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An Examination of the Critical Thinking Skill Levels of the Primary Education Students

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Abstract: What is intended in today's renovated and updated sense of education is not to bring up individuals who merely memorize the information units without questioning, but to bring up enterprising asking, questioning, wondering, problem-solving, and researching individuals, who are equipped with decision-making skills, who may make use of information technologies, and who may think scientifically, creatively, and multi-dimensionally. It is thus intended in this study to determine the levels of critical thinking skill levels of the primary education students, and to examine whether they vary as per the grade levels thereof. Screening design, which intends to describe an existing situation as it is, is therefore used herein. This is a study having been conducted with a total of 173 students from a primary education school in Ankara, which is registered to the Ministry of National Education, 84 of whom are from 6th Grade, 43 of whom are from 7th Grade, and the remaining 46 of whom are from 8th Grade. Cornell Critical Thinking Test-Level X (CCTTLX) was utilized in order to determine the critical thinking levels of the said students. According to the attained findings, critical thinking levels of the students from 6th, 7th, and 8th grades were found to be at medium level. A meaningful difference, which is in favor of the students from the 8th grade, was found between the critical thinking levels of the students from 6th and 8th grades. However, no meaningful difference was found between the critical thinking levels of the students from the 7th grade and those from the 6th and 8th grades. No meaningful difference was found between the critical thinking levels of the said grades also in view of the sub-dimensions of induction, reliability of the observations and sources, deduction, and that of defining the assumptions included within the assessment instrument.

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Keywords: Primary science education, Thinking skills, Critical thinking

Introduction

We live in the age of information and technology. In our daily lives people are subject to an intense flow of information. It is getting difficult to keep track of such an ever-increasing bulk of information. While seeking for an answer to the question of “Which university am I to go?”, deciding on which job we are to take, and under many other similar circumstances we are to make decisions. To make use of a newly launched technological device, to decide whether the news we follow are true or not, to keep track of the events occurring and flowing rapidly around us all require certain skills to come to the fore, and get more developed in the humans. "Thinking" is surely the most important among such skills.

Similar to the adults, children, too, constantly encounter with various problems in their daily lives. They, too, should be able to 'think' in order to solve such problems, and to make and carry out respective decisions. As a

matter of today's education system, students are subject to numerous assessment and evaluation methods, and undergo important examinations that shape their futures. It is also a necessity for them to possess developed thinking skills in order to achieve the desired success in these examinations.

Development of the thinking skills undoubtedly starts at minor ages, and educational institutions play the most critical role with regard to this issue. Education of thinking, which is deemed as one of the most critical needs of our age, is therefore reflected in the new educational programs. What is intended in today's renovated and updated sense of education is not to bring up individuals who merely memorize the information units without questioning, but to bring up enterprising asking, questioning, wondering, problem-solving, and researching individuals, who are equipped with decision-making skills, who may make use of information technologies, and who may think scientifically, creatively, and multi-dimensionally (Akar, 2007). That is why the classical behaviorist methods have been abandoned in the new programs, and such approaches as constructivism, multiple intelligence, brain-based learning have been adopted in place thereof, and instead of a traditional teacher-centered approach, the aforesaid programs have been designed according to a student-centered approach (MEB (Ministry of National Education),2005). Benefits in parallel of these common objectives have been determined in all programs, and activities have been made up in this direction.

Critical thinking is another one of the most critical skills being required in our age. Having the related literature reviewed, it may be seen that, despite being many in number, the researches carried out in relation with critical thinking were focused mostly on the high-school and university students. There are a negligible number of studies having been carried out on the critical thinking skills of the primary education students. In the recent years, Akar (2007), as matter of the renovated programs, carried out a study on the critical thinking skills of the primary education students, and came across meaningful findings. Accordingly, Cornell Critical Thinking Test-Level X (CCTTLX) was utilized in this research, having been carried out for determining the levels of the critical thinking skill levels of the sixth grade primary education students, educational successes, ages, genders, and academic self-conceptions thereof, and the levels of contribution of the programs applied in the year 2004, and the subject students were found to have answered an average of 29 questions in a test of 71 questions. These outcomes were interpreted as the critical thinking skill levels among the students were "insufficient" However, Demir (2006), in a research he carried out in Ankara by means of an assessment instrument he had developed, found out that, primary education students from 4^{th} and 5^{th} Grades had in general a high level of critical thinking skills. Consequently the situation was deemed as a shortcoming, and it was aimed to carry out studies among primary education students for the purpose of shedding light onto the future researches. In the following sections, information was given with regard to the thinking concept, and to the assessment of the critical thinking.

Thinking

Thinking is generally recognized as a cognitive process, a mental exercise, by which information is obtained. It is defined in numerous forms, such as cognition, perception, discernment, intuition, etc. (Hesapçıoğlu & Bakıroğlu, 1997, p. 53, cit. Ergin, 2006). Although it could not have been clarified due to the varying definitions brought about by the psychologists, such as ‘reasoning’ or ‘forming opinions’, thinking concept may be defined as the whole of information, abilities, processes, and attitudes as well. According to Paul & Elder (2008), main elements of thinking may be listed as follows;

- Reasoning always has a purpose.
- Reasoning is always an attempt to understand something, explain some questions, and to solve some problems.
- Reasoning is always based on assumptions.
- Reasoning is always made from a certain point of view.
- Reasoning is always based on findings, information, and proofs.
- Reasoning is always molded and expressed by means of concepts and opinions.
- Reasoning always involves implications or interpretations, through which we may reach conclusions, and construe the available data. Reasoning always works up to something, or brings about effects and outcomes.

Critical Thinking

According to the definition of American Philosophical Association/APA (1990), critical thinking skills are the cognitive skills, such as analyzing interpretations, making inferences, explaining and evaluating proofs, thinking in a conceptual, methodological or contextual manner (Akar, 1998). Cüceloğlu (1999: 255-256) defines critical

thinking as an active and organized mental process, which enables us to understand ourselves and the events around us by being aware of our own thinking process, considering the thinking processes of others, and applying what we have learned. According to Kazancı (1989), critical thinking is the whole of the processes of attitude, information, and ability, being applied in the argumentation and assessment of a problematic situation in view of scientific, cultural, and social standards and dimensions.

Halpern (2003) sees critical thinking as being purposeful, logical, and goal-oriented. This type of thinking involves problem-solving, inference formulation, calculation of probabilities, and decision-making. Taking the points being common in each and every definition, keywords being mentioned in critical thinking may be put forth as "being active, being goal-oriented, reflection, focusing, observation, interpretation, questioning, judging, inference, use of information, distinguishing the stereotypes, analyzing, assessment, logic, problem-solving, and sympathy" (Akar, 2007).

Ennis (1985) put forth that, critical thinking was not merely a set of abilities, and that individuals had to possess tendencies in critical thinking. Ennis (1985) may list tendencies in critical thinking as follows:
1. Searching for a clear expression of a claim or problem
2. Searching for causes
3. Putting the available information in order, and trying them
4. Making use of, and considering reliable sources
5. Determining the whole situation prior to decision-making
6. Trying the remaining issues for the sake of the main point
7. Keeping the original or basic interest in mind
8. Searching for alternatives
9. Being open-minded
a. Taking others' points of view other than his/hers into consideration
b. Delaying or rejecting making judgments when there is no adequate proof and cause at hand
c. Trying to find the causes of obtaining information according to the terms
10. Changing the situation when there are adequate causes and proofs at hand
11. Investigating a subject as thoroughly as permissible
12. Decomposing the parts of a complex whole by an orderly manner
13. Being aware towards his/her own feelings at every stage of his/her works to access information
It is possible to say that many scientists and thinker (McKendree *et al*., 2002; Gomez, 2002; Lewis & Smith, 1993; Halpern, 2003; Paul, 1990; Siegel, 1988; Ennis, 1996; Fung, 2005; Lipman, 1991; Akar, 2007) today mentions of "critical thinking" as one of the most critical skills, which should be possessed by the individuals.

Assessment of Critical Thinking

Various instruments of assessment have been developed by numerous researchers at different times in order to assess the skill of critical thinking. Each and every one of the instruments of assessment differs from each other in terms of;

- features,
- codes of practice,
- aimed grade levels,
- persons,
- scorings, and
- forms of assessment there of (Deniz,2009).

Ennis (2009) has collected these instruments of assessment, having been designed to assess the critical thinking skills under three titles, namely as instruments of assessment assessing multiple dimensions of critical thinking, instruments of assessment assessing only one dimension of critical thinking, and instruments of assessment oriented to certain fields. Many of these instruments of assessment have been collected by Ennis, having studied on the critical thinking skill for long years, and put forth with brief descriptions thereof. One of the critical thinking tests being most widely utilized among the primary and high-school students is the Cornell Critical Thinking Test. Cornell Critical Thinking Test-Level X (CCTTLX) was therefore utilized in this research.
In light of the conducted researches, it was intended to investigate whether the critical thinking skill levels of the primary education students differ in terms of grade level. For this purpose, answers were sought for the following sub-problems:
1. Which level are the following sub-dimensions of the critical thinking skills of the primary education students at in terms of total score

a. Sub-dimension of induction,
b. Sub-dimension of reliability of observations and sources,
c. Sub-dimension of deduction,
d. Sub-dimension of defining the assumptions?

2. Is there any meaningful difference between the critical thinking skill levels of the primary education students from 6th, 7th, and 8th Grades in terms of total score
a. Sub-dimension of induction,
b. Sub-dimension of reliability of observations and sources,
c. Sub-dimension of deduction,
d. Sub-dimension of defining the assumptions?

Method of this research was discussed in the following section.

Method

This research was made for the purpose of determining the critical thinking skill levels of the primary education students, and for the purpose of determining whether their critical thinking skill levels vary as per their grade levels as well. Screening design (Karasar, 1999), which intends to describe an existing situation as it is, is therefore used herein. This is a study having been conducted in the educational year of 2015-2016 with a total of 173 students from a primary education school in Ankara, which is registered to the Ministry of National Education, 84 of whom are from 6th Grade, 43 of whom are from 7th Grade, and the remaining 46 of whom are from 8th Grade.

Data Gathering Tool

Cornell Critical Thinking Test-Level X (CCTTLX) was utilized in the research in order to determine the critical thinking levels of the said students. This instrument of assessment was developed by Ennis & Millman (1985), and adapted to Turkish language by Akar (2007). The multiple (three)-choice test consisting of 71 articles is formed of 4 dimensions.

1. Deducing by way of inductive reasoning: There are 23 questions in this dimension of the test, and the students are expected to deduce correctly with reference to the information (clues) given to them.

2. Deducing by way of deductive reasoning: There are 14 questions in this section. Students are expected to arrive at the correct conclusion with reference to a generalization.

3. Judging the reliability of the observations and sources: There are 24 questions in this section. Students are expected to make accurate observations, and to sort the reliable information out of the information made available to them.

4. Defining (determining) the assumptions within the statements: There are 10 questions in this section. What is expected from the students herein is to sort the stereotypes and pre-assumptions mentioned within the statements.

CEDTDX is applicable from 4th Grade to 14th Grade. Application time for the conduct of the test is for around 50 minutes for the groups of students from secondary education and above. The same is estimated as 64 minutes for the level of primary education. Reliability values of the tool (KR20, KR21 and Sperman-Brown) are seen in between 0.67 and 0.90 in view of the data attained from various researches having been made by the same tool (Ennis, Millman ve Thomko, 2005: 17).

Data Analysis

It was attempted herein to determine whether there was any meaningful difference between the students from 6th, 7th, and 8th Grades in view of the test scores out of those they had earned from Cornell Critical Thinking Test-Level X (CCTTLX). While total scores were taken by way of coding the students' correct answers to the questions in the test by "1", and false ones by "0", average and standard deviation values were calculated therefrom. Single-factor variance analysis (one-way anova) was applied for the unrelated samples in order to

determine whether the students' critical thinking skills showed any meaningful difference as per the grade levels thereof.

Findings and Interpretation

Analyses relevant to the attained data were applied in this study, which was conducted so as to determine the classical thinking skills of the primary education students. Findings were given successively as per the sub-problems of the research.

Findings about the First Sub-Problem of the Research, and the Interpretation

First sub-problem of the research is "Which level are the sub-dimensions of Induction, Reliability of Observations and Sources, Deduction, and Defining the Assumptions of the critical thinking skills of the primary education students at in terms of total score?" Average and standard deviation values thereof were therefore calculated in order to determine the level of the sub-dimensions and total scores of the students' critical thinking skills. The findings obtained are given in Table 1.

Table 1. Students' levels in the cornell critical thinking test-level x scale as per the sub-dimensions and total scores thereof

			6th Grade		7th Grade		8th Grade	
Dimensions	N	Number of Articles	X	Ss	X	Ss	X	Ss
1. Induction (Hypothesis testing)	173	23	12,1	3,9	12,4	3,6	13	2,7
2. Reliability of the Observations and Sources	173	24	10,9	3	11,3	3	11,9	2,8
3. Deduction	173	14	7,54	2,3	7,74	2,3	8,3	2,3
4. Definition of the Assumptions	173	10	4	1,5	4,62	1,7	4,47	1,9
CCTTLX Total Test	173	71	34,5	7,8	36,1	5,7	37,7	6,7

Upon reviewing Table 1, in view of the averages of the scores that 6th Grade students obtained from the Cornell Critical Thinking Test-Level X Scale, the average score from the sub-dimension of induction is seen to be 12.05, while the same from the sub-dimension of reliability of the observations and sources is 10.90, from the sub-dimension of deduction is 7.54, and finally their average score from the sub-dimension of definition of the assumptions is seen to be 4.00. Looking at the total scores of the 6th Grade students, the average score was calculated as 34.51, while the standard deviation value was calculated as 7.82.

In view of the averages of the scores that 7th Grade students obtained from the applied instrument of assessment, the average score from the sub-dimension of induction is seen to be 12.44, while the same from the sub-dimension of reliability of the observations and sources is 11.32, from the sub-dimension of deduction is 7.74, and finally their average score from the sub-dimension of definition of the assumptions is seen to be 4.62. Looking at the total scores that the 7th Grade students obtained from the Cornell Critical Thinking Test-Level X Scale, the average thereof was calculated as 36.13, while the standard deviation value was calculated as 5.68.

In view of the averages of the scores that 8th Grade students as per each sub-dimension, the average score from the sub-dimension of induction is seen to be 13.04, while the same from the sub-dimension of reliability of the observations and sources is 11.91, from the sub-dimension of deduction is 8.30, and finally their average score from the sub-dimension of definition of the assumptions is seen to be 4.647. Looking at the total scores that the 8th Grade students obtained from the Cornell Critical Thinking Test-Level X Scale, the average thereof was calculated as 37.73, while the standard deviation value was calculated as 6.69.

In view of the user norms appertained to CCTTLX, primary education students are found to have obtained scores at medium level. According to the meta-analysis conducted by Ennis *et al*. (2005: 12), average of the scores that the students from the levels of 4th, 5th, 6th Grades obtained from CCTTLX is around 35, while the standard deviation level is around 5. The average of the scores that the students from the levels of 7th and 8th Grades is around 37, while the standard deviation level is again around 5. Comparing the analysis results attained from this research with the norm tables, it may be said about the students within the study group that, their critical thinking skill levels are at medium level.

Findings about the Second Sub-Problem of the Research, and the Interpretation

Second sub-problem of the research is "Is there any meaningful difference between the critical thinking skill levels of the primary education students from 6th, 7th, and 8th Grades in terms of total scores of the sub-dimensions of Induction, Reliability of Observations and Sources, Deduction, and Defining the Assumptions?" Averages of the total scores having been obtained by the students of 6th, 7th, and 8th Grades, both from each of the sub-dimensions of the Cornell Critical Thinking Test-Level X Scale, and from the whole of the scale, were checked in order to determine whether there was any meaningful difference between the critical thinking skill levels of the students. Single-factor variance analysis was applied for estimating whether there was any meaningful difference between the average scores as per the grade levels. Findings attained for the total scores of the students' critical thinking skill levels are shown in Table 2.

Table 2. ANOVA results of the total scores obtained by the students from the cornell critical thinking test level x as per the grade levels thereof

Variance Source	**Sum of Squares**	**sd**	**Mean of Squares**	**F**	**p (p<0,05)**
Intergroup	317,188	2	158,594	3,189	0,044
Intragroup	8455,02	170	49,735		
Total	8772, 208	172			

Upon reviewing Table 2, a meaningful difference in favor of the 8th Grade students may be seen between the critical thinking levels of the students as per the grade levels thereof (F(2-170)= 3,189, p<0,05). In other words, critical thinking levels of the students meaningfully vary depending to the grade levels of the students. Critical thinking skill levels of the 8th Grade students (X= 37,74) were higher than the same skill levels of the 6th Grade students (X= 34,51) according to the results of the Scheffe test, having been conducted so as to find out between which groups do the inter-grade differences exist. However, no meaningful difference was found between the critical thinking levels of the students from the 7th grade (X= 36,14) and those from the 6th and 8th grades. Consequently, in view of the critical thinking skill levels, meaningful difference was found between the 6th and 8th Grade students.

Whether there was any meaningful difference as per the grade level was calculated by means of single-factor variance analysis according to the sub-dimensions of induction, reliability of the observations and sources, deduction, and definition of the assumptions of the Cornell Critical Thinking Test-Level X Scale, having been applied to the critical thinking skill levels of the 6th, 7th, and 8th Grade students. Except the sub-dimension of the definition of the assumptions, an increase may be seen in the scores of all sub-dimensions among students from 6th to 8th Grade. However the results of the conducted analyses reveal that, there is no meaningful difference as per all four sub-dimensions within the scale. It is therefore possible to say that, the skills of induction, reliability of the observations and sources, deduction, and definition of the assumptions do not change depending to the grade levels.

In view of the results attained from the first sub-problem of the research, it was seen that, the critical thinking skill levels were at medium level for 6th, 7th, and 8th Grade students. This is a finding similar to the result of the meta-analysis of the various studies conducted in USA, which were reported by Ennis *et al*. (2005). However, it contradicts with the study, in which Demir (2006) reported that, in the research conducted in the city of Ankara, 4th and 5th Grade students were found to possess high levels of critical thinking skill in general. It is suggested that, the difference between the results of the researches in question may arise from the quality of the instruments of assessment being used therein.

Upon review of the results attained from the second sub-problem of the research in terms of critical thinking skill levels, no meaningful difference was found between the 6th and 7th Grade students, while a meaningful difference in favor of 8th Grade students was found between them and the 8th Grade students. It was further found that, the critical thinking skill levels of the 7th Grade students revealed no meaningful difference between those of the other two grade levels. It is suggested that, the aforesaid meaningful difference between the 6th and 8th Grade students in terms of critical thinking skill levels might have arisen as per the age level. While it is acknowledged that, there is a transition from the concrete operations period to the abstract operations period between these two grade levels, it is an expected outcome for the 8th Grade students to have shown higher levels of critical thinking skills. Besides, it is also suggested that, the teaching program in use is also effective in the development of the critical thinking skill levels, which were found to be increasing at all grade levels in conclusion of the respective researches.

Conclusion and Suggestions

In this section, results of the research are shown on the basis of the findings attained in the third section. There are also suggestions made for the future researches.

Critical thinking skill levels of the students from 6th, 7th, and 8th grades were found to be at medium level. Meanwhile, an increase was seen in the critical thinking skill scores as the grade level increased. Analyzing whether this increase was meaningful, a meaningful difference in favor of 8th grade students was found between the critical thinking skill levels of the 6th and 8th grade students. However, no meaningful difference was found between the critical thinking levels of the students from the 7th grade and those of the students from the 6th and 8th grades. No meaningful difference was found between the critical thinking levels of the said grades also in view of the sub-dimensions of induction, reliability of the observations and sources, deduction, and that of defining the assumptions included within the assessment instrument.

Suggestions

This research was conducted with 173 primary education students from a primary education school. It may be suggested to expand the scope of the research by way of increasing the number of students at different schools in different cities. Researches may be conducted also for determining the factors influencing the critical thinking skills of the students.

While the critical thinking skill levels of the 6th, 7th, and 8th Grade students were found as medium, more gains and activities with regard to the improvement of critical thinking skills may be included within the scope of the teaching programs. Meanwhile, it is further suggested to search for the influence of the lessons included within the teaching programs on the development of the critical thinking skills.

Taking the instruments of assessment being applied both at home and abroad into consideration, it may also be suggested to design and develop new instruments of assessment applicable in Turkey for the assessment of the critical thinking skills. While descriptive and quantitative analysis methods are applied more often in the assessment of the critical thinking skills, not only the qualitative instruments of assessment may be developed, but it may also be suggested to increase the frequency of application of the available instruments of qualitative assessment.

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