

## The Effect of 8-week educational game training on cognitive flexibility, emotional intelligence and coping strategies

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Published online: June 30, 2023

(Accepted for publication June 15, 2023)

DOI:10.7752/jpes.2023.06187

### Abstract:

This study was conducted to investigate the relationship between 8 (eight) weeks of play education and cognitive flexibility, emotional intelligence, and coping strategies of secondary school students. Survey model, one of the quantitative research methods, was used for the study. The study group consists of high school students selected in Bandırma district of Balıkesir province in the school year 2022-2023 through simple random sampling from non-random sampling methods. A total of 223 high school students in the control group and experimental group participated in the study. The Personal Information Form, "Cognitive Flexibility, Emotional Intelligence and Coping Strategies Scale" questionnaires were used to collect data. Repeated measures analysis of variance and linear regression analysis were used to analyze the data. In the study, EG's cognitive flexibility, emotional intelligence and coping strategies did not change in pre-test, mid-test and post-test (respectively;  $F_{2, 333}=1.908$ ,  $p=.151$ ,  $F_{2, 333}=1.140$ ,  $p=.321$ ), but there was a significant difference between emotional intelligence ( $F_{2, 333}=6.115$ ,  $p=.003$ ). Cognitive flexibility and coping strategies did not change in CG ( $F_{2, 333}=.219$ ,  $p=.803$ ,  $F_{2, 333}=.808$ ,  $p=.446$ ), but emotional intelligence results decreased gradually ( $F_{2, 333}=4.808$ ,  $p=.010$ ). As a result, while eight-week game training applied to secondary school students did not have an effect on cognitive flexibility and coping strategies, it had a positive effect on emotional intelligence levels. As a result of the post-test, it was determined that this behavior became permanent. Although there was no significant difference in the development of secondary students' cognitive flexibility, emotional intelligence, and coping strategies through play, it is reasonable to assume that integrating play into the classroom can increase students' learning ability, positively influence academic performance, regulate sleep quality, and develop the individual as a whole physiologically, psychologically, and cognitively. More reliable results can be obtained by collecting qualitative data from the research group.

**Key Words:** Coping Strategies, Cognitive Flexibility, Emotional Intelligence, Secondary Education Students, Gaming.

### Introduction

A game is a set of activities played within the framework of certain rules in which there is a result, performances can be compared, and individuals can entertain themselves (Young et al., 2012). Huizinga defined games as "actions that are different from everyday life, which have time and space in accordance with certain rules, which stimulate joy and the individual's instinct to win or lose" (L'Abate, 2009). Games are also known as physical activities that have rules, consist of goals, consist of results, individuals challenge each other, individuals entertain themselves through interaction and a certain sense of representation (Prensky, 2001). When we look at games; they consist of elements that have a certain systematic, can have variable results, consist of different values, are based on a certain effort, individuals add emotionality to the results, and individuals enjoy life as a result of the activity (Jull, 2005).

When individuals play games, they have to make certain decisions within the game. Instead of making a single decision during the game, individuals can make alternative decisions thanks to their cognitive flexibility. Cognitive flexibility is the ability of individuals to use their cognitive techniques to draw a road map for themselves in current or sudden situations that occur in their environment (Canas et al., 2003). Thanks to cognitive flexibility, the learning process can be improved by gaining new experiences, current analyzes can be used instead of specific strategies, and healthy reasoning can be used in complex situations (Canas et al., 2006). When we look at the aims of cognitive flexibility, we can see that it is to reduce the thinking time, to automate skills, to brainstorm hypotheses serially, to mobilize different strategies, to keep attention active, to ensure skill transfer (Kramer et al., 1995) and to keep up with changing situations. Cognitive flexibility also contributes positively to the realization of various solutions, flexible decision-making in situations and the development of self-efficacy (Martin & Rubin, 1995).

When individuals use their cognitive flexibility, the concept of emotion emerges, which leads to the emergence of some biological reactions. In order for people to achieve some goals, they need to control internal and external processes (Gross, 2014). While taking these processes under control, they need to use emotional intelligence. Emotional intelligence is defined as the ability of individuals to observe their own and others' emotions, to make distinctions as a result of these behaviors, and to guide their thoughts and behaviors (Salovey & Mayer, 1990). Emotional intelligence is a characteristic not represented by cognitive intelligence (Goleman, 1995). Emotional intelligence plays an important role in helping individuals to reveal their emotions, to ensure their self-control and to improve their social relationships by putting themselves in the other person's shoes (Martin, 2018). Emotional intelligence has been explained as ability-based; being aware of others' emotions and directing emotions (Sakfloske, Austine, & Minski, 2003), mixed emotional intelligence; individuals' ability to empathize and manage social skills (Goleman, 1995) and trait model; the ability to use information through one's own emotions (Petrides, Pika, & Kokkinaki, 2007).

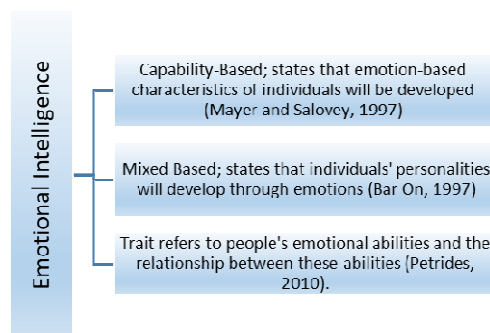


Figure 1. Models of Emotional Intelligence

People need to make some decisions in current situations thanks to their emotional intelligence. While making decisions, they need to take a good stance against the positive and negative consequences of the decision they have taken. It is important for individuals to develop some coping strategies when they are stressed. Coping strategies are defined as individuals' internal and external determination of their behaviors and thoughts in a stressful situation (Stephenson & Delongis, 2020). Individuals need to develop the healthiest way of thinking and try the most appropriate solutions to the events they have experienced or will experience. Their location, social structure and economic facts play an important role in the development of coping strategies.

When the studies are examined; Malkoç and Mutlu (2019) on psychological well-being, self-confidence and cognitive flexibility of university students, Wu et al. (2021) on emotional intelligence and cognitive activities of parents on their children, Alonso et al. (2019) on emotional intelligence and cognitive organization in children, and Reza et al. (2020) on mental imagery and emotional intelligence of Iranian national team.

When the literature is examined, it is seen that different studies have been conducted on different sample groups regarding cognitive flexibility, emotional intelligence and coping strategies. It has been observed that secondary school students are oriented towards digital technologies, the phenomenon of cognitiveness is postponed, they have psychological inadequacies due to the complexity of their emotions, and they cannot reason about what to do in the face of instant events. In the light of these situations, the aim of the study was to examine the relationships between game education and cognitive flexibility, emotional intelligence and coping strategies in secondary school students.

1. Is there any relationship between 8-week game training and cognitive flexibility, emotional intelligence and coping strategies of secondary school students?

### Material & methods

This section includes the research model, research group, data collection tools and data analysis.

#### Research Model

In this study, the survey model was used among quantitative research methods. In survey studies, existing situations are revealed by describing the subjects (Büyüköztürk, 2017). This method, which is widely used in social sciences, is a descriptive method used to analyze the basic coverage areas of the sample group (gender, age, branch, school type) (Can, 2020).

#### Research Group

A total of 223 secondary school students, 118 in the experimental group and 105 in the control group, studying in the Bandırma district of Balıkesir province in the 2022-2023 academic year, participated in this study.

#### Data Collection Tools

Firstly, the demographic information form developed by the researcher, secondly, the Coping Scale for Adolescents developed by Sprinto et al. (1988) and adapted into Turkish by Bedel, Işık, and Hamarta (2014), thirdly, the Cognitive Flexibility Scale (CRS) developed by Martin and Rubin (1995) and adapted into Turkish

by Çelikkaleli (2014), and lastly, the Emotional Intelligence Inventory developed by Schutte, et al, (1998) and adapted into Turkish by Tok, Bender, Tatar, and Saltukoğlu (2017).

### **Personal Information**

In order to determine the demographic characteristics of the participants, there were 3 questions about gender, age, and grade level.

#### **Validity and Reliability Study of the Coping Scale for Adolescents (CPSA)**

The Coping Scale for Adolescents developed by Sprinto et al. (1988) and adapted into Turkish by Bedel, Işık, and Hamarta (2014) consists of three sub-dimensions, namely active coping, avoidant coping, and negative coping, and 11 items in total. The scale is graded as Never (0), Always (3). The internal consistency coefficient of the scale was found to be 0.72 for active coping, 0.70 for avoidant coping and 0.65 for negative coping. In this study, the Cronbach's alpha internal consistency coefficient of the scale was found to be 0.60.

#### **Cognitive Flexibility Scale (CRS):**

The Cognitive Flexibility Scale (CRS) developed by Martin and Rubin (1995) and adapted into Turkish by Çelikkaleli (2014) consists of one dimension and 11 items. The scale is graded from 1 "Strongly disagree" to 6 "Strongly agree". Items 2, 3, 6 and 10 are reverse scored. In the Turkish adaptation of the scale, the internal consistency coefficient of the scale was found to be 0.74. In this study, the Cronbach's alpha internal consistency coefficient was found to be 0.60.

#### **Emotional Intelligence Inventory:**

The Emotional Intelligence Inventory (EI scale) developed by Schutte, et al. (1998) and adapted into Turkish by Tok, Bender, Tatar, and Saltukoğlu (2017) consists of 41 items and 3 sub-dimensions: "optimism", "evaluation of emotions" and "use of emotions". The scale is graded from 1 "Strongly disagree" to 6 "Strongly agree". In the Turkish adaptation study, the Cronbach-Alpha internal consistency coefficient of the scale was found to be 0.82. In this study, the Cronbach's Alpha internal consistency coefficient of the scale was found to be 0.60.

### **Data Collection**

In the study, students in the same category were divided into two homogeneous groups. Then, the pretest was applied to the control and experimental groups without playing the game. In order to examine the effects of the game on cognitive flexibility, emotional intelligence and coping strategies, an 8-week game program for cognitive development, emotional intelligence and coping strategies was applied to the experimental group. At the end of the process, a post-test was conducted and data were collected. One month after the post-test application, the post-test was applied to the experimental group and the control group. Because the pre-test was applied to investigate whether the differences in the post-test continued or not.

#### **Week 1 Rock Paper Scissors Game**

Equipment Used: Circle

Game Procedure:

- The class is divided into 2 groups and 2 teams are formed
- Long snake-shaped (S) hoops with a width of 9 meters are placed in the hall between the 2 teams.
- Groups divided into 2 line up at the two ends of the circles
- On the start command, the first player of each group makes a double foot jump and moves towards the opponent's area.
- Opponents perform hand gestures including a rock-paper-scissors variation at the first point they meet
- The player who wins the hand game continues to move towards the opponent's field by jumping on both feet.
- The losing player is out of the game and moves to the back of the line in their group
- The next player in the losing player's group takes the place of his teammate and advances towards the opponent's area with a two-foot leap
- When the players come together again, a game of rock paper scissors is played
- The player who reaches the end of the hoops earns 1 point for his team
- The game continues until the teams have a total score of 3.

#### **Week 2 Balloon Transportation Game**

Equipment Used: Balloon, funnel

Game Procedure:

- The class is divided into 2 groups and 2 teams are formed
- They line up side by side in a single row with a distance of 5 meters between the teams.
- At a distance of 9 meters, funnels are placed at the beginning and end of the playing field
- The first players of the teams move forward at a light pace, tip the balloon with their hands (without holding it).
- The player who goes around the funnel and returns to his/her turn gives the balloon to the next player
- The game continues until all players in the team have moved the balloon
- Whichever team's players finish carrying the balloons before the opposing team wins 1 point
- The game continues until the teams have a total score of 3.

#### **Week 3 Sauce Game**

Equipment Used: Circle, funnel

Game Procedure:

- The class is divided into 2 groups and 2 teams are formed
- They line up side by side in a single row with 2 meters between teams.
- 6 meters ahead of the games, 9 circles in the form of 3\*3 are placed in a square shape with a distance between them.
- The first three players in 1 team receive a yellow funnel, the first three players in the other team receive a red funnel
- After the start command, the first players in the first row run and drop the funnels into the circles
- After turning around, he touches the hand of his next friend and moves to the end
- After receiving the start command, the second student quickly takes the second funnel to the playground
- Then the third students repeat the same process
- The game continues until the funnels of one of the teams line up parallel horizontally, parallel vertically or diagonally with funnels of the same color
- Whichever team forms S-O-S first wins one point
- The game continues until the teams have a total score of 3.

**Week 4 Capture the Cover Game**

Equipment Used: Training Bowl (cover)

Game Procedure:

- The class is divided into 2 groups and each player is an individual
- Players line up in a straight line with half a meter between them and the bowls directly between them.
- Players start the game standing
- In the game that starts with the teacher's command, the players move their hands according to the command given by the teacher until the teacher says "bowl" (Example: The teacher says "eye", the player moves his/her hand to his/her eye, etc.).
- The player who gets the bowl first when the teacher says "bowl" wins 1 point
- The game continues until players have a total score of 3
- Can also be played as a team if desired.

**Week 5 Hamsball Game**

Equipment Used: Circle, ball

Game Procedure:

- The class is divided into 2 groups and each player has a partner
- Place 1 circle in the middle at a distance of 5 meters between both partners
- A funnel is used to determine where the partners will stand
- With the start command, the player shoots the handball so that it hits the center hoop
- Another point to be considered by the shooter is to shoot in such a way that the opponent has difficulty in catching the ball.
- If the opponent fails to catch the shot, the player who made the shot wins 1 point
- The game continues until one side has 3 points
- Losing players are out of the game while winning players are paired again
- Pairings continue until the final battle and the winner of the final becomes the champion.

**Week 6 Ball Carrying Game**

Tools and Equipment Used: Ball

Game Procedure:

- The class is divided into 2 groups and 2 teams are formed
- Each team has one ball
- Teams pass side by side with a distance of 3 meters between them
- Team players line up in a row at a distance of half a meter
- Players spread their feet more than shoulder width apart
- The player in front passes the ball between his legs to the player behind him
- When the ball reaches the last player, the last player runs with the ball to the front of the line
- This cycle continues until the player who was at the head of the line at the start of the game is at the head of the line again
- Whichever team completes the cycle early wins 1 point
- Variations of the cycle can be varied from between the legs to the back, from overhead to back, and from waist level, one right and one left
- The game continues until the teams have a total score of 3.

**Week 7 Funnel Grab Game**

Tools and Equipment Used: Funnel

Game Procedure:

- The class is divided into groups of 4
- A funnel is placed in each corner with a distance of 2 meters between them to obtain a square shape.
- Put the 5th funnel in the center of the square

- Every corner has a player who owns it
- After the start command, players move other funnels to their corner, one at a time
- The player who collects 3 funnels in their corner before their opponents wins
- Losing players are out of the game while winning players are paired again
- Pairings continue until the final battle and the winner of the final becomes the champion.

#### Week 8 Floor Hockey Game

Equipment Used: Training Dish

Game Procedure:

- The class is divided into 2 groups and each player has a partner
- Partners take push-up position with a distance of 2 meters between them
- Players in the push-up position have their hands outstretched more than shoulder-width apart
- Training bowls placed where their hands are represent castles
- On the start command, players try to score a goal with the training cup used as a ball into the opponent's goal without breaking the push-up position.
- Player scoring 3 goals in the opponent's goal gets 1 point
- Losing players are out of the game while winning players are paired again
- Pairings continue until the final battle and the winner of the final becomes the champion.

The ethics committee report of the research was approved by Bandırma Onyedi Eylül University Social Sciences Ethics Committee.

#### Data Analysis

In this study, SPSS 25.0 package program was used to analyze the data. The kurtosis and skewness values were examined in order to reveal whether the data had a normal distribution or not and it was seen that the results were between -1.5 and +1.5 and it was decided that the data came from a normal distribution (Tabachnick & Fidell, 2007). Frequency analysis, reliability coefficient calculations, linear regression analysis and repeated measures ANOVA analysis were performed. Calculations were made according to  $p < 0.05$  significance level in the analysis.

#### Results

**Table 1. Demographic Variables**

	Variables	f	%	
EG	Gender	Female	61	51,7
		Male	57	48,3
		Total	118	100
	Age	14 year	11	9,3
		15 year	48	40,7
		16 year	28	23,7
		17 year	31	26,3
		Total	118	100
	Class Level	9.	30	25,4
		10.	32	27,1
		11.	32	27,1
		12.	24	20,3
	Total	118	100	
CG	Gender	Female	67	63,8
		Male	38	36,2
		Total	105	100,0
	Age	14 year	2	1,9
		15 year	27	25,7
		16 year	31	29,5
		17 year	27	25,7
		14 year	16	15,2
		18 year	2	1,9
		Total	105	100,0
	Class Level	9.	35	33,3
		10.	31	29,5
		11.	25	23,8
		12.	14	13,3
		Total	105	100,0

In Table 1, the highest percentages of categorical variables are given in the descriptive statistics obtained from the participants. According to these results, in EG; female participants (51.7%) in the gender variable, 15 years old (40.7%) in the age variable, and 3rd and 4th grades in the class variable (27.1%). When CG is examined, female participants (63.8%) in the gender variable, 15 years old (39.5%) in the age variable, and 3rd and 4th grades in the class variable

(27.1%).

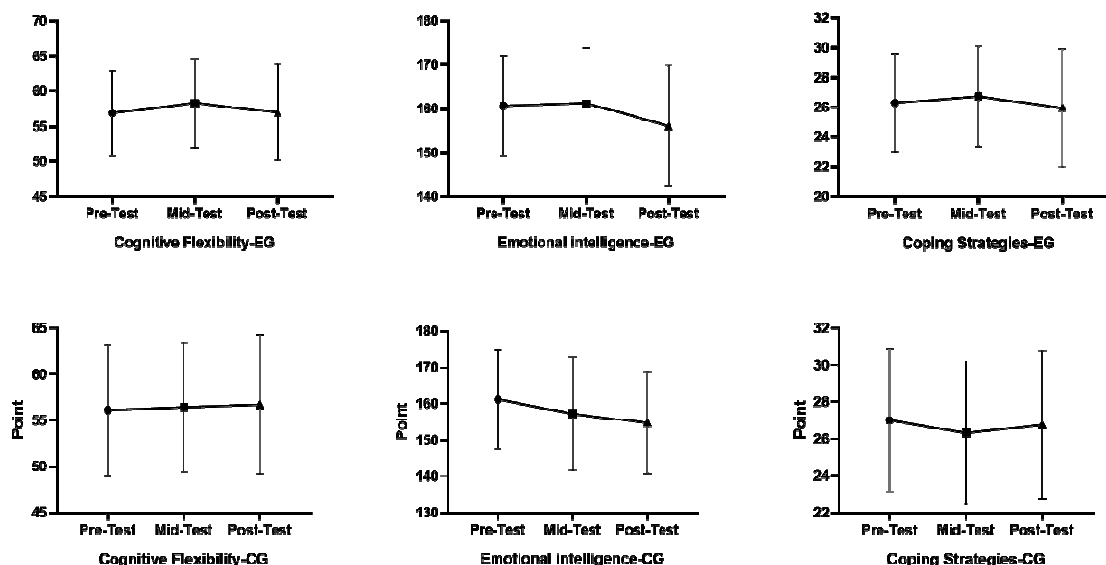


Figure 1. Repeated anova results of participants

In the study, EG's cognitive flexibility, emotional intelligence and coping strategies did not change in pre-test, mid-test and post-test (respectively;  $F_{2, 333}=1.908$ ,  $p=.151$ ,  $F_{2, 333}=1.140$ ,  $p=.321$ ), but there was a significant difference between emotional intelligence ( $F_{2, 333}=6.115$ ,  $p=.003$ ). Cognitive flexibility and coping strategies did not change in CG ( $F_{2, 333}=.219$ ,  $p=.803$ ,  $F_{2, 333}=.808$ ,  $p=.446$ ), but emotional intelligence results decreased gradually ( $F_{2, 333}=4.808$ ,  $p=.010$ ).

Table 2: Results of Linear Regression Analysis to Determine the Effects of Cognitive Flexibility and Emotional Intelligence Levels of the EG on Coping Strategies

Test Time	Independent variable	Dependent Variable	R2	F	Beta	t	p	Durbin Watson
Pre-Test	Still	Coping Strategies	.038	2.125	-	3.229	.002	1.902
	Cognitive flexibility				.000	.001	.999	
	Emotional Intelligence				.194	2.051	.043	
Mid-Test	Still	Coping Strategies	.169	12.265		1.194	.235	2.404
	Cognitive flexibility				-.019	-.213	.832	
	Emotional Intelligence				.424	4.808	.000	
Post-Test	Still	Coping Strategies	.152	11.446	-	.972	.333	1.641
	Cognitive flexibility				.058	.676	.500	
	Emotional Intelligence				.408	4.777	.000	

Linear regression analysis was performed to explain the effect of cognitive flexibility and emotional intelligence and its sub-dimensions on coping in EG. While cognitive flexibility and emotional intelligence levels explained 3.8% of coping as a result of the pre-test, it increased to 16.9% in the post-test and decreased to 15.2% in the post-test (Table 2). In the pre-test scores, a 1-unit increase in the emotional intelligence variable was significant and resulted in an increase of 0.194 ( $\beta=.194$ );

In the post-test, 1-unit increase in the emotional intelligence variable causes a significant 0.424 increase in coping ( $\beta=.424$ ), and in the post-test, 1-unit increase in the emotional intelligence variable causes a significant and 0.408 increase in coping ( $\beta=.408$ ). In the pre-test, post-test and post-tests, it was seen that there was no significant relationship between cognitive flexibility and coping ( $p>0.05$ ).

**Table 3: Results of Linear Regression Analysis to Determine the Effects of Cognitive Flexibility and Emotional Intelligence Levels of the CG on Coping**

Test Time	Independent variable	Dependent Variable	R2	F	Beta	t	p	Durbin Watson
Pre-Test	Still	Coping Strategies	.013	1.703	-	4.423	.000	1.615
	Cognitive flexibility				-.040	-.404	.687	
	Emotional Intelligence				.172	1.749	.083	
Mid-Test	Still	Coping Strategies	-.004	.824	-	6.490	.000	1.826
	Cognitive flexibility				-.131	-1.263	.210	
	Emotional Intelligence				.058	.564	.574	
Post-Test	Still	Coping Strategies	.152	10.341	-	2.884	.005	1.896
	Cognitive flexibility				-.109	-1.185	.239	
	Emotional Intelligence				.374	4.061	.000	

Linear regression analysis was performed to explain the effect of cognitive flexibility and emotional intelligence and its sub-dimensions on coping in the control group. While cognitive flexibility and emotional intelligence levels explained 1.3% of coping as a result of the pre-test, it was observed that it decreased to -.004% in the post-test and increased to 15.2% in the post-test (Table 3). A 1-unit increase in the emotional intelligence variable in post-test scores causes a significant 0.374 increase in coping ( $\beta=.374$ ). In the pre-test and post-tests, it is seen that there is no significant relationship between cognitive flexibility and emotional intelligence on coping ( $p>0.05$ ).

### Dicussion

In this study, the relationships between cognitive flexibility, emotional intelligence and coping strategies of the 8-week game program applied to secondary school students were examined. When the cognitive flexibility, emotional intelligence, and coping strategies of the study group were examined, no significant difference was found between the experimental and control groups at the pretest, posttest, and posttest. Huijgen et al. (2015), in their study examining the cognitive functions of elite and sub-elite athletes, concluded that elite athletes have a more developed concept of "executive cognition" than sub-elite athletes. Supto (2023) emphasized that active physical education lessons have important contributions to students' cognitive, affective and psychomotor aspects, that today's technologies have negative effects on students and that the efficient teaching of physical education lessons has a positive contribution to academic development.

Erbektaş et al. (2017), in their study on the level of emotional intelligence of amateur and professional athletes, found that there was no difference in the emotional intelligence scores of high school students, which was due to the lack of appropriate fields in schools. Trigueros et al. (2019) concluded in their study on emotional intelligence in adolescents that physical education can be very useful in obtaining good grades emotionally, maintaining active life habits, and focusing on emotions. In addition, emotional intelligence was found to have positive relationships with positive emotions and negative relationships with negative emotions (Salami, 2010; Salavera et al., 2017). Tugay et al. (2004) concluded that a positive affective attitude reduces the negative impact of external factors and improves coping strategies in stressful situations, and it was found to have a positive impact on individuals' cognitive resilience (Fletcher & Sarkar, 2012). Çelik et al. (2021), in a study of elite athletes, found that the level of emotional intelligence increased during high-level competitions and had an impact on performance.

Pascoe et al. (2019), in their study on the impact of stress on secondary and higher education students, found that academic stress affects young people mentally and physically. If good stress coping management is not practiced, it is thought to cause long-term health-related effects in adolescence and early adulthood that continue throughout the lives of individuals (Sawyer et al., 2012). As a result of research, it has been found that education-based interventions to increase stress coping skills positively affect education and minimize health risks (Perry et al., 2017). If targeted school programs for coping with stress for students have been found to reduce coping-related symptoms (Kraag et al., 2006).

When the results of linear regression analysis were examined between the coping strategies of cognitive intelligence and emotional intelligence of the experimental group and the control group, it was statistically found that there was no significant difference. Bilgiç and Bilgin (2016) found no significant difference between adolescents in their study in which they investigated their cognitive flexibility and decision-making strategies.

Bekirler and Guenay Bilaloğlu (2022) concluded in their study on preschool teachers that there was a significant positive difference between cognitive flexibility and self-efficacy. Deniz and Yılmaz (2005) concluded in their study on university students that there is a significant positive relationship between emotional intelligence and coping strategies. Kara (2020) found in his study of athletes that there is a significant positive relationship between cognitive flexibility and decision making (coping). Okçuoğlu Tosun (2015) concluded in her study on nurses that there is a significant relationship between emotional intelligence and stress coping. Jacobs et al (2008) concluded in a study of normal individuals that there is a significant negative relationship between emotional intelligence and anxiety phobia. Aydın (2023) conducted a study on university students and found that there is no significant negative relationship between cognitive flexibility and emotion regulation.

### Conclusions

Although there was no significant difference in the development of secondary students' cognitive flexibility, emotional intelligence, and coping strategies as a result of the 8-week game, it is reasonable to assume that integrating the game into the classroom can increase students' learning ability, positively influence academic performance, regulate sleep quality, and develop the individual as a whole physiologically, psychologically, and cognitively.

### Conflicts of interest

There is not conflict of interest.

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