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The Effect of Intelligence Games on 6th and 7th Grade Students' Critical Thinking Skills, and Student Opinions on Their Science Course Achievement[1]

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Abstract

The purpose of this study was to evaluate the critical thinking abilities of sixth and seventh grade students who participated in an intelligence games course as well as their perceptions of their performance in a science course. The sample of the study consisted of 16 students at 6th and 7th grade level studying in Ardahan. A mixed research model using quantitative and qualitative data was preferred in the study. In order to collect quantitative data, a single-group pre-test, post-test experimental design was used, and the critical thinking skills test and demographic characteristics form were used as scales. For qualitative data, a case study was conducted and a semi-structured interview form was applied. Critical thinking skills test data were analyzed by dependent sample t-test and the effect of father and mother education level on critical thinking skills was analyzed by ANOVA test. The semi-structured interview form was analyzed by content analysis. Due to the Covid-19 pandemic, the study was conducted as a "Live Lesson" over the Education Information Network (EBA) for 10 weeks as 1 class hour per week. For the activities in the course, the book "Teaching Material for Teachers of Secondary and Imam Hatip Secondary Schools Grades 5, 6, 7 and 8" and smart device applications of strategy games were used. As a result of the research, A small change in favor of the post-test was detected between the pre-test and post-test averages of the critical thinking skills test. Additionally, there was no correlation between the students' critical thinking abilities and their parents' educational levels among those who took the intelligence games course ($p>0.05$). The students claimed that intelligence games would benefit the science course in their interviews and that they enjoyed the intelligence games course. They also claimed that playing intelligence games helped them develop their cognitive abilities, including attention and memory.

Keywords: Intelligence games, critical thinking, science, middle school students, mixed design

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Introduction

Intelligence games have always been popular because they enable one to make quick, precise, and original decisions in the face of challenges and to renew the individual himself (Devecioğlu & Karadağ, 2014). The game of ur found in the tomb of the Sumerian king of Ur in 4 thousand BC, the game of go, which has a history of 4 thousand years in East Asia, especially in Japan, Korea and China, mangala played in Anatolia (MEB, 2013; MEB, 2016; Öner & Dindar, 2018), chaturanga, which was played in India in the 6th century and is the ancestor of chess, and chess played since the 1600s (Davidson, 1949) demonstrate that intelligence games have existed in people's lives since ancient times.

Today, the contributions of intelligence games to human life have been understood and some of them such as strategy games, geometric-mechanical games, reasoning-operation games, verbal games, and memory games are included in the curriculum (MoNE, 2013). The reason for this situation is that individuals need to have many skills such as creative and critical thinking, collaborative work, problem solving, efficient communication, being open to changes and using technology in a beneficial way in order to be successful in business and education life (Eryılmaz & Uluyol, 2015). In order to provide students with these 21st century skills, an elective "Intelligence Games Course" was started to be implemented gradually starting from the 5th and 6th grades of secondary schools in the 2013-2014 academic year. With the elective intelligence games course, it is aimed for students to recognize and develop their own intelligence capacities, find unique and quick solutions to problems, think systematically, work individually and in teams, and develop a positive attitude towards problem solving (MoNE, 2013). In the implementation of the course, step-by-step teaching that goes from easy to difficult, near to far, simple to complex, known to unknown, shows a progressive relationship and gives the student the right to choose is preferred (MoNE, 2013). In order to provide a flexible structure to the intelligence games course and to enable the teacher to group the course according to student levels, the achievements of these games were classified according to different difficulty levels as D1, D2, D3 (levels) in the curriculum (Devecioğlu & Karadağ, 2014). In the measurement and evaluation of the course, checklists, graded scoring forms, observation, self-evaluation, and group evaluation tools are used to evaluate the student's skill acquisition process (MoNE, 2013).

Critical thinking, which is one of the requirements of the age that can be taught to students through intelligence games, has recently been one of the most discussed and researched topics (Güven & Kürüm, 2004). In the process of critical thinking, different mental processes occur, such as distinguishing and controlling variables, recognizing gaps in knowledge, recognizing the necessity of explanatory definitions, evaluating how strong the justifications are on the way to the conclusion, making inferences from the findings, making decisions according to rational criteria, and reading for understanding (Education Reform Initiative, 2008). All these skills and competencies are characteristics that every individual should have today (Güven & Kürüm, 2004) and these characteristics can only be acquired through education (Şenşekerci & Bilgin, 2008). In order to gain critical thinking skills, students should start to be trained in these aspects at an early age (Kurnaz, 2019).

Critical thinking skills have also been included in the achievements of the "Science Curriculum" organized by the Ministry of National Education in 2018. It is stated in the curriculum that today's individuals should be able to produce and use knowledge, solve problems, think critically, be entrepreneurial and determined, have high communication skills, have empathy, and contribute to the society and culture they live in (MoNE, 2018). Intelligence games can be one of these applications. These games can contribute to students' academic achievement as well as critical thinking skills. In this sense, Demirel (2015) determined an increase in students' academic achievement thanks to intelligence games; Baki (2018) determined an increase in students' self-efficacy towards academic effort by using these games.

In summary, it is stated in the literature that critical thinking skills are a skill required by our age and that this skill can be acquired by students through intelligence games. From this perspective, this study aims to examine the relationship between intelligence games and critical thinking skills and to investigate the effect of these games on success in science classes. In addition, the study also investigated the effect of the mother and father education levels of students taking intelligence games courses on critical thinking skills. In line with the purpose of the study, a study was conducted on the problem of

"Do intelligence games have an effect on the critical thinking skills of 6th and 7th grade students and their success in science classes?" The sub-problems of the study are as follows.

1. What is the level of effect of the intelligence games course on the critical thinking skills of 6th and 7th grade students?
2. Does the mother's education level of 6th and 7th grade students taking intelligence games course affect their critical thinking skills?
3. Does the father's education level of 6th and 7th grade students taking intelligence games course affect their critical thinking skills?
4. What are the opinions of 6th and 7th grade students who take intelligence games course about their success in science class?

Method

Research Model

This research was conducted with a mixed research model in which both methods were used together in order to make situations that could not be explained by quantitative or qualitative methods alone more understandable. Thus, the need to choose one of these two models was eliminated and both qualitative and quantitative data related to the same basic phenomena could be examined (Kıral and Kıral, 2011). Because the reason for choosing the mixed research model is to find solutions to problems that cannot be explained by the quantitative research model that evaluates events with results (scores and numbers) and the qualitative research model that conducts process-oriented research alone (Büyüköztürk et al., 2019).

A single-group pretest-posttest experimental design was used to collect quantitative data, and a case study design that allows a holistic approach that allows for an in-depth examination of the situation was used to collect qualitative data, and semi-structured interviews were conducted with students.

Study Group

Since this study was conducted during the period when the Covid-19 pandemic, the appropriate sampling method was preferred in determining the study group. The aim of the appropriate sampling method is to minimize the loss of time, money and labor (Büyüköztürk et al., 2019). It was carried out through distance education via the Education Information Network (EBA) and the study group was formed with students who did not have problems using smart device and internet in order not to disrupt the process. The study was conducted with 16 students studying in the 6th and 7th grades of Kazım Karabekir Regional Boarding Secondary School in the Central District of Ardahan Province in the 2020-2021 academic year.

Data Collection Instruments

The data of the study were collected through critical thinking skills test, demographic information form and semi-structured interview form.

Critical Thinking Skills Test: In order to collect the quantitative data of the study, the "Critical Thinking Skills Test" developed by Eğmir and Ocak (2016) was applied. In the analyses made on the final version of the test consisting of 25 questions, the KR-20 and KR-21 values for the whole test were found to be 0.61 and 0.63, respectively. In addition, the difficulty index for the whole test was found to be 0.37 and the discrimination index was found to be 0.32. Thus, it can be said that the test is a test with a medium difficulty and a very good level of discrimination.

Demographic Information Form: It was created in line with expert opinions.

Semi-structured Interview Questions Form: The item pool, which was created by using literature to determine the effect of intelligence games on science lessons, was presented to 3 field experts for their opinions. The form was finalized by making necessary corrections and additions in line with the opinions of the field experts. In qualitative research, credibility, transferability, verifiability and reliability are examined in order to ensure internal and external validity and reliability. In addition, the statements of the participants of the study, especially the data

obtained from the interviews, were given in the form of direct quotes, thus trying to increase internal validity. A trustworthy environment was created during the interviews, the names of the participants were not used in the study and code names were given to the participants.

Implementation

For the implementation of the study, a 10-week course on intelligence games was planned for 1 class hour per week and the lessons were conducted as live lessons through EBA. While teaching the lessons, the curriculum of the course (2013) and the activities of "Secondary School and Imam Hatip Secondary School Intelligence Games Teaching Material for 5th, 6th, 7th and 8th Grades and Teachers (2016)" were used. Before the lessons started, the "Critical Thinking Skills Test" was applied on the digital platform as a pre-test. Students solved the test projected on the screen via EBA live lesson and sent their answers to the researcher by creating an answer sheet. While solving the test, the students' voices were muted, their images were kept on and they were asked to finish the test within a certain period of time.

In the process of the lessons, first of all, the activities related to intelligence games were projected on the screen, the rules of the activities were explained by the researcher and the students were shown how to play. In the next stage, the students were assigned as "hosts", i.e. "administrators", and they were allowed to play the activities by showing them on their smart devices to the other students participating in the lesson. In this process, the moves made by the students who lost or won the game were discussed and the game was evaluated. In cases where the duration of the class was not sufficient, the activities were sent to the students with the help of smart devices and they were allowed to complete the activities at home. Some strategy games were played through smart device applications. Students downloaded the applications of mangala, pentago and reversi games to their smart devices and played them by projecting them on the screen during the live lesson. While choosing these applications, care was taken to ensure that they did not contain inappropriate advertisements and promotions.

At the end of the 10-week period, the "Critical Thinking Skills Test" was applied as a post-test with EBA live lesson as in the pre-test and interviews were conducted. In the interviews, it was tried to determine the relationship established between intelligence games and science course by the students. Demographic characteristics form was also applied as a post-test.

Analysis of the Data

In order to examine the effect of intelligence games activities on students' critical thinking skills, the pre-test and post-test data of the experimental group (N experimental group = 16) were analyzed by performing a "dependent sample t-test" after it was determined that they showed a normal distribution. The Shapiro-Wilk value of the "Difference Score" (Yıldırım, 2016) obtained from the difference between the pre-test and post-test scores of the "Critical Thinking Skills Test" of the experimental group students is greater than 0.05 ($p>0.05$). Since the skewness coefficient obtained from the data divided by its standard error is between +1.96 and -1.96 at a significance level of 5%, the data is interpreted as being close to normal. In addition, for the normal distribution test, the fact that the mean value and median value of the data are close to each other is accepted as an indicator that the data set has a normal distribution. In the literature, it is stated that if the number of subjects is $n>10$, the groups should show a normal distribution in order to apply a parametric test. In order to collect the quantitative data of the study, the "Critical Thinking Skills Test" developed by Eğmir and Ocak (2016) was applied. In the analyses made on the final version of the test consisting of 25 questions, the KR-20 and KR-21 values for the whole test were found to be 0.61 and 0.63, respectively. In addition, the difficulty index for the whole test was found to be 0.37 and the discrimination index was found to be 0.32. Thus, it can be said that the test is a test with a medium difficulty and a very good level of discrimination.

The data obtained with the Critical Thinking Skills Test was analyzed with the dependent sample t-test in the SPSS program; the effect of the mother and father education status of the students taking the intelligence games course on the critical thinking skills was analyzed with the one-way variance analysis, ANOVA, to see the intra-group and inter-group variations. In the analysis of interview data, which is the qualitative dimension of the research, content analysis was preferred. In this study, the data obtained from the open-ended questions directed to the students were classified based on themes and codes with content analysis, and their detailed opinions on intelligence games were tried to be revealed.

Content analysis is one of the indispensable methods of social sciences (Metin & Ünal, 2022) and is used to provide an objective, measurable and verifiable explanation of open-ended content (Fiske, 1996). The reliability of the content analysis was calculated with the formula [Reliability = Consensus / (Consensus + Disagreement) x 100] developed by Miles and Huberman (1994). Values above 70% were considered reliable. A final consensus was reached in the categories where the researchers had disagreements. The credibility of the study was ensured by consulting two separate experts from the field of science education. In categories where the researchers had disagreements, expert opinions were again consulted and a final consensus was reached. For the transferability of the study, the detailed presentation of the findings with themes and codes supported this purpose. Showing the themes and codes to the experts and reaching a consensus both ensured the consistency of the study and supported its transferability. The researchers remained impartial in the study and did not engage in any guiding behavior.

Results and Interpretation

Within the scope of the study, the effects of intelligence games activities on critical thinking skills and science course, and the effects of mother and father education levels on critical thinking skills were investigated. In addition, students' opinions on whether intelligence games contribute to success in the science course, if so, in which subjects with which features they increase success, whether intelligence games are necessary to be successful in the science course, and whether they want to have intelligence games in the science course were examined.

The Effect of Intelligence Games Activities on Critical Thinking Skills

When the effect of intelligence games activities on students' critical thinking skills were examined, the pre-test and post-test data of the experimental group showed a normal distribution and were analyzed with the dependent sample t-test. Descriptive statistics results are presented in Table 1.

Table 1.

Critical Thinking Skills Test Pre-Test and Post-Test Scores of the Experimental Group

Group	Test	N	$\bar{x}$	ss	Min	Max	sd	t	p
Experiment	Pre-test test	16	15.87	4.84	5	22	15	-1.56	0.13
	Post-test	16	17.37	4.04	8	22			

As seen in Table 1, the mean scores of the experimental group students in the critical thinking test were 15.87 ($\bar{x}$ pre-test=15.87) before taking the intelligence games course and 17.37 ($\bar{x}$ post-test =17.37) after the intelligence games course. The p value was greater than 0.05 (p=0.13) and this result shows that there is no significant relationship between intelligence games and critical thinking skills (p>0.05).

The Effect of Demographic Characteristics of The Students Taking Intelligence Games Course on Critical Thinking Skills

Demographic data of the students who took the intelligence games course is given in the table below

Table 2.

Demographic Data of Students

Demographic Data		f	%
Gender	Girl	14	87.5
	Boy	2	12.5
Mother's Education Level	Elementary	7	43.8
	High School	5	31.3
	University	3	18.8
	Post-graduate	0	0
	None	1	6.3

Table 2 Continuing

Father's Education Level	Elementary	5	31.3
	High School	5	31.3
	University	6	37.5
	Post-graduate	0	0
	None	0	0
Liking Science Class	Likes	16	100
	Don't Like	0	0

The variables of gender and liking science class among the data collected with the demographic characteristics information form were not subjected to analysis since they did not show significant differences as can be seen in the table. The results of the analysis according to mother and father education levels are given below.

The Effect of Mother's Education Level of The Students Taking Intelligence Games Course on Critical Thinking Skills

The critical thinking test values of the experimental group students according to their mother's education level are given in Table 3, and the results of the ANOVA test for the effect of mother's education level on their critical thinking skills are given in Table 4.

Table 3.

Critical Thinking Scale Posttest Scores According to Mother's Education Level

Mother's Education Level	Critical Thinking Skill Test		
	N	x̄	SS
Elementary	7	15.28	4.88
High School	5	17.8	2.38
University	3	20.33	2.08
None	1	21.00	.

According to Table 3, the critical thinking skill test averages of the students who took the intelligence games course were 15.28 (x̄=15.28) for 7 students whose mothers graduated from primary school, 17.8 (x̄=17.80) for 5 students who graduated from high school, 20.33 (x̄=20.33) for 3 students who graduated from university, and 21 (x̄=21) for 1 student who did not graduate from any school.

Table 4.

Anova Test Results for the Effect of Mother's Education Status on Critical Thinking Skills of The Students Taking Intelligence Games Lessons

Source of Variance	Sum of Squares	sd	Average of Squares	f	p
Intergroup	70.85	3	23.61	1.62	0.23
Intragroup	174.89	12	14.57		
Sum	245.75	15			

When Table 4 is examined, it is seen that there is no significant relationship between the critical thinking skills of the students who took the intelligence games course and their mother's education level ($p>0.05$).

The Effect of Father's Education Level on Critical Thinking Skills of The Students Taking Intelligence Games Course

The critical thinking test values of the experimental group students according to their fathers' education levels are given in Table 5, and the results of the Anova test for the effect of fathers' education levels on their critical thinking skills are given in Table 6.

Table 5.

Critical thinking scale post-test scores according to father's education level

Father's Education Level	Critical Thinking Skill Test		
	N	x̄	SS
Elementary	5	14.4	5.41
High School	5	19.6	0.89
University	6	18	3.2

Table 5 shows that the mean critical thinking skills test scores of the students who took the intelligence games course were 14.4 ($\bar{x}$= 14.4) for 5 students whose fathers graduated from primary school, 19.6 ($\bar{x}$= 19.6) for 5 students who graduated from high school, and 18 ($\bar{x}$= 18) for 6 students who graduated from university.

Table 6.

Anova test results for the effect of father's education status on the critical thinking skills of the students taking the intelligence games course.

Source of Variance	Sum of Squares	sd	Average of Squares	f	p
Intergroup	71.35	2	35.67	2.65	0.10
Intragroup	174.4	13	13.41		
Sum	245.75	15			

When Table 6 is examined, it is seen that there is no significant relationship between the father's education level and critical thinking skills of the students who took the intelligence games course ($p>0.05$).

The Effect of Intelligence Games Activities On The Science Course

In order to determine the effect of intelligence games on the science course, interviews consisting of 5 questions were conducted with the students at the end of the intelligence games course. By performing content analysis, the answers given were divided into themes and codes.

Student Opinions on the Question of "Do you think that intelligence games contribute to your success in science course? If yes, why? If no, why?"

Eight of the 14 students interviewed (S1, S3, S4, S5, S8, S10, S12, S14) stated that intelligence games contributed positively to their achievement in the science course; five students (S6, S7, S9, S11, S13) stated that intelligence games had no effect on their achievement in the science course; and one student (S2) was undecided on this issue.

Table 7.

Themes and Codes Related to the Question "Do you think that Intelligence Games contribute to your success in Science Course? If yes, why? If no, why?"

Theme	Code	f	%	Student
Cognitive Skills	Logical deduction	2	12.5	S1, S5
	Practical thinking	1	6.25	S3
	Foresight	2	12.5	S4, S14
	Inquiry	1	6.25	S8
	Making the Right Decision	1	6.25	S8
	Commenting	1	6.25	S12
Ability to solve questions	Speed	1	6.25	S1
	Attention	1	6.25	S2
	Inferring	1	6.25	S4
	Understanding correctly	2	12.5	S10, S3
	Making transaction	1	6.25	S14

Table 7 Continuing

Intelligence Games	Entertainment	2	12.5	S2, S9
Science	Academic	4	25	S2, S7, S9, S11

In Table 7, it is seen that students who think that intelligence games contribute to their success in science courses generally state that intelligence games are effective in the development of their cognitive skills and question solving skills. Some student responses on this topic are as follows:

S3: *"...it made me understand the questions easier",*

S4: *"It is necessary to be foresighted because it is necessary to predict the opponent's next move",*

S10: *"...it helped me understand what I read",*

S14: *"Being foresighted can be used in science lessons",*

The students who thought that intelligence games did not contribute to their success in science course emphasized the fun aspect of intelligence games and the academic aspect of science. Some student responses on this subject are as follows:

S6: *"It can contribute more to the mathematics course instead of the science course".*

S13: *"... Their fields are distinct from one another. I cannot find a common feature",*

Student Opinions on the Question "In Which Subject of Science Course, Do You Think Intelligence Games Increase Your Success and Why?"

Each student answered this question according to the subject they learned at their own grade level. Student opinions are presented in Table 8.

Table 8.

Table of Subjects for the Question "In which subject of the Science Course do you think that Intelligence Games increase your success?"

Class Level	Topics	f	%	Student
6th grade	Unit 1: Solar System and Eclipses (Solar and Lunar Eclipses)	1	6.66	S4
	Unit 2: Systems in Our Body (Circulatory System)	1	6.66	S2
	Unit 3: Force and Motion (Constant Speed Motion)	1	6.66	S14
	Unit 4: Matter and Heat (Density)	1	6.66	S14
	Unit 7: Transmission of Electricity	1	6.66	S1
7th grade	Unit 2: Cell and Divisions (Cell)	2	13.32	S7, S13
	Unit 3: Force and Energy (The Relationship of Force, Work and Energy)	1	6.66	S12
	Unit 4: Pure Substances and Mixtures (Granular Structure of Matter)	4	26.64	S5, S7, S8, S11
	Unit 7: Electrical Circuits (Ways Light Bulbs Are Connected)	3	19.98	S6, S10, S13

Table 8 shows that students in the sixth and seventh grades naturally stated that intelligence games helped them succeed in various science subjects in accordance with the subjects they learned at their own grade level. The following are some examples of student responses to this topic:

S2: *"It had an effect in the systems unit, especially on the circulatory system. It made me pay attention to small details",*

S7: *"...it helped me memorize the elements",*

S9: *"It had an effect in general, but I cannot choose a specific topic".*

Table 9.

Themes and Codes Table for the Question of "In which subject of the Science Course do you think that Intelligence Games increase your success and why?"

Theme	Code	f	%	Student
Cognitive Skills	Analytical thinking	1	7.14	S1
	Attention	2	14.28	S2, S8
	Problem solving	1	7.14	S3
	Decomposing	2	14.28	S3, S10
	Establish a cause-and-effect relationship	1	7.14	S4
	Reading comprehension	1	7.14	S5
	Focusing	1	7.14	S8
	Memory	2	14.28	S7, S11
Mathematical skills	Making a transaction	2	14.28	S13, S14
Visual Intelligence	Visual perception	1	7.14	S12

According to Table 9, students thought that some cognitive and mathematical skills and visual perception improved with intelligence games. Some of the students' opinions on this subject are as follows:

S4: *"Since a cause-effect relationship has been established, I need to predict the opponent's move",*

S5: *"I understand better what is asked of me in the questions",*

S7: *"It may have helped me memorize organelles and elements. It improved my memory",*

S12: *"On work and energy. Since there are visual questions on this subject, I think intelligence games are helpful".*

S14: *"The subject of Electricity. Since there are numbers, transactions and placing light bulbs in their places",*

Student Opinions Regarding the Question of "Which Feature of Intelligence Games Do You Think Has Affected Your Success in Science Lesson? Explain."

The students were asked which features of intelligence games had an effect on achievement in the science course, and the answers were divided into themes and codes by content analysis and the findings are given in Table 10.

Table 10.

Table of Themes and Codes for the Question of "In your opinion, which feature of brain teasers affected your success in science course? Explain."

Theme	Code	f	%	Student
Cognitive Skills	Quick thinking	4	22.22	S1, S5, S9, S10
	Decision making	1	5.55	S1
	Logical inference	2	11.11	S3, S9
	Attention	2	11.11	S2, S8
	Memory	6	33.33	S4, S6, S7, S11, S12, S13
	Inquiring	1	5.55	S8
	Focusing	1	5.55	S10
Mathematical Skills	Making a transaction	1	5.55	S14

When Table 10 is examined, it is seen that students mainly think that "memory" and "memorization" skills developed through intelligence games are effective in their success in science courses. The second most common response is "quick thinking". The students who have given this answer are mostly 7th

grade students. The students stated that they accelerated over time while giving their answers in the trials they took. They said that these gains would contribute to the High School Entrance Examination they would take in the 8th grade.

Student Opinions on the Question of "Do you think brain teasers are necessary to be successful in science course?"

The answers given by the students to this question were analyzed and summarized in Table 11.

Table 11.

Student Opinion Table for the Question "Do You Think Intelligence Games are Necessary to Succeed in Science Course?"

Opinion	f	%	Student
Necessary	5	35.71	S1, S3, S6, S8, S10
A little necessary	3	21.42	S2, S5, S9
Not required	6	42.85	S4, S7, S11, S12, S13, S14

According to Table 11, the opinions of some students who think that intelligence games are necessary to be successful in science courses are as follows:

S1: *"Logical thinking and quick decision-making can be gained through intelligence games"*,

S3: *"It helped me to solve questions"*,

S10: *"It improved my memory"*.

Student opinions who think that it is a little necessary:

S2: *"It is not necessary in all subjects"*,

S5: *"...maybe we can understand the subjects better"*,

S9: *"It can contribute to success. Focusing provides fast and logical thinking"*.

The opinions of some students who think that intelligence games are not necessary to be successful in science are as follows:

S4: *"There are no concepts related to science in intelligence games"*,

S7: *"I don't think intelligence games are related to science, they may be more related to math or Turkish lessons"*,

S13: *"...two different fields"*.

Student Opinions on the Question of "Would you like to have intelligence games in the science course and why?"

The opinions of some of the 12 students who answered this question as "Yes, I would like to" are as follows:

S1: *"Acquisitions in science is in mutual interaction with quick thinking, visual perception and memory in intelligence games"*,

S7: *"I don't like science class very much, it would be very good. The class can become more fun"*,

S8: *"...I enjoy playing. It increased my focus. It provided success in my lessons. It will contribute to this lesson too"*,

S10: *"It becomes more memorable"*,

S13: *"I think that the numerical part of our brain develops with brain teasers. Science is a numerical course too, so it can be useful"*.

Conclusion and Discussion

Bottino et al., (2007) stated that the intelligence games course has significant effects on problem solving and creative thinking skills; Ott and Pozzi (2012) stated that learning activities developed with technological games can support creative thinking. Reiter, Thornton and Vennebush (2014) mentioned in their studies that the 'kendoku' game improves reasoning skills. Bottino and Ott (2006), Bottino, Ott, Tavella & Benigno (2010), Bottino, Ott & Benigno (2009) and Bottino, Ott & Tavella (2013) showed that mind games increase students' academic success in their courses and contribute to reasoning skills. But in this study, in which the effect of intelligence games on the critical thinking skills of 6th and 7th grade students and the opinions of the students participating in the study on the success of intelligence games in science course were examined, a small change occurred between the mean results of the critical thinking skill test pre-test and post-test in favor of the post-test. It was thought that the number of students in the sample group, the duration of the study, the pandemic conditions, and the fact that the course and scales were conducted remotely (via EBA, live course) were effective in this result. Intelligence games may cause the result to change when the lessons and scales are conducted face to face. The lesson hours and the number of students per student may also have an effect on this result. Different results can be achieved with more students and intelligence games lessons. However, in Savaş (2019)'s study with science teacher candidates who took an intelligence games course, it was discovered that intelligence games provided an increase in the critical thinking skills of teacher candidates.

The findings of the study showed that mother's and father's education levels did not have any effect on the critical thinking skills of the students who took the intelligence games course. Similarly, Ekinci and Aybek (2010, p. 825) and Can and Kaymakçı (2015, p. 80) reported that the education levels of mother and father did not have any effect on critical thinking tendencies. Tümkaya and Aybek (2008, pp. 393-394), on the other hand, found that father's education level had no effect on students' critical thinking skills, but mother's education level had an effect on critical thinking skills. They found that students with mothers who had higher education levels or higher had better critical thinking skills.

In this study, the majority of the students stated that intelligence games contributed positively to their success in science courses, and that their cognitive and question-solving skills increased thanks to intelligence games; especially their skills such as logical inference, farsightedness, practical thinking, questioning, correct decision-making and interpretation improved. In terms of question-solving skills, some students thought that their speed, attention, inference-making and correct comprehension skills improved. Similarly, Savaş (2019) stated that practical thinking ability emerged through intelligence games; Baki (2018) stated that students realized the importance of being careful through these games and Çalışkan (2019) stated that students can think quickly and practically thanks to intelligence games. In the interviews, the students who thought that intelligence games had no effect on their success in the science course pointed out that intelligence games are fun and science is an academic course.

The students who participated in the study and took the intelligence games course stated that intelligence games improved their cognitive and mathematical skills and visual perception, thus contributing to many subjects of science. Similarly, Yöndemli (2018) also found that students' mathematical and reasoning skills increased with intelligence games.

Within the scope of the study, the majority of the students stated that intelligence games were not necessary to be successful in the science course, but the presence of intelligence games in the science course could make the course more fun and memorable.

Recommendations

1. The study was conducted through distance education (via EBA). Since this system was new for both students and teachers, problems on the issues such as motivation and attention occurred. For this reason, the results of the study can be compared by conducting studies at which intelligence games and scales are applied face-to-face.
2. The study can be conducted with a larger sample and another age groups and the results can be compared.

3. The effect of intelligence games not only on critical thinking skills but also on different thinking skills and developmental characteristics can be investigated.
4. Quantitative research can be conducted on the effect of intelligence games on science course.
5. Research can be conducted on the effects of intelligence games not only on science but also on other courses such as mathematics and Turkish.
6. Intelligence games can be modified according to some subjects of science course and applied as in-class activities and the effect of these activities on students' achievement in science course can be investigated.

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Ethics statement: In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

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