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The Effect of Creative Dance on Spatial Thinking, Mental Rotation

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Abstract

Secondary education is an intense and stressful period of education due to its structure, and this period is also the critical developmental stage for adolescents. It is aimed to facilitate their learning in this critical period and support their hormonal, emotional, and social development. Thus, the effect of movement/creative dance on the spatial thinking and mental rotation skills of adolescents was investigated in this study. In this way, it was aimed to raise awareness among students, educators, and parents about the effect of creative dance on the learning and development of adolescents. A mixed-method research model was used for this study. The experimental design with the pretest-posttest control group, which is one of the semi-experimental designs, was employed in the quantitative dimension of the study. The "case study" method was adopted in the qualitative aspect of the study. The study group of the research consisted of students attending the 7th grade at a private school located in the center of Çanakkale Province in the 2018-2019 academic year. One of the five classes in the school was selected as the experimental group and the other as the control group, using the simple random sampling technique. While the number of students in the experimental group was 32, that in the control group was 31. 27 (42.9%) of the students were female and 36 (57.1%) were male. "Creative dance training and spatial thinking/mental rotation skills training" was designed and applied for 6 weeks, 4 hours a week. The data of the study were obtained through the rotation test developed by Vandenberg and Kuse (1978), redesigned by Peters, Laeng, et al. (1995), and adapted into Turkish by the same researchers. MRTA Rotation Test and "semi-structured interview form" prepared by the researcher were used in the study. It was discovered as a result of the study that creative dance education improved students' spatial thinking and mental rotation skills and there was a significant difference between the pre-post test scores of the students and the test scores they obtained from spatial thinking, mental rotation at the end of the experiment, and the time variable. A significant difference was also detected between the spatial thinking and mental rotation measurements carried out at the beginning and end of the experiment in the experimental and control groups. Redesigning the curricula based on movement/dance to promote the cognitive development of students will support their holistic development.

Keywords: Creative dance, spatial thinking, mental rotation skills

Introduction

The act of movement is inherent in the nature of the child. We can assert that imagination and the desire to act intensely are fundamental to the child's social, emotional, physical, and cognitive growth, especially in the early years of development. However, the periods in which the child's development is the fastest coincide with the education years. Due to its structure, the education system can be said to deprive children of movement for a long time and employ activities intensively based on cognitive skills in a certain environment and a certain period. However, another important point is that children use shuttle vehicles to go to school or to reach a place, and this takes a long time in metropolitan cities. It restricts the child's processes of movement during the most critical developmental period in most of the time spent in and out of school.

Field studies provide results indicating that movement positively affects learning, and physiological, emotional, and social development (Cotman, and Berchtold, 2002; Winter, 2007; Roig et al., 2012; Viswesh, Yang, Gupta, 2018). The child, who is instinctively loaded with the act of movement, disrupts the learning process in the classroom or experiences distraction and attention deficit disorder. This situation emerges as a problem in terms of learning and classroom guidance.

In the Turkish Education System, students are subjected to a general exam in the transition to a higher education level during the secondary education process. For this reason, it can be said that students are exposed to a learning life process with challenging assignments and tests to prepare for more intense learning content. In this case, the student, at the secondary education level, may be faced with being more inactive. However, field studies have revealed that there is a significant relationship between movement toward adolescence, in which the brain is being structured, and cognitive development (Esteban-Cornejo, Tejero-Gonzalez, Sallis, & Veiga, 2015; Stroth, Hille, Spitzer, & Reinhardt, 2009; Sibley & Etnier, 2003; Linder, 2002). Studies have shown that there is a significant positive relationship between movement and problem-solving (Bond, Lyle, Tappe, Rogers & D'Zurilla 2002), creativity (Rakusin, 1990), remembrance (Stroth, Hille, Spitzer, & Reinhardt, 2009), long-term coding (Tomporowski, 2003), mathematical thinking (Sibley & Etnier, 2003), comprehension (Stroth, Hille, Spitzer, & Reinhardt 2009), managing emotions (Fox, 1999), socializing (Gilbert 1992), and three-dimensional thinking skills (Emerson & Leigh, 1979; Logan, 1984; D'avella & Lacquaniti, 2013).

Creative Dance/Movement, Spatial Thinking, and Mental Rotation Skills

Creative dance has been defined in different aspects by field experts. For example, while Dimondstein (1971) expressed emotions and thoughts as activating, Hecox, Levine, and Scott (1975) defined it as an individual's social, creative, and physical effectiveness, independent of physical education or exercise. As can be understood from these definitions, the key feature of creative dance/movement can be explained as the individual's self-reflective feeling, that is, the structural movements that s/he performs successively according to his/her individual preferences (Joyce, 1994). In other words, it is the individual's realization of his/her own individual strengths and weaknesses, as well as his/her physical, social, and emotional aspects. These original creative dance moves also teach students:

a. to describe their bodies, perceptions, feelings, and themselves (Emerson & Leigh, 1979),
b. to engage in creative thinking rather than imitation and conscious thinking actions (Rakusin, 1990),
c. to sense visuospatial information with movement (Emerson & Leigh, 1979; Logan, 1984),
d. to become aware of space (Logan, 1984).

It can be stated that adolescence is a process in which the brain is physically structured, hormones work intensively, and physical development is disproportionate. Creative dance can be defined as spatial thinking, mental visualization, and rotation as a means of supporting the individual to realize his/her body, position himself/herself in the environment and provide spatial awareness. Spatial thinking refers to the variety of mental procedures involved in capturing, encoding, and manipulating information within the spatial image, whether two-dimensional or three-dimensional (Clements & Battista 1992). While *spatial thinking* usually involves imagining that objects will appear from a different angle, *mental rotation* refers to the ability to imagine how an object seen from one perspective will look when viewed from a new perspective (Chaney & Kephart, 1986; Johnson & Moore, 2020). There is a fundamental relationship between creative dance, spatial thinking, and mental rotation (Hagedoorn, 2012). The most comprehensive study on this relationship was carried out by Wohlschäger & Wohlschläger (1998), which unveiled a

positive relationship between mental rotation and motor processes. Dance also includes motor skills at its basis. For example, dance choreography is the act of restructuring the body and arranging and visualizing it in more than one geometrical form and associating it with space and featuring it by interacting with other dancers and arranging the rhythm (Emerson & Leigh, 1979; Logan, 1984; Chane & Kephart, 1986; Stinson, 1998; Hagedoorn, 2012). According to this, it can be asserted that creative dancing will affect students' mental rotation and visualization skills. The aim of the study was to enable students to recognize their bodies, emotions, and social developments and gain spatial awareness, as well as support their cognitive development, especially problem-solving, analytical thinking, and numerical and reading skills through creative dance/movement during adolescence. At the same time, it was to provide information to educators about the contribution that the inclusion of dance/movement activities in the instructional design process will have on learning. In this study, the effect of movement/creative dance on the spatial thinking and mental rotation skills of adolescents coinciding with an intense and stressful period of the education system was investigated. In this way, it was aimed to raise awareness among students, educators, and parents about the effect of creative dance on the learning and development of adolescents. The research sought answers to the following questions:

1. What is the effect of creative dance training on spatial thinking and mental rotation in adolescents?
2. What are the students' views on the spatial thinking and mental rotation skills of creative dance?

Method

Research Model

In this study, a mixed-method research model was used in line with its purpose. The mixed method is the use of views of qualitative and quantitative research models related to the research and the researcher and research design approaches together (Merriam, 2013; Creswell & Clark, 2015). The "integrated mixed pattern", in which the data of qualitative and quantitative techniques were collected at the same time and then the interpretation was made together, was used in this study.

The experimental design with the pretest-posttest control group, one of the semi-experimental designs, was used in the quantitative dimension of the study. The main purpose of this design is to determine the effect of the investigated variable on the group. Whether the variable tested with this design was effective or not (the effect of the independent variable on the dependent variable) was determined by testing the significance of the difference between the pre-test and post-test means (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2008; Kıncal, 2010). To collect data, pre-test and post-test were used in accordance with the design.

The "case study" method was used in the qualitative aspect of the study. According to Creswell (2007), a case study is an in-depth examination of a limited system based on large and comprehensive data sets. The focus of the case study is to try to describe an event as it exists. It is the examination of a single unit or a limited system, making intense descriptions and interpreting

depending on the context (Hancock & Algozzine, 2006). The experimental group of the study was used for the case study. A focus group interview was conducted with the case study group to collect data. Observations were made during the implementation process.

Study Group

The study group of the research consisted of students attending the 7th grade at a private school in the city center of Çanakkale Province in the 2018-2019 academic year. One of the five classes in the school was selected as the experimental group and the other as the control group by using the simple random sampling technique. (Büyüköztürk, Çakmak, Akgün, Karadeniz & Demirel, 2008). While the number of students in the experimental group was 32, that in the control group was 31. 27 (42.9%) of the students were female and 36 (57.1%) were male. In determining the study group, students who had danced or played sports for a long time were identified in the experimental and control groups. As it was thought that they would vary the data of the study and therefore, these students were not included in the experimental process. At the same time, other factors that may affect the practice, student interests, in-class achievement scores, especially the average score of subjects such as mathematics, science, Turkish, visual arts, physical education, age, and gender distribution rates in classes were taken into account.

Development of Instructional Design

For the application, first of all, "spatial thinking/mental rotation skill training with creative dance education" was designed by the researcher for the experimental group to improve the spatial thinking and mental rotation skills of the students. During the preparation phase, the scientific opinions and guidance of the faculty members of the Department of Educational Sciences and Performing Arts at Mimar Sinan Fine Arts University and Çanakkale Onsekiz Mart University were received. The interests of secondary school students, their social, emotional, and physical development and learning characteristics, as well as the contents and learning outcomes of all 7th-grade instructional programs implemented by the Ministry of Education Training Board in schools, were taken into account while designing the activities. In the control group, the activities proposed by the school within the annual plan were carried out exactly.

Spatial thinking/mental rotation skill instructional design with creative dance training consisted of the contents such as self-concept/subjectivity, space-perception, body perception, body-space awareness, emotion, imagination, and space-imagination relationship. The prepared design was applied every week in the company of professional dancers and during the observation processes. The application lasted for 6 weeks, four hours a week. To follow the pre-application process, guidance teachers of the classes where the application was carried out were given a total of 8 hours of training for 2 weeks on creative dance, spatial thinking, and mental rotation skills. The training was designed in two dimensions. The first dimension covered learning, spatial thinking/mental rotation skills, structure and functioning of the brain, and characteristics and learning processes of adolescents, and the second dimension included creative dance features (hands-on), body awareness, space perception, and imagination.

The prepared design was applied as a pilot study in two classrooms that were in the seventh grade of the school and were not included in the study. The deficiencies in the design have been eliminated through this application.

Experimental Procedures

Experimental procedures of the study were carried out in March, April, and May of the year 2019. In the experimental and control groups, students who had danced or played sports for a long time were identified and these students were not included in the experimental process as it was thought that they would vary the data of the study. Within the scope of the procedures, first of all, the "MRTA Rotation Test (A)" was applied to the experimental and control groups under the supervision of the researcher during the course.

The application of spatial thinking/mental rotation skills instructional design with creative dance training continued for six weeks, in two sessions, and lasted two lesson hours a week during the sports lessons and social activities of the students. One week after the applications concluded, the "MRTA Rotation Test (A)" was applied to the experimental and control groups again as a post-test.

The researcher attended as an observer during the application process. A semi-structured focus group interview was held with 7 volunteer students from the experimental group in the week the application was concluded.

Data Collection Tools and Data Collection

Mental Rotation Test A (MRTA Rotation Test A) was used to collect data in the quantitative dimension of the study, and interview techniques were applied to collect data in the qualitative dimension. Semi-structured interview forms were developed by the researcher.

Mental Rotation Test A: The MRTA Rotation Test A, which was used in the study to measure students' spatial thinking and mental rotation, was developed by Vandenberg and Kuse (1978) and was rearranged by Peters, Laeng, et al. (1995). This test consisted of figures drawn by Shepard and Metzler (1978) and is essentially a version of the Vandenburg and Kuse mental rotation test redrawn by AutoCAD. The test was translated into Turkish by Peters, Laeng et al. (1995) and the Turkish version was used with permission in this study. Since the test only contained figures in the scale, there was no need to engage in the adaptation process. It consisted of 24 items in which three-dimensional (two-dimensional) drawings of geometric figures were compared. In this test, students were asked to match the three-dimensional geometric figure given in each item with its correspondent provided within four options. While the student got a "1" point in case both of the figures given within options are found, he/she got a "0" point in case of finding none or one of the figures. The sum of the scores constituted the students' spatial thinking and mental rotation scores (Caissie, Vigneau, & Bors, 2009). The maximum possible score was 24.

Semi-structured interview form: A "semi-structured interview form", prepared by the researcher, was used to obtain students' views on creative dance application. In this form, there were three questions to determine the students' views on the creative dance application, the

learning outcomes they achieved, and the positive and negative aspects of the application. These were:

1. Has creative dancing had any impact on you in terms of thoughts, emotions, and social and physical dimensions? Please explain.

2. Has creative dancing had any impact on your spatial thinking/mental rotations skills? How?

3. Have you used your spatial thinking/mental rotation skills in your school and out-of-school life? How?

Data Analysis

SPSS 25 statistical software program was used in the analysis of the quantitative data obtained in the study. "Mixed pattern ANOVA" test was used to determine the effect of creative dance on students' spatial thinking and mental rotation skills. For the test, first of all, the assumptions of normal distribution, absence of extreme values, and equality of variances were tested (Büyüköztürk, 2002; 63). Qualitative data of the research were obtained by content analysis.

Ethical Permissions of the Study

In this study, all the rules specified to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were catered to. None of the actions specified under the title of “Actions Contrary to Scientific Research and Publication Ethics”, which is the second part of the directive, were undertaken.

Findings

Findings on Quantitative Data:

What is The Effect of Creative Dance Training on Spatial Thinking and Mental Rotation in Adolescents?

In this study, mixed pattern ANOVA analysis was used to determine the effect of creative dance education on spatial thinking and mental rotation in adolescents. The assumptions of the mixed pattern ANOVA test were checked before the test. First of all, it was determined that the dependent variable (pretest and posttest) showed normal distribution in the experimental and control groups according to the Shapiro-Wilk test result ($p>.05$). In addition, it was observed that there were no extreme values in the data in the controls made with the Boxplot chart. According to the Levene test results, it was shown that the variances of the dependent variable were equal in the experimental and control groups ($p>.05$). The analysis process began after providing the assumptions. For this, first of all, the interaction effect of the time (pretest-posttest) and group (experiment-control) variables and then the simple main effects for both variables were calculated separately.

Table 1. *Descriptive values of spatial thinking and mental rotation measured during the research process*

Time	Group	Mean	Ss	N
Pre-test	Control	11,45	5,150	31
	Experimental	10,22	5,091	32
Post-test	Control	15,00	5,203	31
	Experimental	17,34	2,813	32

According to the spatial thinking and mental rotation score results obtained within the scope of the study, while the mean of the experimental group was 10.22 at the beginning of the experiment, that of the control group was 11.45. At the end of the experiment, the mean of the experimental group increased to 17.34 and that of the control group to 15 (Table 1). It can be observed when the means were examined in general that the rotation test scores increased in both the experimental and control groups. While the scores were similar at the beginning of the experiment, it can be noticed that there was a significant increase in the spatial thinking and mental rotations of the experimental group at the end of the experiment. This difference between the groups can also be seen in Figure 1.

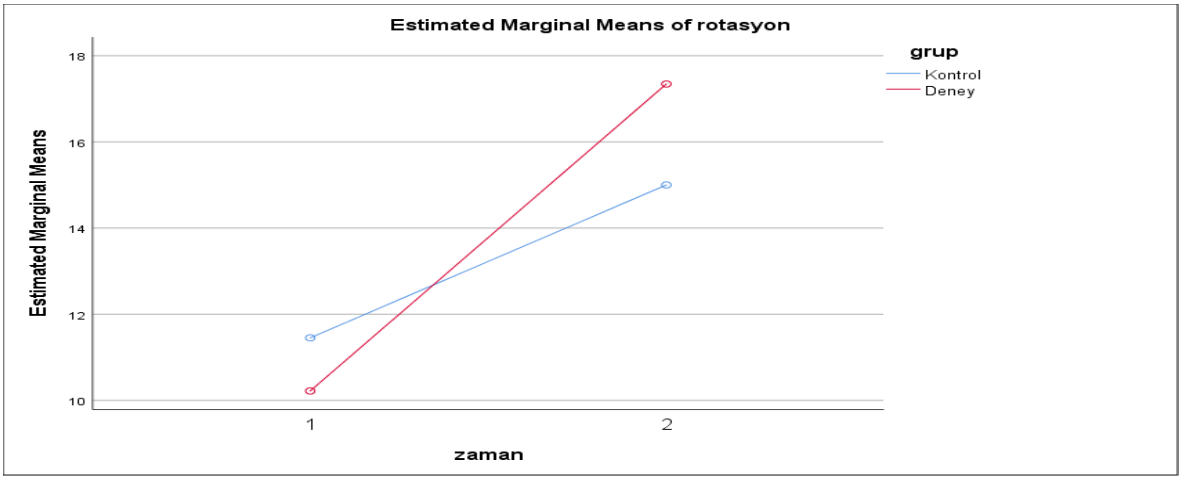

Figure 1. *The effect of creative dance on spatial thinking and mental rotation changes in experimental and control groups.*

Mixed pattern ANOVA was administered to determine the effect of creative dance on spatial thinking and mental rotation in individuals participating in the study. The spatial thinking and mental rotations of the experimental and control groups participating in the experiment were measured twice, at the beginning as well as at the end of the experiment. Analysis results are given in Table 2.

Table 2. *The results of the mixed pattern ANOVA test to determine the effect of creative dance on spatial thinking and mental rotation*

	Sum of Squares	Sd.	Mean of Squares	F	p
Time	896,903	1	896,903	56,485	,000
Error (time)	968,589	61	15,879		
Time * Group	100,713	1	100,713	6,343	,014
Error (time*group)	968,589	61	15,879		

It was determined according to the analysis results obtained that the main effect of time ($F(1\ 61)= 56,485$, $p=.000$) was significant. This result showed that there was a difference between

spatial thinking and mental rotations measured before and after the experiment in the experimental and control groups. The interaction effect of group and time was found to be significant (F(1 61)= 6.343, p=014). According to this result, it was seen that creative dance had a significant effect on spatial thinking and mental rotation (Table 2). Since the interaction effect was significant, simple main effects were calculated for time and group variables to understand the difference between groups. Analysis results were provided in Tables 3 and 4.

Table 3. *Results of simple main effects analysis with dependent groups t-test for the time variable*

		Mean	Sd.	t	p
Control	Pre-experiment	11,45	5,150	3,880	,001
	Post-experiment	15,00	5,203		
Experiment	Pre-experiment	10,22	5,091	6,590	,000
	Post-experiment	17,34	2,813		

According to the results of the simple main effect analysis for the time variable, there was a significant difference between the spatial thinking and mental rotation measurements made at the beginning and end of the experiment in the experimental and control groups (p<.05). While the difference was 2.55 in the control group, it was 7.12 in the experimental group.

Table 4. *Results of simple main effects analysis with dependent groups t-test for group variable*

		Mean	Sd.	t	p
Pre-experiment	Control	11,45	5,150	,955	,343
	Experiment	10,22	5,091		
Post-experiment	Control	15,00	5,203	-2,234	,029
	Experiment	17,34	2,813		

According to the results of the simple main effect analysis for the group variable, while there was no significant difference between the means obtained from the spatial thinking and mental rotation measurements made at the beginning of the experiment between the experimental and control groups, there was a significant difference at the end of the experiment (p<.05). When the results of the interaction effect and simple main effect analyzes were examined together, it can be said that creative dance training in seventh-grade students improved their spatial thinking and mental rotation. The increase in the post-test in the control group might have occurred by chance, or it might have been due to students' remembrance and thinking about the test.

Qualitative Data Findings on the Effect of Creative Dance on Spatial Thinking and Mental Rotation Skills of the Experimental Group

What are the Students' Views on the Spatial Thinking and Mental Rotation Skills of Creative Dance?

Has creative dancing had any impact on you in terms of thoughts, emotions, social and physical dimensions? Please explain.

The results of the interviews with the students who volunteered from the experimental group were given below:

In the Thought Dimension;

"It was good that it was impromptu", "it was difficult to adjust my body by feeling someone else's movements and imagining them in my mind", "imagining someone else's movements in my mind felt like a game and I enjoyed it a lot. It was fun to guess by imagining in my mind", "I first was thinking of what I would do. Then I set my feelings and thoughts free".

In the Emotion Dimension;

"Imagining someone else's movements in my mind felt like a game and I enjoyed it a lot. It was fun to guess by imagining in my mind", "creative dancing was good", "I did not like creative dancing, I was tired of constantly thinking about how to move my body", "I felt free while dancing", "the idea of dancing frightened me at first, but then it made me feel very comfortable, I will continue to dance", "It was not dancing but creative dancing that was nice. It felt good to move my body as I felt it."

In the Social Dimension;

"I was frightened by the idea of dancing with my friends", *"I didn't like dancing with the group", and "It felt good to adjust myself by feeling someone else's movements. It was a relief to find a place for myself in the group", "Even though the idea of creative dancing in the group felt bad, I learned to behave in a relaxed manner among my friends."*

In the Physical Dimension;

"I felt my body in creative dance", "it was difficult to use my body at first, but then I controlled it better", and "it was difficult to adjust my body by feeling someone else's movements and imagining them in my mind", "at first, I had difficulty using my arms", "It was not dancing but creative dancing that was nice. It felt good to move my body as I felt it."

Has creative dancing had an impact on your spatial thinking/ mental rotation ability? How?

According to the results of the interviews with the students who volunteered from the experimental group, their views on the effect of creative dancing on spatial thinking/mental rotation skills were as follows:

"It was difficult to dance without bumping into others", "I had difficulty dancing back-to-back without seeing my friend, but then it was nice to dance by feeling him/her", "at first, I thought I couldn't do it without seeing and feeling my friend while moving together, but later I was happy to succeed", "it was difficult to adjust my body by feeling someone else's movements and imagining them in my mind, then it felt like a game and I enjoyed it a lot, it was enjoyable to guess by imagining in my mind", "I sometimes thought I could not control my body when I had to dance in confined areas, but then I learnt to establish a relationship between space and my body in time", "I made my own body noticeable while I was turning the body up, down, right and left in creative dance and thinking about how to do it; it was funny at first but now it is good to notice my own body", "I was against dancing at first but now it makes me happy when I don't hit anything anymore", "the activity of visualizing the space in my mind with my back turned was difficult. I couldn't do it for a long time, but I did it when I left my body and mind free", "I had a hard time dancing with my back turned and without stepping on the rope between me and my friend. At first, I stepped on the rope as well as bumped into my friend, but then I learned to position the rope in my mind", "I never believed that creative dance could make me feel my surroundings so much, but now I feel the space that I enter as a whole".

Have you used your spatial thinking/mental rotation skills in your school and out-of-school life? How?

According to the results of the interview with the volunteer students from the experimental group, their opinions about using spatial thinking/mental rotation in their lives;

In the School Environment;

"I didn't like painting, but now I can imagine it in my mind more easily", "I use the ability to imagine in my mind in my classes now. This made me relax in mathematics", "I try to imagine in my mind while I am reading something. I think it's fun to read", "I close my eyes and try to guess spaces and their locations at school", "I think I will attend physical education classes".

Out of School Environment*;*

"I adjust my distance with people without difficulty", "I tried to anticipate other people's movements while my back is turned. This sounded like a game to me. I tried to use it at home or on the transport I got on. I think it was good for me. It made me feel good", "I never believed that creative dance could make me feel my surroundings this much, but now I feel the space that I enter as a whole", "my skills of explaining games to my brother have improved", "It seems like I can give directions more easily now".

In the interview, the statements about students' acts of noticing their bodies, making imaginations/visualizations, dreaming, and using them in their lessons and different areas of their daily lives support the problem of the study.

Discussions and Conclusion

It can be said that according to the data of this study that creative dance education improves students' spatial thinking and mental rotation. This could be explained by the fact that while the scores of the students in the test applied at the beginning of the experiment were similar, there was a significant increase in the test scores they obtained from the spatial thinking and mental rotations at the end of the experiment. The effects of creative dance, such as students' thinking about the movements they do or making sense of the movement as they feel by noticing their bodies, self-control, concentration, and focusing skills (Gilbert, 1992; Reinhardt & Stinson, 1998; Tomporowski, 2003; Stroth, Hille, Spitzer & Reinhardt, 2009; Jansen & Pietsch, 2010), physical space, awareness of individual differences (Von Rosseberg- Kempton, Dickinson, & Poole, 1999; Johnson & Moore, 2020), and creating spatial relationships (Logan, 1984; Hagendoorn, 2012; Johnson & Moore, 2020)), can be interpreted as supporting mental thinking skills by improving students' fantasy and imagination skills. Students supported this situation with their views like "*I felt my body in creative dance", "It was difficult to use my body at first, but then I managed to control it better", "It was good that it was impromptu",* and *"I made my own body noticeable while I was turning the body up, down, right and left in creative dance and thinking about how to do it; it was funny at first but now it is good to notice my own body"*. The views of the students also overlapped with the studies carried out in the field. In other words, they stated that their awareness of their own body increased, and their attention, interest, and self-control skills differed through creative dance. In addition, students also expressed that they established the body-space relationship and that they felt the objects or people in the space and turned their position or situation in their minds by statements such as "*it was difficult to adjust my body by feeling someone else's movements and imagining them in my mind, then it felt like a game and I enjoyed it a lot, it was enjoyable to guess by imagining in my mind",* and *"I sometimes thought I wouldn't be able to control my body when I had to dance in a small area. but then I learned to establish a relationship between space and my body. I also tried to use it at home or in the transports I got on. I think it was good for me. It made me feel good"*. When this situation was considered in terms of the individual's spatial thinking, it can be expressed as the situation of imagining objects as they might appear from a different perspective. At the same time, it explained the students' statement "*I imagined it in my mind*" when considering *mental rotation* as the ability to visualize how an object seen from one perspective would appear when viewed from a new perspective (Johnson & Moore, 2020). In their studies, Kaya, Yılmaz (2019), Frick and Möhring (2016), Hagedoorn (2012), Jansen and Pietsch (2010), Soska, Adolph and Johnson (2010), Shadmehr and Moussavi (2000), Shepard (1978) revealed that there was a fundamental relationship between

dance-creative dance and spatial thinking, mental rotation, and imagination. According to the findings of the study and the results of the field research, it can be stated that creative dance influenced students' spatial thinking and mental rotation skills.

The findings of the study on the effect of creative dance and spatial thinking, and mental rotation skills in terms of time, showed a significant difference between the spatial thinking and mental rotation measurements made at the beginning and end of the experiment in the experimental and control groups. It can be asserted when examining the results of interaction effect and simple main effect analyses together that students' creative dance education improved their spatial thinking and mental rotation. Student opinions that support this finding, like "*I thought at first that I would not be able to do it by feeling and moving together without seeing my friend, but then I was happy to succeed", "I sometimes thought I would not be able to control my body when I had to dance in a small area, but then I gradually learned to establish a relationship between space and my body. I tried to use it at home or on the transport I got on. I thought this was good for me and made me feel good",* and *"I was against dancing at first but now it made me happy that I didn't bump into anything",* can be explained that creative dance, spatial thinking, and mental rotation constituted a significant difference over time.

In the studies they conducted, Hecox, Levine, and Scott (1975), Chin (1988). Jansen, Pietsch (2010), Jola (2010), Stevens, Ginsborg, Lester (2011), Gunderson, Gerardo Ramirez, Beilock, and Levine (2013) emphasized the importance of spatial awareness, body representation and time perception in both dance and spatial thinking as well as in mental rotation skills. The study represented a certain period, and it was difficult to make a definite judgment about the effect of creative dance on spatial thinking and mental rotation skills in terms of time. However, it can be stated that there was a difference in supporting them with results from field studies.

As a result, during adolescence, redesigning the curricula based on movement/dance can support the holistic development of students in the process of their social, emotional, physical, and hormonal development, and in the period when they are busy with exams, assignments, and learning intensive content that is the return of the education system. In terms of contributing to the field, it may be recommended to conduct more detailed studies based on neuroscience to support the developmental characteristics of adolescents. Thus, it can contribute to the structuring of the curriculum, the revision of the guidance programs, and the interaction within the family.

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Contribution Rate of Researchers

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Genişletilmiş Türkçe Özet

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Yaratıcı Dansın Uzamsal Düşünme, Zihinsel Döndürme Becerisi Üzerindeki Etkisi

Giriş

Çocuğun doğasında hareket eylemi vardır. Özellikle gelişimin ilk yıllarında oyun, hayal gücü ve yoğun hareket etme isteği çocuğun sosyal, duygusal, fiziksel ve bilişsel gelişiminde temeldir diyebiliriz. Ancak çocuğun gelişiminin en hızlı olduğu dönemler eğitim yıllarına denk düşmektedir. Eğitim sistemi yapısı gereği, belli bir ortamda ve belli zaman içerisinde çocukları uzun süre hareket eyleminden yoksun bırakarak, yoğun olarak bilişsel becerilere dayalı etkinlikleri işe koştuğu söylenebilir. Okulda geçirilen zamanlarının çoğunda, çocuğun en kritik gelişim döneminde hareket etme süreçlerini kısıtlamaktadır. Alan araştırmaları hareket etmenin, öğrenme, fizyolojik, duygusal ve sosyal gelişimi olumlu etkilediğine dair sonuçlar sunmaktadır (Cotman,, Berchtold, 2002; Winter, 2007; Roig ve ark., 2012; Viswesh, Yang, Gupta, 2018).

Türk Eğitim Sistemi'nde, ortaöğretim sürecinde öğrenciler, bir üst öğrenim kademesine geçişte genel bir sınava tabi tutulmaktadır. Bu nedenle öğrenciler, daha yoğun bir öğrenme içeriğine hazırlanmak, zorlu ödevlerin ve testlerin olduğu bir öğrenim yaşantısı sürecine maruz kaldıkları söylenebilir. Bu durum da orta öğrenim düzeyinde öğrenci, daha hareketsiz kalma ile karşı karşıya kalabiliyor. Ancak alan araştırmaları, beynin yapılandırıldığı ergenlik dönemine yönelik hareket ile bilişsel gelişim arasında önemli bir ilişki olduğunu ortaya koymuştur (Esteban-Cornejo, Tejero-Gonzalez, Sallis ve Veiga, 2015; Stroth, Hille, Spitzer ve Reinhardt, 2009; Sibley ve Etnier, 2003; Linder, 2002).

Yaratıcı Dans/Hareket ve Uzamsal Düşünme, Zihinsel Döndürme Becerisi

Yaratıcı dans, alan uzmanlarınca farklı açılardan tanımlanmıştır. Örneğin Dimondstein (1971), duygu ve düşünceleri harekete geçirme olarak ifade ederken; Hecox, Levine, ve Scott (1975), beden eğitimi ya da egzersizden bağımsız olarak, bireyin sosyal, yaratıcı, ve fiziksel

etkileyiciliğidir biçiminde tanımlamıştır. Yaratıcı dans/ bireyin kendi özgünlüğünde, bireysel güçlü ve zayıf yönlerini ve aynı zamanda fiziksel, sosyal ve duygusal yönünü fark etmesidir diyebiliriz.

Uzamsal düşünme, genellikle nesnelerin farklı bir açıdan görüneceklerini zihinde canlandırmayı içerirken; *zihinsel döndürme*, bir perspektiften görülen bir nesnenin, yeni bir perspektiften bakıldığında nasıl görüneceğini hayal etme yeteneğini ifade eder (Chaney ve Kephart, 1986; Johnson ve Moore, 2020). Yaratıcı dans ile uzamsal düşünme, zihinsel döndürme arasında temel bir ilişki vardır (Hagedoorn, 2012). Bu ilişkiye yönelik en kapsamlı çalışma Wohlschäger ve Wohlschläger (1998) tarafından yapılmış, zihinsel döndürme ve motor süreçler arasında olumlu bir ilişki olduğunu ortaya koymuştur. Buna göre, öğrencilerde yaratıcı dans etmenin onların zihinsel döndürme, görselleştirme becerilerine etki edeceği söylenebilir. Araştırmanın amacı öğrencilerin ergenlik döneminde, yaratıcı dansın uzamsal düşünme, zihinsel döndürme becerilerine etkisi araştırılmıştır. Araştırmada aşağıdaki sorulara cevap aranmıştır;

3. Ergenlerde yaratıcı dans eğitiminin uzamsal düşünme, zihinsel döndürme üzerine etkisi nedir?
4. Yaratıcı dansın uzamsal düşünme, zihinsel döndürme becerisine ilişkin öğrenci görüşleri nelerdir?

Yöntem

Araştırma Modeli

Bu çalışmada, araştırmanın amacı doğrultusunda karma yöntem araştırma modelinden faydalanılmıştır. Karma yöntem, nitel ve nicel araştırma modellerinin araştırmaya ve araştırmacıya ilişkin görüşlerinin, araştırma tasarımı yaklaşımlarının bir arada kullanılmasıdır (Merriam, 2013; Creswell ve Clark, 2015). Bu çalışmada, nitel ve nicel tekniklerin verilerinin aynı anda toplandığı ve yorumlamanın sonrasında birlikte yapıldığı "iç içe karma desen" kullanılmıştır.

Araştırmanın nicel boyutunda, yarı-deneysel desenlerden öntest-sontest kontrol gruplu deneysel desen kullanılmıştır. Bu desenin temel amacı, araştırılan değişkenin grup üzerindeki etkisinin belirlenmesidir. Çalışmanın nitel boyutunda "örnek olay" yönteminden faydalanılmıştır.

Çalışma Grubu

Araştırmanın çalışma grubu 2018-2019 eğitim öğretim yılında Çanakkale il merkezinde özel bir okulun 7. sınıfına devam eden öğrencilerinden oluşmuştur. Okulda bulunan beş sınıftan birisi deney, birisi ise kontrol grubu olarak basit seçkisiz örneklem tekniği ile seçilmiştir. Deney grubunda yer alan öğrenci sayısı 32 iken kontrol grubunda 31'dir. Öğrencilerin 27'si (%42.9) kız, 36'sı (%57.1) ise erkektir. Çalışma grubu belirlemede, deney ve kontrol grubunda daha önce uzun süre dans etmiş veya spor yapmış öğrenciler belirlenmiştir. Çalışmanın verilerini farklılaştırabileceği düşünülmüş ve bu öğrenciler denel işlem sürecine alınmamıştır. Aynı zamanda uygulamayı etkileyebilecek diğer faktörler, öğrenci ilgileri, sınıf içi başarı puanları özellikle matematik, fen, Türkçe, görsel sanatlar, beden eğitimi gibi derslerin puan ortalamaları, yaş, sınıflarda cinsiyet dağılımı oranları dikkate alınmıştır.

Öğretim Tasarımının Geliştirilmesi

Uygulama için öncelikle araştırmacı tarafından, deney grubuna yönelik öğrencilerin uzamsal düşünme, zihinsel döndürme becerilerini geliştirmeye yönelik "yaratıcı dans eğitimle uzamsal düşünme/zihinsel döndürme beceri eğitimi" tasarlanmıştır. Hazırlık aşamasında Mimar Sinan Güzel Sanatlar Üniversitesi ve Çanakkale Onsekiz Mart Üniversitesi Eğitim Bilimleri ile Sahne Sanatları Bölümü öğretim üyelerinin bilimsel görüş ve rehberlikleri alınmıştır. Etkinlikler tasarlanırken, ortaokul çağı öğrencilerinin ilgileri, sosyal, duygusal, fiziksel gelişim ve öğrenme özellikleri ile MEB Talim Terbiye Kurulu'nun okullarda uyguladığı ilköğretim programı 7. sınıf düzeyi tüm öğretim programlarının kazanım ve içerikleri dikkate alınmıştır. Kontrol grubunda okulun yıllık plan dahilinde planlamış olduğu etkinlikler aynen uygulanmıştır.

Denel İşlem

Araştırmanın denel işlemleri 2019 yılı Mart, Nisan ve Mayıs aylarında gerçekleştirilmiştir. İşlemler kapsamında öncelikle deney ve kontrol gruplarına ders içerisinde araştırmacının gözetiminde "MRTA Rotasyon Testi (A)" uygulanmıştır. Yaratıcı dans eğitimle uzamsal düşünme/zihinsel döndürme beceri eğitimi tasarımı uygulanmış ve bir hafta sonra "MRTA Rotasyon Testi (A)" son test olarak tekrar deney ve kontrol grubuna uygulanmıştır. Uygulamanın bittiği hafta deney grubundan gönüllü 7 öğrenciyle yarı yapılandırılmış odak grup görüşmesi yapılmıştır.

Veri Toplama Araçları ve Verilerin Toplanması

Araştırmanın nicel boyutunda veri toplamak için Mental Rotasyon Testi A (MRTA Rotasyon Testi A) nitel boyutunda veri toplamak için ise gözlem ve görüşme teknikleri kullanılmıştır. Yarı yapılandırılmış görüşme formu araştırmacı tarafından geliştirilmiştir.

Mental Rotasyon Testi A: Araştırmada öğrencilerin uzamsal düşünme, zihinsel döndürmelerinin ölçülebilmesi için kullanılan MRTA Rotasyon Testi A, Vandenberg ve Kuse (1978) tarafından geliştirilmiş ve Peters, Laeng ve ark. (1995) tarafından yeniden düzenlenmiştir. Test Türkçeye Peters, Laeng ve ark. (1995) tarafından çevrilmiş ve bu araştırmada izin alınan Türkçe versiyonu kullanılmıştır. Ölçekte sadece figürler bulunduğu için herhangi bir uyarlama çalışmasına ihtiyaç duyulmamıştır.

Yarı yapılandırılmış görüşme formu: Öğrencilerin yaratıcı dans uygulamasına ilişkin görüşlerinin elde edilmesinde araştırmacı tarafından hazırlanan "yarı yapılandırılmış görüşme formu" kullanılmıştır.

Verilerin Analizi

Araştırmada elde edilen nicel verilerin analizinde SPSS 25 istatistik programı kullanılmıştır. Yaratıcı dansın öğrencilerin uzamsal düşünme, zihinsel döndürme becerileri üzerine etkisini belirlemek için "karma desen ANOVA" testinden faydalanılmıştır. Test için öncelikle, normal dağılım, uç değerlerin olmaması ve varyansların eşitliği varsayımları test edilmiştir (Büyüköztürk, 2002; 63). Araştırmanın nitel verileri içerik analizi ile elde edilmiştir.

Araştırmanın Etik İzinleri

Yapılan bu çalışmada "Yükseköğretim Kurumları Bilimsel Araştırma ve Yayın Etiği Yönergesi" kapsamında uyulması belirtilen tüm kurallara uyulmuştur. Yönergenin ikinci bölümü olan "Bilimsel Araştırma ve Yayın Etiğine Aykırı Eylemler" başlığı altında belirtilen eylemlerden hiçbiri gerçekleştirilmemiştir.

Bulgular

Nicel Verilere İlişkin Bulgular

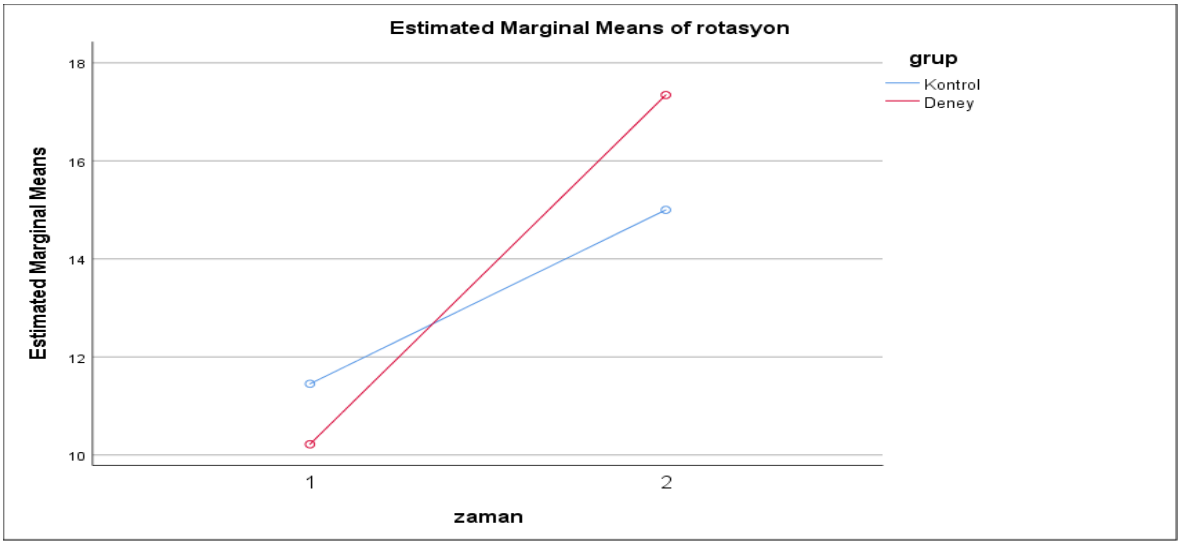
Ergenlerde yaratıcı dans eğitiminin uzamsal düşünme, zihinsel döndürme üzerine etkisi nedir?

Bu araştırmada ergenlerde yaratıcı dans eğitiminin uzamsal düşünme, zihinsel döndürme üzerine etkisini belirlemek amacıyla karma desen ANOVA analizi kullanıldı. Test öncesi karma desen ANOVA testinin varsayımları kontrol edildi. Öncelikle bağımlı değişkenin (ön test ve son test) deney ve kontrol gruplarında, Shapiro Wilk testi sonucuna göre normal dağılım gösterdiği tespit edildi (p>.05). Ayrıca Boxplot grafiğiyle yapılan kontrollerde verilerde uç değerlerin olmadığı görüldü. Levene testi sonucuna göre, deney ve kontrol gruplarında bağımlı değişkenin varyanslarının eşit olduğunu göstermiştir (p>.05). Varsayımların sağlanmasından sonra analiz sürecine geçilmiştir. Bunun için öncelikle zaman (ön test-sontest) ve grup (deney-kontrol) değişkenlerinin etkileşim etkisi ardından her iki değişken için ayrı ayrı basit ana etkileri hesaplanmıştır.

Tablo 1. *Araştırma sürecinde ölçülen uzamsal düşünme, zihinsel döndürmeye ilişkin tanımlayıcı değerler*

Zaman	Grup	Ort.	Ss	N
Deneyin Başında	Kontrol	11,45	5,150	31
	Deney	10,22	5,091	32
Deneyin sonunda	Kontrol	15,00	5,203	31
	Deney	17,34	2,813	32

Araştırma kapsamında elde edilen uzamsal düşünme, zihinsel döndürme puan sonuçlarına göre, deneyin başında deney grubunun ortalaması 10.22 iken, kontrol grubunun ortalaması 11.45'tir. Deneyin sonunda ise deney grubunun ortalaması 17,34'e, kontrol grubunun ortalaması ise 15'e yükselmiştir (Tablo 1). Ortalamalara genel olarak bakıldığında hem deney hem de kontrol gruplarında rotasyon test puanlarının yükseldiği görülebilir. Deneyin başında puanlar benzer iken deney sonunda deney grubunun uzamsal düşünme, zihinsel döndürmelerinde belirgin bir artış olduğu görülebilir. Gruplar arasındaki bu fark Şekil 1 üzerinde de görülebilir.



Şekil 1. Deney ve kontrol gruplarında yaratıcı dansın uzamsal düşünme, zihinsel döndürmesi değişimine etkisi

Araştırmaya katılan bireylerde yaratıcı dansın uzamsal düşünme, zihinsel döndürme üzerine etkisini belirlemek için karma desen ANOVA, yapıldı. Deneye katılan deney ve kontrol gruplarının uzamsal düşünme, zihinsel döndürmeleri deneyin başında ve sonunda olmak üzere iki defa ölçüldü. Analiz sonuçları Tablo 2'de yer alıyor.

Tablo 2. *Yaratıcı dansın uzamsal düşünme, zihinsel döndürme üzerine etkisinin belirlemeye yönelik yapılan karma desen ANOVA testi sonucu*

	Kareler Toplamı	Sd.	Kareler Ortalaması	F	p
Zaman	896,903	1	896,903	56,485	,000
Hata(zaman)	968,589	61	15,879		
Zaman * Grup	100,713	1	100,713	6,343	,014
Hata(zaman*grup)	968,589	61	15,879		

Elde edilen analiz sonucuna göre, zamanın ($F_{(1\ 61)}$= 56,485, p=.000) ana etkisinin anlamlı olduğu tespit edildi. Bu sonuç deney ve kontrol gruplarında, deney öncesi ve deney sonrasında ölçülen uzamsal düşünme, zihinsel döndürmeler arasında fark olduğunu gösteriyor. Grup ve zamanın etkileşim etkisinin ise anlamlı olduğu tespit edildi ($F_{(1\ 61)}$= 6,343, p=014). Bu sonuca göre yaratıcı dansın uzamsal düşünme, zihinsel döndürme üzerine anlamlı etkisinin olduğu görülmektedir (Tablo 2). Etkileşim etkisi anlamlı çıktığı için, gruplar arasında farkı anlama adına zaman ve grup değişkenleri için basit ana etkiler hesaplandı. Analiz sonuçları Tablo 3 ve Tablo 4'te yer alıyor.

Tablo 3. *Zaman değişkeni için, bağımlı gruplar t testi ile yapılan basit ana etki analizi sonuçları*

		Ort.	Ss.	t	p
Kontrol	Deneyin Başında	11,45	5,150	3,880	,001
	Deneyin Sonunda	15,00	5,203		
Deney	Deneyin Başında	10,22	5,091	6,590	,000
	Deneyin Sonunda	17,34	2,813		

Zaman değişkeni için yapılan basit ana etki analizi sonuçlarına göre; deney ve kontrol gruplarında deneyin başında ve sonunda yapılan uzamsal düşünme, zihinsel döndürme ölçümleri arasında anlamlı fark vardır (p<.05). Kontrol grubunda fark 2.55 iken, deney grubunda 7.12'dir.

Tablo 4. *Grup değişkeni için, bağımsız gruplar t testi ile yapılan basit ana etki analizi sonuçları*

		Ort.	Ss.	t	p
Deneyin Başında	Kontrol	11,45	5,150	,955	,343
	Deney	10,22	5,091		
Deneyin Sonunda	Kontrol	15,00	5,203	-2,234	,029
	Deney	17,34	2,813		

Grup değişkeni için yapılan basit ana etki analizi sonuçlarına göre; deney ve kontrol grupları arasında deneyin başında yapılan uzamsal düşünme, zihinsel döndürme ölçümlerinden elde edilen ortalamalar arasında anlamlı fark yok iken deney sonunda anlamlı fark vardır ($p<.05$). Etkileşim etkisi ve basit ana etki analizleri sonuçları birlikte incelendiğinde, yedinci sınıf öğrencilerinde yaratıcı dans eğitiminin onların uzamsal düşünme, zihinsel döndürmelerini geliştirdiği söylenebilir. Kontrol grubunda son testteki artış tesadüfen gerçekleşebileceği gibi öğrencilerin test hatırlaması ve üzerinde düşünmesinden kaynaklanmış olabilir.

Deney Grubunun Yaratıcı Dansın Uzamsal Düşünme, Zihinsel Döndürme Becerisine Etkisine İlişkin Nitel Veri Bulguları

Yaratıcı dansın uzamsal düşünme, zihinsel döndürme becerisine ilişkin öğrenci görüşleri nelerdir?

Yaratıcı dans etmenin sizde, düşünce, duygu, sosyal ve fiziksel boyutlarda bir etkisi oldu mu? Açıklar mısınız?

Deney grubundan gönüllü olan öğrencilerle yapılan görüşme sonuçları aşağıda verilmiştir;

Düşünce Boyutunda;

"doğaçlama olması güzeldi", "başkasının hareketlerini hissederek, zihnimde hayal ederek, bedenimi ayarlamak zordu", "başkasının hareketlerini zihnimde hayal etmek bana oyun gibi geldi ve çok zevk aldım, zihnimde hayal ederek, tahmin etmek eğlenceliydi", "yaratıcı dans ederken önce ne yapacağımı düşünüyordum, daha sonra duygularımı ve düşüncelerimi rahat bıraktım".

Duygu Boyutunda;

"başkasının hareketlerini hissederek, zihnimde hayal etmek bana oyun gibi geldi ve çok zevk aldım, zihnimde hayal ederek, tahmin etmek eğlenceliydi", "yaratıcı dans etmek iyiydi", "yaratıcı dansı sevmedim, sürekli bedenimi nasıl hareket ettireceğimi düşünmekten yoruldum", "dans ederken kendimi özgür hissettim", "dans etme fikri önce korkuttu, ama sonrasında beni çok rahatlattı, dans etmeye devam edeceğim", "dans etmek değil ama yaratıcı dans çok güzeldi, içimden geldiği gibi bedenimi hareket ettirmek beni iyi hissettirdi".

Sosyal Boyutta;

"arkadaşlarımla birlikte dans etme fikri korkuttu", "grupla dans etmeyi sevmedim", "başkasının hareketlerini hissederek kendimi ayarlamak iyi geldi; grup içinde kendime yer bulmak rahatlattı", "grup içinde yaratıcı dans etme fikri kötü geldiyse de arkadaşlarımın arasında kendimi rahat bırakmayı öğrendim".

Fiziksel Boyutta;

"yaratıcı dansta bedenimi hissettim", "bedenimi ilk zamanlarda kullanmak zordu, sonrasında daha iyi kontrol ettim", "başkasının hareketlerini hissederek, zihnimde hayal ederek, bedenimi ayarlamak zordu", "ilk zamanlarda kollarımı kullanmakta zorluk çektim", "dans etmek değil ama yaratıcı dans çok güzeldi, içimden geldiği gibi bedenimi hareket ettirmek beni iyi hissettirdi".

Yaratıcı dans etmek, uzamsal düşünme/ zihinsel döndürme becerin üzerinde etkisi oldu mu? Nasıl?

Deney grubundan gönüllü olan öğrencilerle yapılan görüşme sonuçlara göre yaratıcı dans etmek ile uzamsal düşünme/zihinsel döndürme becerisine etkisine ilişkin görüşleri şöyledir:

"başkalarına çarpmadan dans etmek zordu", "sırt sırta vererek, arkadaşımı görmeden dans etmekte zorlandım, sonrasında onu hissederek dans etmek güzeldi", "arkadaşımı görmeden, hissederek ortak hareket ederken ilk başlarda yapamayacağımı düşündüm, sonrasında bunu başarmaktan mutlu oldum", "başkasının hareketlerini hissederek, zihnimde hayal ederek, bedenimi ayarlamak zordu, sonra bu bana oyun gibi geldi ve çok zevk aldım, zihnimde hayal ederek, tahmin etmek eğlenceliydi", "bazen küçük alanda dans etmem gerektiğinde, bedenimi kontrol edemeyeceğimi düşündüm, ama sonra mekân ile bedenim arasında zamanla ilişki kurmayı öğrendim", "yaratıcı dansta bedeni aşağı, yukarı, sağa ve sola döndürürken, nasıl yapacağımı düşünürken kendi bedenimi görselleştirdim; bu önce komik geldi ama şimdi kendi bedenimi fark etmek iyi geldi", "dans etmeye başta karşıydım ama şimdi artık hiçbir şeye çarpmadığım için beni mutlu etti". "sırtım dönükken zihnimde mekanı canlandırma etkinliği zordu; uzun süre yapamadım ama bedenimi ve zihnimi rahat bırakınca yaptım", "arkadaşımla aramızda bulunan ipe basmadan ve arkam dönük dans etmekte zorlandım; ilk başlarda hem ipe bastım hem de arkadaşıma çarptım; ipi zihnimde konumlandırmayı öğrendim", "yaratıcı dansın çevremi bu kadar hissetmemi sağlayacağına hiç inanmadım; ama şimdi girdiğim alanı bütünde hissediyorum".

Uzamsal düşünme/ zihinsel döndürme becerini okulda ve okul dışı yaşamında kullandın mı? Nasıl?

Deney grubundan gönüllü olan öğrencilerle yapılan görüşme sonuçlara göre uzamsal düşünme/zihinsel döndürmeyi yaşantısında kullanmaya yönelik belirttikleri görüşler;

Okul Ortamında;

"resim yapmaktan hoşlanmıyordum, şimdi zihnimde daha kolay hayal edebiliyorum", "zihnimde hayal etme becerisini artık derslerde kullanıyorum, bu matematikte beni rahatlattı", "bir şey okurken zihnimde hayal etmeye çalışıyorum; galiba okumak zevkli", "gözlerimi kapatıp okuldaki mekanları ve yerlerini tahmin etmeye çalışıyorum", "galiba beden eğitimi dersine katılacağım".

Okul Dışı Ortamda;

"insanlarla mesafemi zorlanmadan ayarlıyorum", "arkam dönükken diğer insanların hareketlerini tahmin etmeye çalışıyorum; bu bana oyun gibi geliyor; bunu evde ya da bindiğim taşıtlarda da kullanmaya çalıştım; bunun kendime iyi geldiğini düşünüyorum, bana iyi hissettiriyor", "yaratıcı dansın çevremi bu kadar hissetmemi sağlayacağına hiç inanmadım; ama şimdi girdiğim alanı bütünde hissediyorum", "kardeşime oyun anlatma becerim gelişti", artık galiba daha kolay yol tarif edebilirim gibi geliyor".

Yapılan görüşmede, öğrencilerin bedenlerini fark etmesi, imgelem/görselleştirme yapması, hayal kurması ve bunları derslerinde, günlük yaşamlarının farklı alanlarında kullanmalarına yönelik ifadeleri çalışmanın problemini desteklemektedir.

Tartışma ve Sonuç

Bu kısımda çalışmanın bulgularından elde sonuçlara ve bu sonuçların benzer çalışmalarla olan Bu çalışmanın verilerine göre, yaratıcı dans eğitiminin öğrencilerin uzamsal düşünme, zihinsel döndürmelerini geliştirdiği söylenebilir. Bu durum öğrencilerin deneyin başında uygulanan testten aldıkları puanların benzer iken deney sonunda uzamsal düşünme, zihinsel döndürmelerinden aldıkları test puanları arasında anlamlı bir artış olması ile açıklanabilir. Öğrencilerin bedenlerini fark ederek, yaptıkları hareketleri düşünmeleri ya da içlerinden geldiği gibi hareketi anlamlandırmaları, kendilerini kontrol etme, konsantrasyon ve odaklanma becerileri

(Gilbert, 1992; Reinhardt ve Stinson,, 1998; Tomporowski, 2003; Stroth, Hille, Spitzer ve Reinhardt, 2009; Jansen ve Pietsch, 2010), fiziksel alan, bireysel farklılıkların farkına varma (Von Rosseberg- Gempton, Dickinson ve Poole, 1999; Johnson ve Moore, 2020), mekânsal ilişki oluşturma (Logan, 1984; Hagendoorn, 2012; Johnson ve Moore, 2020) gibi yaratıcı dansın etkileri, öğrencilerin imgeleme ve hayal etme becerilerini geliştirerek zihinsel düşünme becerilerine destek verdiği biçiminde yorumlanabilir. Bu durumu öğrenci görüşleri de *"yaratıcı dansta bedenimi hissettim", "bedenimi ilk zamanlarda kullanmak zordu, sonrasında daha iyi kontrol ettim, "doğaçlama olması güzeldi", "yaratıcı dansta bedeni aşağı, yukarı, sağa ve sola döndürürken, nasıl yapacağımı düşünürken kendi bedenimi görselleştirdim; bu önce komik geldi ama şimdi kendi bedenimi fark etmek iyi geldi"* ifadeleri ile belirtmişlerdir. Öğrencilerin görüşleri alanda yapılan çalışmalarla da örtüşmektedir; yani yaratıcı dans ile kendi bedenlerinin farkındalıklarının arttığını, dikkat, ilgi ve kendilerini kontrol etme becerilerinin farklılaştığını belirtmişlerdir. Buna ek olarak yine öğrenciler, "*başkasının hareketlerini hissederek, zihnimde hayal ederek, bedenimi ayarlamak zordu, sonra bu bana oyun gibi geldi ve çok zevk aldım, zihnimde hayal ederek, tahmin etmek eğlenceliydi", "bazen küçük alanda dans etmem gerektiğinde, bedenimi kontrol edemeyeceğimi düşündüm, ama sonra alan ile bedenim arasında zamanla ilişki kurmayı öğrendim; bunu evde ya da bindiğim taşıtlarda da kullanmaya çalıştım; bunun kendime iyi geldiğini düşünüyorum, bana iyi hissettiriyor"* ifadeleri ile de beden-mekân ilişkisini kurdukları, mekân içindeki nesne ya da insanları hissederek, onların konum veya durumlarını zihinlerinde döndürdüklerini belirtmişlerdir. Bu durum, bireyin uzamsal düşünmesi açısından ele alındığında, nesneleri farklı bir bakış açısından görünebilecekleri gibi hayal etme durumu olarak ifade edilebilir. Aynı zamanda *zihinsel döndürme*, bir perspektiften görülen bir nesnenin, yeni bir perspektiften bakıldığında nasıl görüneceğini zihinde canlandırma becerisi olarak düşünüldüğünde (Johnson, Moore, 2020) öğrencilerin *"zihnimde hayal ettim"* ifadesini açıklamaktadır.

Araştırmanın yaratıcı dans ile uzamsal düşünme, zihinsel döndürme becerisinin zaman bakımından etkisine ilişkin bulgu deney ve kontrol gruplarında deneyin başında ve sonunda yapılan uzamsal düşünme, zihinsel döndürme ölçümleri arasında anlamlı fark bulunmuştur. Etkileşim etkisi ve basit ana etki analizleri sonuçları birlikte incelendiğinde, öğrencilerin yaratıcı dans eğitiminin onların uzamsal düşünme, zihinsel döndürmelerini geliştirdiği söylenebilir. Hecox, Levine ve Scott (1975), Chin (1988). Jansen, Pietsch (2010), Jola (2010), Stevens, Ginsborg, Lester (2011), Gunderson, Gerardo Ramirez, Beilock ve Levine (2013) alanda yaptıkları araştırmalarda hem dansta hem de uzamsal düşünme, zihinsel döndürme becerisinde mekansal farkındalık, beden temsili ve zaman algısının önemli olduğunu vurgulamışlardır.

Sonuç olarak ergenlik döneminde öğrenciler, hem sosyal, duygusal, fiziksel, hormonal gelişimlerinin olduğu bir süreçte hem de eğitim sisteminin getirisi olan sınavların, ödevlerin ve yoğun içeriklerin öğrenildiği dönemde bilişsel gelişimlerini desteklemek için öğretim programlarının hareket/dans temelli olarak yeniden tasarlanması ile öğrencilerin bütünsel gelişimlerine destek verecektir. Alana katkı sağlaması açısından ergenlerin gelişim özelliklerini desteklemek amaçlı nörobilim temelinde daha ayrıntılı çalışmalar yapılması önerilebilir. Böylece öğretim programlarının yapılandırılmasına, rehberlik programlarının yeniden gözden geçirilmesine ve aile içi etkileşime katkı sağlayabilir.