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Investigation of the Effect of Educational Games on Balance and Coordination in Children with Learning Disabilities

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Abstract

The purpose of this research is to contribute to the balance and coordination skills of these children by playing educational games for children diagnosed with learning disabilities, who are behind their peers in academic and social areas, have problems in learning basic academic skills, although there is no problem in their intelligence levels. Children with learning difficulties are behind in motor skills such as balance and coordination compared to their peers. This situation also negatively affects children's social communication skills. Considering all these negative situations, it is predicted that educational games can be beneficial for these children both physically and psychologically. A total of 6 students, 4 girls and 2 boys, residing in Kirsehir province, diagnosed with learning disability and continuing inclusive education, participated in this study. A total of 24 educational games compiled from various sources were applied to these students, 12 of which were for balance and 12 for coordination skills. In this study, a single group pretest-posttest experimental model was used. In the educational game applications, each session was planned as 40 minutes and by using the demonstration technique, it was ensured that the subjects played the educational games correctly and in accordance with its purpose. Lincoln Oseretsky Motor Development Test (LOMDT) and Motor Coordination Field Test (MCFT) were used to collect data on balance and coordination skills. In the study, data were collected with pre-test and post-test application. The data obtained as a result of the research were analyzed with the Statistical Package for the Social Sciences (SPSS) 22.00 package program and analyzed with the "Wilcoxon Signed Ranks" test. As a result of the research, it was revealed that the educational games applied positively contributed to the balance and general body coordination skills of our subjects with learning disabilities, but did not contribute to the hand-eye coordination. This thesis study gives a local result due to the small number of subjects and being conducted in a single province. By using this study as a pioneer in the field, more studies can be carried out by diversifying the educational games with more subjects.

Keywords: Learning disability; Educational games; Balance and coordination

Introduction

Learning disability was first discovered in 1896 by Dr. Morgan, and it was named "congenital word blindness". Morgan stated that 14-year-old Percy is a physiologically and psychologically healthy child like his peers, with no problems in his vision or intelligence, and that he has no problems in learning mathematics and is successful; on the other hand, he found that he had difficulty keeping written words conveyed to him visually in his memory and had difficulty reading the words. After this situation, he used the term "congenital word blindness". In the following period, including the years 1930-1940, it was called "Minimal brain damage" and after the 1960s, it began to be used as "Minimal brain dysfunction". In 1963, Samuel Kirk defined learning disabilities for the first time in the field of special education. In this definition, the child's intelligence level in Learning Disability (LD) is within normal parameters, neurologically based; it is stated that some problems in learning areas and social communication processes are a negative situation that can negatively affect the course of the individual in his future life. Learning Disability (LD) is defined in the Journal of Announcements organized by the Ministry of Education in Turkey as the negativities that occur in the individual's ability to express him and learn basic academic skills, even though his mental measurements are normal or above normal, when he does not have sensory, physiological, neuropsychological or sensory disabilities. This condition is mostly noticed in the primary school period and is defined as a cognitive disorder that causes the individual to fall behind his peers and negatively affect his life [1-4]. According to Diagnostic and Statistical Manual (DSM)-5, learning disabilities are conditions in which problems occur in the basic academic skills listed below:

- Mistakes in word pronunciation and slowness in reading,
- Difficulties in understanding the content of the text read,
- Problems in spelling words,
- Difficulty in written expression,
- Difficulties in perceiving numbers and performing mathematical operations,
- Reasoning problems in numerical and arithmetic terms.

It is defined as difficulties in learning and using basic school skills, where one or more of the academic difficulties listed above do not improve despite all efforts and last for at least six months. These problems cause adaptation problems to occur over time and cause the student to fall behind their peers academically [5].

However, LD is shown to be a common developmental and neurobiological problem of childhood; It is defined as a disorder that causes impairments in the functionality of one or more areas [6].

We can list the characteristics of individuals with LD, which Demir defines as a developmental disorder of neurological origin, as follows [2]:

- The intelligence level must be at least normal (IQ>85),
- There should be no mental health problems,
- Brain related tumor etc. The disease should not be one,
- Sensory organs must be healthy,
- There must be difficulty in verbal and written expression,
- There must be difficulty in learning mathematics,
- There must be problems in the areas of social interaction and communication,
- Despite standard education, success should not be achieved according to age and intelligence criteria.

When the literature was reviewed regarding LD, it was seen that there were many definitions and categorizations. One of the common characteristics of children with LD is that each of them has a unique way of learning. While a child has writing difficulty as well as reading difficulty; in the other, only arithmetic disorder may be present. For this reason, it is not possible to talk about a homogeneous group in LD due to the heterogeneous distribution within the group [7].

Problem

The learning process that is complementary to education; although it is a process in which the information we receive from our environment through our sensory organs is transferred first to short-term memory and then to permanent memory through repetition and factors that support learning, it seems that there are a number of factors that affect this process [8]. We can say that one of the most important of these factors is the learning disability problem that occurs in the individual due to prenatal or postnatal reasons. The concept of learning disability describes the difficulty experienced by the child in acquiring the ability to learn and use written and verbal language [9]. In addition, it is known that individuals with learning disabilities have problems with fine motor, gross motor and balance and understanding concepts. It is known that individuals whose motor skills do not develop also face problems in learning [10,11]. Based on the assertion that motor skills are a set of movements made depending on experience and learning, individuals with learning disabilities are among the situations that limit the individual as they are negatively affected psychologically and physiologically during the learning process. It can be said that it came [12,13]. It can be said that games are among the applications that will help eliminate this negative situation. Turkish Language Association defines the game as entertainment that develops intelligence and ability, has certain rules and helps to have a good time [14]. It can be said that learning, as put forward in this definition, is positively affected and developed by combining the game with the feeling of pleasure. In addition to giving pleasure, the game teaches to obey the rules, the child experiences being dependent on his opponents and the game rules in order to play the game correctly, and the game itself provides learning. Game methods used in education have taken their place in the literature under the title of educational games. In addition to allowing the child to spend quality time, educational games also help the child grow up healthy and acquire good habits [15]. It can be said that the contribution of educational games is undeniable in minimizing the impact of negative situations experienced by individuals with learning disabilities and increasing the benefits of positive effects on the individual.

Based on this fact, the purpose of this study was created by considering that the situation of children with learning difficulties will become more positive with the educational games they will play, depending on their age group and the degree of the negative situation they experience. Similar characteristics of the educational games to be used in the study and the students who will participate in the application were taken into consideration. In line with this purpose, the study will seek answers to the following problems and sub-problems.

The problem is that we can contribute to the development of balance and coordination skills of children who are behind their peers in terms of balance and coordination due to learning disabilities, through educational games.

Focus

In the literature review, it was seen that models were applied to support and increase the basic academic skills of children diagnosed with learning disabilities when looked at in a general framework within the support education activities and achievements implemented by the Ministry of National Education. Research has mostly been conducted to examine academic skills and the psycho-social situations of children and parents. In this context, it is of great importance to consider the psycho-motor development of children so that they can live as independent individuals.

However, studies show that the human body develops as a whole [16]. Game is a factor that acts as a bridge between the child and the real world. From this perspective, the more a child plays, the more he changes and develops [17]. The educational games applied in the study for motor skills increase the importance of the research as they will contribute to the development of children's different field skills such as cognitive, academic and language skills.

In this study, it is planned to create a model to improve the balance and coordination of children with learning disabilities through educational game applications and to enable them to become independent or less dependent individuals. The study is important in that it is the first practice-based study in the field of physical education and sports in Turkey. In this respect, it is thought that it will contribute to new studies and the field. It is also important that the compilation of the educational game activities used is easy for the parents of the children to implement. This study contributes to the field in terms of creating a new model in sports sciences and providing new gains (Figure 1).

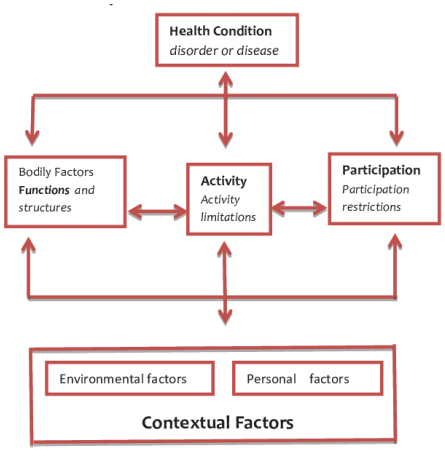

Figure 1: The ICF-CY model including constructs capturing functioning and disability.

Aim and research questions

The aim of this research is to examine the effect of educational games on balance and coordination skills, which are among the motor skill problems in children with learning disabilities. In this study, the aim of this study is to compile the games available in the field for children with learning disabilities and to reveal whether these educational games have an effect on the development of children's balance and coordination skills.

Methodology

General background

In this study, which examined the effects of these games on balance and coordination by playing purposeful educational games to students with LD studying in inclusive classes, a single-group pretest-posttest experimental design, one of the quantitative research methods, was used. In this design, measurements are either obtained from a single group or observations are made before and after the experimental application [18]. In this research model, the pre-test before the experimental application begins, and the application of the same test after the applications are completed is called the post-test [19]. Single-group pretest-posttest experimental design; It aims to observe the effect of the applied study on a single group [20].

Sample

The population of the research consists of children who received inclusive education at the primary school level in Kirsehir in the 2021-2022 academic years and were medically diagnosed with learning disabilities. Our sample consists of 6 students diagnosed with learning disabilities at a primary school in Kirsehir. In addition, Motor coordination field test and Lincoln Oseretzky Motor Development Test (LOKS KF 18) were used to determine the study group [10,21].

Considering the students included in the study, A1, a 3rd grade female student, and A5, a 3rd grade male student, were diagnosed when they started primary school. A2, a 4th grade female student, and A3, a 2nd grade female student were diagnosed when they started primary school. A4, a 4th grade male student, and A6, a 4th grade male student, were diagnosed when they started primary school. There is no physical condition that would prevent students from physically performing activities.

Instrument and procedures

The following tools and equipment were used throughout the research;

To evaluate gross and fine motor skills;

- Motor coordination field test [10].

To measure the psycho-motor development of children with learning disabilities, diagnosed with intellectual disabilities and normal children aged 1-13;

- Lincoln Oseretzky Motor Development Test (LOKS KF 18)' and the award prepared to be given to the participants [21].

To collect application reliability and inter observer reliability data;

- Video camera
- CD

To keep records of subject performance,

To be used in educational games;

- Jump rope
- Balloon
- Circle
- Soccer ball
- Handball ball
- Funnel
- Aquarius
- Ribbon
- Box
- Table
- Cushion
- Ping pong ball
- Slalom
- Jump obstacle

Data analysis

In this research, the demonstration technique was applied to the subjects, and the reaction times/distances of the subjects before and after the training were compared in order to gain balance and coordination skills. Wilcoxon Signed Rank test was used in data analysis. SPSS 22.0 package program was used to analyze the data. In statistical procedures, the significance level was taken as 0.05.

Results

Table 1 shows the pre-test and post-test data of the student coded as A1. Table 2 shows the pre-test and post-test data of the student coded as A2. Table 3 shows the pre-test and post-test data of the student coded as A3. Table 4 shows the pre-test and post-test data of the student coded as A4. Table 5 shows the pre-test and post-test data of the student coded as A5. Table 6 shows the pre-test and post-test data of the student coded as A6.

Variables	Pre-test data	Post-test data
Standing on one leg with eyes open	7 sec	11 sec
Standing on one leg with eyes closed	4 sec	6 sec
Ball throw	03-Mar	03-Mar
Ball catching	03-Mar	03-Mar
Walking backwards	159 cm	172 cm
Skipping rope	6	9
Don't touch the heels by jumping	3/0	03-Feb
Hopscotch	165 cm	180 cm

Table 1: A1 pre-test post-test data.

Variables	Pre-test data	Post-test data
Standing on one leg with eyes open	1 sec	2 sec
Standing on one leg with eyes closed	0 sec	0 sec
Ball throw	03-Feb	03-Mar
Ball catching	03-Feb	03-Mar
Walking backwards	45 cm	53 cm
Skipping rope	0	2
Don't touch the heels by jumping	3/0	03-Jan
Hopscotch	60 cm	79 cm

Table 2: A2 pre-test post-test data.

Variables	Pre-test data	Post-test data
Standing on one leg with eyes open	3 sec	3 sec
Standing on one leg with eyes closed	0 sec	2 sec
Ball throw	03-Mar	03-Mar
Ball catching	03-Mar	03-Mar
Walking backwards	52 cm	66 cm
Skipping rope	0	2
Touching the heels by jumping	3/0	03-Jan
Hopscotch	95 cm	118 cm

Table 3: A3 pre-test post-test data.

Variables	Pre-test data	Post-test data
Standing on one leg with eyes open	11 sec	14 sec
Standing on one leg with eyes closed	7 sec	9 sec
Ball throw	03-Mar	03-Mar
Ball catching	03-Mar	03-Mar
Walking backwards	179 cm	207 cm
Skipping rope	2	5
Touching the heels by jumping	03-Jan	03-Feb
Hopscotch	165 cm	198 cm

Table 4: A4 pre-test post-test data.

Variables	Pre-test data	Post-test data
Standing on one leg with eyes open	6 sec	9 sec
Standing on one leg with eyes closed	2 sec	3 sec
Ball throw	03-Mar	03-Mar
Ball catching	03-Mar	03-Mar
Walking backwards	172 cm	21 cm
Skipping rope	1	3
Touching the heels by jumping	03-Jan	03-Feb
Hopscotch	160 cm	175 cm

Table 5: A5 pre-test post-test data.

Variables	Pre-test data	Post-test data
Standing on one leg with eyes open	14 sec	18 sec
Standing on one leg with eyes closed	8 sec	11 sec
Ball throw	03-Mar	03-Mar
Ball catching	03-Mar	03-Mar
Walking backwards	195 cm	230 cm
Skipping rope	5	10
Touching the heels by jumping	03-Jan	03-Mar
Hopscotch	184 cm	246 cm

Table 6: A6 pre-test post-test data.

Table 7 shows the "Wilcoxon Signed Ranks" test results of the pretest-posttest score average of the parameters of standing on one leg with eyes open and standing on one leg with eyes closed, which are the parameters used in measuring the balance skills of the subjects. As a result of the research, a statistically significant difference was detected in the mean scores of the parameters used to measure the balance skills of the subjects ($p<0.05$).

In Table 8, ball throwing and ball catching parameters were used to measure the hand-eye coordination skills of the subjects. To analyze ball throwing and ball catching skills, pretest-posttest mean scores were compared with the "Wilcoxon Signed Ranks" test. As a result of the analysis, no statistically significant difference was detected ($p>0.05$).

In Table 9, the parameters of walking backwards, jumping rope, touching the heels by jumping and hopscotch were used to measure the general body coordination skills of the subjects. The "Wilcoxon Signed Ranks" test results of the pre-test-post-test score average of these parameters are shown. As a result of the analysis, a statistically significant difference was detected ($p<0.05$).

Variables	Pre-test and post-test	N	Rank average	Sum of rows	Z	P
Standing on one leg with eyes open pre-test pos-test	Negative rows	0	0,00	0,00	-	-
	Positive rows	5	3,00	15,00	-2,041	0,041
	Equal	01-Jan	-	-	-	-
	Total	06-Jan	-	-	-	-
Standing on one leg with eyes open pre-test pos-test	Negative rows	0	0,00	0,00	-	-
	Positive rows	5	3,00	15,00	-2,060	0,039
	Equal	01-Jan	-	-	-	-
	Total	6	-	-	-	-

Table 7: Wilcoxon signed rank test results of subjects' balance skills.

Variables	Pre-test and post-test	N	Rank average	Sum of rows	Z	P
Throwing ball	Negative Rows	0	0,00	0,00	-	-
	Positive Rows	1	1,00	1,00	-1,000	0,317
	Equal	05-Jan	-	-	-	-
	Total	06-Jan	-	-	-	-
Catching ball	Negative Rows	0	0,00	0,00	-	-
	Positive Rows	1	1,00	1,00	-1,000	0,317
	Equal	05-Jan	-	-	-	-
	Total	6	-	-	-	-

Table 8: Wilcoxon test results of subjects' hand-eye coordination skills.

Variables	Pre-test and post-test	N	Rank average	Sum of rows	Z	P
	Negative rows	0	0,00	0,00	-	-
	Positive rows	6	3,50	21,00	-2,201	0,028
Walking backwards	Equal	00-Jan	-	-	-	-
	Total	06-Jan	-	-	-	-
	Negative rows	0	0,00	0,00	-	-
	Positive rows	6	3,50	21,00	-2,232	0,026
Skipping rope	Equal	00-Jan	-	-	-	-
	Total	6	-	-	-	-
	Negative rows	0	0,00	0,00		
	Positive rows	6	3,50	21,00	-2,271	0,023
Touching the heels by jumping Walking backwards	Equal	0	-	-	-	-
	Total	6	-	-	-	-
	Negative rows	0	0,00	0,00	-	-
	Positive rows	6	3,50	21,00	-2,201	0,028
	Equal	0	-	-	-	-
	Total	6	-	-	-	-

Table 9: General body coordination skills wilcoxon marked rows-test results.

Discussion

In this study, six students diagnosed with learning disabilities were played educational games that required them to use balance and coordination skills, and it was examined whether these games were effective in the development of balance and coordination skills.

In the research, pre-test and post-test values of the parameters of standing on one leg with eyes open, standing on one leg with eyes closed, throwing a ball, holding a ball, walking backwards, jumping rope, touching the heels by jumping and hopscotch were taken. SPSS 22.0 package program was used to analyze the data and "Wilcoxon Signed Rank" test was applied for data analysis.

In addition, elements that were assumed to affect the internal validity of the research were taken under control. A number of precautions have been taken to control external factors, dependent and independent variables. And it is limited to differences arising only from the independent variable. The parents of the subjects were informed in detail about the educational games and practice sessions.

In addition, in order to minimize the effect of another factor, the maturation factor, the researcher divided a lesson into two and organized it as a 15-minute demonstration session and a 25-minute demonstration session.

All applications in this study were carried out in the empty meeting room of the primary school where the students attended and under the supervision of the researcher. Finally, to prevent the subjects from experiencing any attendance problems, the lesson were administered at the school the children attended.

As a result of the analysis, a statistically significant difference was detected in the mean scores of the pretest-posttest data collected from the subjects ($p<0.05$).

A significant difference was detected in the pretest-post test mean scores of the measurements used to measure balance skills including the parameters of waiting on one leg with eyes open, standing on one leg with eyes closed ($p<0.05$).

In the study on static and dynamic balance in children with LD, purposefully selected games were applied, and as a result of the application, it was revealed that there were positive improvements in the static and dynamic balance of the subjects [22]. This supports the hypothesis that balance skills can be improved in children with LD through educational games.

As a result of the analysis, no statistically significant difference was found in the pre-test and post-test score averages, which included the ball throwing and ball holding parameters, which were applied at the second test battery and measured hand-eye coordination skills ($p<0.05$).

The results obtained from the Movement Assessment Battery for Children (MABC) applied to children with LD; it has been revealed that children's performance in manual dexterity, ball skills and balance skills is lower than the norm values [23]. This study reveals that students diagnosed with LD have problems in balance and hand-eye coordination skills, and it does not support the study conducted in this regard. According to this study, it was observed that children diagnosed with learning disabilities did not have problems with their hand-eye coordination skills.

As a result of the analysis, a statistically significant difference was detected in the pre-test and post-test score averages, which included the parameters of walking backwards, jumping rope, touching the heels by jumping and hopscotch, which were applied as a post-test battery and measured general body coordination skills ($p<0.05$).

Research findings shows that 1) The subjects contributed to the development of balance and general body coordination skills thanks to the compiled educational games, 2) It did not make a positive contribution to the development of hand-eye coordination.

The findings obtained as a result of this research, which was conducted using educational games, showed that educational games had a positive effect on the balance and coordination skills of the six students diagnosed with learning disabilities who participated in the research. The findings obtained from studies conducted on children with typical development show that educational games contribute to the development of children's psycho-motor skills while also increasing their social skills among the results of the research [24-28].

Physical education and recreation practices are activities that contribute to children's psychosocial development, leisure skills and intellectual achievement, while physical activity can be used to improve the balance and coordination skills of children with special needs as well as in typically developing children [29,30]. Based on these studies, the basic principle is that movement repetition is necessary to improve balance and coordination skills in children. For this reason, educational games were used to make children repeat movements without losing motivation.

The use of educational games as activities that enable the positive development of children's motor functions in addition to the treatment of some disability situations; this study supports the idea that educational games can be used to improve balance and coordination skills in individuals with learning disabilities [31-33].

In addition, educational game studies conducted on special needs children with cerebral palsy, autism spectrum disorder, and trainable mental disabilities also reveal that educational games have positive effects on the development of psycho-motor skills [34-36]. In this context, the educational games program prepared for this purpose is consistent with other studies [37-42].

Conclusion

It has been revealed that sports skills such as balance, coordination, kinesthetic and movement speed can be improved in children with intellectual disabilities through games. In a study conducted on children with autism, it was stated that music and physical activity were used together and that there were positive developments in children's motor skills as a result of the applied activities. Based on these results, the positive results in educational games applied to children with LD support this study. It is of quality.

It has been observed that people who graduated from physical education and sports teaching and coaching departments think positively about educational games and include them in their lessons, while they are at a good level in terms of educational game playing skills, but they have deficiencies in taking risks.

Suggestions

The study can be repeated with individuals in other age groups diagnosed with learning disabilities.

By increasing the number of study subjects, the effects of educational games on balance and coordination skills can be examined in larger groups.

By conducting the study in different regions and provinces of Turkey, it can be transformed from a local study into a general study.

Games used as educational games can be diversified and the study can be repeated.

Individuals diagnosed with learning disabilities whose balance and coordination have been improved can be given exercise training aimed at this development.

The effects of these developments on academic success of individuals diagnosed with learning disabilities whose balance and coordination are improved can be examined.

In line with the results of the study, an educational game module can be created for children diagnosed with learning disabilities and support can be provided to teachers working at the primary school level and the families of these children.

According to the results of the study, a section on learning disabilities and educational games can be added to the content of the special education course module taught in sports science faculties of universities.

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