and interpretation sub-dimensions are higher than those of male prospective classroom teachers, with a medium effect size.

The average sub-dimension scores of prospective classroom teachers' critical thinking skills are compared according to grade levels with the Kruskall-Wallis H Test (Table 9).

The average sub-dimension scores of prospective classroom teachers' critical thinking skills are compared according to grade levels in Table 9. The average rank scores of prospective classroom teachers who are in the second grade are the highest while the scores of prospective classroom teachers who are in the fourth grade are the lowest at all the sub-dimensions except for the sub-dimension of interpretation. It is seen that third grades have the highest average rank score at the sub-dimension of interpretation. It is further found that the difference between the average sub-dimension scores according to grade levels is statistically significant. Regarding the effect size of the difference between the average sub-dimension scores, a large effect size is obtained for sub-dimensions of Inference and Interpretation, since the Cohen's *f* is greater than 0.40. On the other hand, the sub-dimensions of Recognition of Assumptions, Deduction, and Evaluation of Arguments have small effect sizes since the Cohen's *f* is between 0.10 and 0.24. In the direction of these findings, it can be said that there is a significant difference between the average sub-dimensions scores of prospective classroom teachers' critical thinking skills according to their grade levels. Except for the interpretation subdimension, it can be commented that just like the critical thinking skill levels of the prospective teachers in the third and fourth grades, a large effect size is found in the inference and interpretation sub-dimensions, and small effect size is found in the other subdimensions.

4. CONCLUSION AND RECOMMENDATIONS

In this study, the critical thinking skills of prospective classroom teachers are identified. The average scores of prospective classroom teachers' critical thinking skills are calculated as 0.63. The calculated value shows that prospective classroom teachers have an intermediate level of critical thinking skills. In addition to that, the average sub-dimension scores of prospective classroom teachers' critical thinking skills are also calculated. Accordingly, the sub-dimensions of Interpretation and Deduction are considered high-level, the sub-dimensions of Recognition of Assumptions and Evaluation of Arguments are intermediate level, and the subdimension of Inference is considered bottom-end level. It was concluded that while the prospective classroom teachers were at a high level with a large effect in making interpretation and performing deduction, they were at a low level with a large effect in making inferences. The inference sub-di-

Table 9. The Comparison of Average Scores of Sub-Dimensions of Critical Thinking Skill According to the Grade Level

Sub-Dimensions	Grade Level	N	Rank Average	Chi-Square x^2	sd	p	ή2	Significant Difference
Inference	1st Grade	150	313.49	24.667	3	0.000	0.83	2nd Grade
	2nd Grade	185	394.01					1st-3rd-4th Grade
	3rd Grade	132	329.61					2nd Grade
	4th Grade	204	304.07					2nd Grade
Recognition of Assumptions	1st Grade	150	308.29	25.096	3	0.000	0.20	2nd Grade
	2nd Grade	185	388.72					1st-4th Grade
	3rd Grade	132	349.48					-
	4th Grade	204	299.84					2nd Grade
Deduction	1st Grade	150	322.73	22.874	3	0.000	0.18	2nd Grade
	2nd Grade	185	389.98					1st-4th Grade
	3rd Grade	132	332.58					-
	4th Grade	204	299.02					2nd Grade
Interpretation	1st Grade	150	312.19	111.594	3	0.000	0.44	2nd-3rd-4th Grade
	2nd Grade	185	395.53					1st-4th Grade
	3rd Grade	132	435.84					4th Grade
	4th Grade	204	234.92					1st-2nd-3rd Grade
Evaluation of Arguments	1st Grade	150	320.08	27.388	3	0.000	0.19	2nd Grade
	2nd Grade	185	387.38					1st-4th Grade
	3rd Grade	132	353.56					4th Grade
	4th Grade	204	289.75					2nd-3rd Grade

$x^2(3, n = 671) = 24.667, 25.096, 22.874, 111.594, 27.388$; $p = 0.000$

ή2= 0.83; 0.20; 0.18; 0.44; 0.19

mension forms the basis of reasoning, and its bottom-end level may have contributed to the low level of critical thinking skills. When the studies conducted in our country on critical thinking skills of prospective classroom teachers are observed, the levels of critical thinking skills of prospective classroom teachers are found to be low (Türkmen, 2014; Yüksel, Uzun & Dost, 2013; Sağlam & Büyükuysal, 2013), or below intermediate (Akdere, 2012) or as intermediate (Bayat, 2014; Kürüm, 2002; Beşoluk & Önder, 2011; Yıldırım & Şensoy, 2017; Durnacı & Ültay, 2020). In studies that were conducted specifically with prospective classroom teachers, it is observed that prospective classroom teachers have low-level (Açışlı, 2016) and intermediate-level (Gökkuş & Delican, 2016) tendencies of critical thinking skills. This study presents results that are similar to other studies conducted in our country, in which teacher candidates and prospective classroom teachers are studied. Students' inability to provide theory-evidence coordination in terms of critical thinking skills and accepting what they believe as certain truths may cause them not to reach a high level of reasoning (Klahr & Dunbar, 1988; Kuhn, 2004). In a study conducted with prospective teachers, Schwartz and colleagues (2004) found that providing prospective teachers with direct opportunities for reasoning, and giving them enough time for reflection and discussion strengthened prospective teachers' critical thinking skills and interests. According to Moore (2010), the frequent use of open-ended questions in classroom discussions, giving the learner plenty of time to reflect on the questions, and group interaction support the development of critical thinking skills. Chen and She (2015), on the other hand, found that students of critical reasoning education produced significantly more accurate hypotheses and evidence-based explanations, and increased their reasoning levels compared to students who did not receive this education. Therefore, reasoning skills are one of the skills that can be developed later, and critical thinking skills can be increased by giving opportunities to prospective classroom teachers.

Moreover, the difference between the average rank scores of critical thinking skills and their subdimensions are compared according to gender. It is found that the average critical thinking skill scores of female prospective teachers are higher than those of male teachers with a medium effect size. Also, the average rank scores of sub-dimensions of Recognition of Assumptions and Interpretation of female classroom candidates are higher than those of male classroom candidates with a medium effect size. When the related studies with teacher candidates were examined, studies were found that showed parallels with the results of this study in terms of the gender variable (Gülveren, 2007; Zayif, 2008; Beşoluk & Önder, 2011; Çetinkaya, 2011; Yıldız & Yılmaz, 2020). Rudd, Baker, and Hoover (2000), in their study with university students, found that female students scored higher than males in truth-seeking and open-mindedness dimensions. In the research conducted by Zayif in 2008 and by Çetinkaya in 2011, they found a significant difference in favor of female teacher candidates in the sub-dimensions of open-mindedness and truth seeking. Hypothetical reasoning can develop through the search for correct information, and the presentation of open-minded views can increase the power of interpretation. So, female teacher candidates' capabilities of evaluating assumptions on behalf of seeking truths and interpreting events and situations open-mindedly, can be the fundamental reason of difference seen at sub-dimensions of critical thinking skill.

The averages of prospective classroom teachers' critical thinking skills and sub-dimensions are compared according to grade levels. It is found that the average rank scores of critical thinking skills of the prospective classroom teachers who are in second grade are the highest, while the average rank scores of critical thinking skills of the prospective classroom teachers who are in fourth grade are the lowest. It is further found that levels of critical thinking skills decrease with a large effect size for prospective classroom teachers in third and fourth grades. Except for the interpretation sub-dimension, it was determined that the scores of prospective classroom teachers decreased gradually in the third and fourth grades, with a large effect size in the inference and interpretation sub-dimensions, and a small effect was found in the other sub-dimensions, just as in the critical thinking skill levels. Kürüm (2002) found in his study that the ability to interpret, which is one of the indicators of critical thinking, is higher only in second year students, it differs in their favor, and there is no difference in other classes. When the results of the related studies on critical thinking skills according to grade level were examined, it was determined that the teaching process at the university did not provide any improvements on the critical thinking levels of teacher candidates (Yıldırım & Şensoy, 2017). As the reason for this situation, Tümkaya (2011) stated that since a rotebased process is followed in the teaching environments where teacher candidates are trained in our country, this process does not contribute to the critical thinking of teacher candidates. According to Korkmaz (2009), the fact that the education given in education faculties remains very theoretical, that multiple-choice questions are generally preferred in evaluation activities, and that activities requiring analysis, synthesis and evaluation skills are less involved may have resulted in this situation. Sağlam and Büyükuysal (2013) listed the obstacles to critical thinking as rote learning-teaching environment, failures of instructors in creating a democratic classroom environment, lecture-based course approach process and exam systems in their focus group interviews with prospective teachers. Özelçi (2012) emphasizes that practices supporting critical thinking skills are absent at education faculties. Yeşilpınar (2011) stated that the courses taken by the prospective classroom

teachers during their undergraduate education were insufficient in terms of critical thinking, and this was due to the theoretical nature of the courses. Korkmaz (2009), on the other hand, stated that this situation should be questioned and that it does not match the quality of the teacher in today's understanding of education. The reason for the decrease in the average scores of the critical thinking skills, and the respective scores of the prospective classroom teachers in the sub-dimensions in the third and fourth grades, may also be the preparation of the prospective classroom teachers to be appointed to the multiple-choice examination system by the Public Personnel Selection Examination (KPSS). Güven and Dak (2017) found in their study that teacher candidates evaluate KPSS as a process and spend the last two years of their undergraduate education both trying to pass their undergraduate courses and preparing for the KPSS. In their study, Taşan and Bektaş (2016) stated that pre-service teachers stated that PPSE pushed them to rote learning. One other characteristic of such exams is exposing the candidates to negative situations like anxiety and stress (Wang & Browns, 2014). In Kuran (2012), teacher candidates mentioned that they experienced negativities such as high anxiety and stress, and these anxieties affect their cognitive field and effective field. Yavuz and Akdeniz (2019) mentioned that when the anxiety felt by teacher candidates about the KPSS exam increase, their exhaustion levels would also increase, so the anxiety of the exam and the exhaustion arise together. This situation may have affected average scores of critical thinking skills on the grade level.

In the related studies, it was found that different practices in the education process improved the critical thinking skills of prospective teachers. Yıldırım (2009), who designed a subject-based critical thinking program, revealed in his study with prospective science teachers that science education based on critical thinking was more effective in directing critical thinking than traditional teaching methods, and argued that this situation could be explained by putting the candidates at the center of the learning process. In his quasiexperimental study with pre- and post-test control group, Schreglmann (2011) found a significant difference in favor of the experimental group in the critical thinking post-test scores. Fung and Howe (2012), in their study aiming to develop critical thinking through group work, found that there was a significant difference in favor of the experimental group in the critical thinking post-test results at the end of the group activities. In another study on nuclear energy, which is a socio-scientific issue, it was determined that the reasoning levels of pre-service teachers who produced arguments increased (Demircioğlu & Uçar, 2014).

Since reasoning is at the focus of critical thinking, the activities related to the critical thinking skill sub-dimensions of the prospective teachers contribute to the development of critical thinking as well. The fact that prospective classroom teachers' undergraduate education is far from rote will provide them with different activities and experiences that they can use in their future professional lives, improve their professional development and increase their critical thinking disposition by improving their reasoning power. Taking the course process out of different teaching methods will prevent rote learning and monotony, and will positively affect the critical thinking process by approaching events and situations from different perspectives, interpreting them, and sharing their ideas with others. In addition, the Teacher Training Undergraduate Programs were rearranged by the Council of Higher Education (YÖK) in 2018, and it was cleared that different elective courses could be taught with the course codes of Field Education, Vocational Knowledge and General Culture. Elective courses such as "Critical and Analytical Thinking", "Human Relations and Communication" and "Social Skills Teaching" determined by YÖK for the Primary Education Undergraduate Program, or semester courses that the instructor can recommend are selected and can contribute to the development of their skills. Along with this, the restructuring process of education faculties started, and with the decision of the Higher Education Institution meeting dated 10.08.2020, it was decided to authorize the relevant boards in determining the courses, curricula and credits in teaching programs (YÖK, 2020). When evaluated from this point of view, it can be seen important that the education faculty boards recommend adding courses that will improve the critical reasoning skills of prospective teachers to the curriculum to be redesigned. Thus, these experiences of prospective classroom teachers in the undergraduate education process will contribute to raising the generation who can think critically in the future.

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