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Adapted Games for the Development of Gross Motor and Manipulative Skills of Primary School Children with Down Syndrome

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Research Article
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Abstract

Among the single-subject research models, the single-start, multiple-probe across-behavior model was used. The population of the research consists of children with down syndrome between the ages of six (6) and ten (10) living in Isparta. The sample of the research was created with two (2) children determined by simple random sampling method from among the families that constitute the population and agreed to participate in the research voluntarily. The research lasted seventeen (17) weeks in total. The children participating in the research were able to walk to the determined target in accordance with the tempo, to run to the determined target in accordance with the tempo, to walk between obstacles, to run through obstacles, to walk on a balance board, to jump from the step board to the ground with two feet, to jump from the ground to the step board with two feet, to reach the target with both hands. It is aimed to develop the skills of throwing the ball, throwing the ball to the target with the right hand, and throwing the ball to the target with the left hand. A behavior observation form was used to collect data. The data obtained at the end of the application was analyzed by showing it on a graph. The data obtained in the research were converted into line graphs. It was concluded that children learn simple movements faster than complex movements. It was concluded that the adapted game-based movement training program was effective in the development of psychomotor skills of children with Down syndrome.
Keywords: Down syndrom, Educational game, Education

İlkokul Çağındaki Down Sendromlu Çocukların Kaba Motor ve Manipülatif Becerilerinin Geliştirilmesinde Uyarlanmış Oyunlar

Öz

Tek denekli araştırma modellerinden tekli başlangıç, davranışlar arası çoklu yoklama modeli kullanılmıştır. Araştırmanın evrenini, Isparta ilinde yaşayan, altı (6) ile on (10) yaş aralığındaki down sendromlu çocuklar oluşturmaktadır. Araştırmanın örneklemi ise, evreni oluşturan ve araştırmaya gönüllü olarak katılmayı kabul eden ailelerin arasından basit tesadüfi örnekleme yöntemiyle belirlenen iki (2) çocuk ile oluşturulmuştur. Araştırma toplamda on yedi (17) hafta sürmüştür. Araştırmaya katılan çocukların, belirlenen hedefe tempoya uygun yürüme, belirlenen hedefe tempoya uygun koşma, engellerin arasından yürüme, engellerin arasından koşma, denge tahtası üzerinde yürüme, çift ayak ile step tahtasının üzerinden yere sıçrama, çift ayak ile yerden step tahtasının üzerine sıçrama, hedefe çift elle top atma, hedefe sağ el ile top atma, hedefe sol el ile top atma becerilerinin geliştirilmesi hedeflenmiştir. Verilerin toplanmasında davranış gözlem formu kullanılmıştır. Uygulama sonunda elde edilen veriler, grafik üzerinde gösterilerek analiz edilmiştir. Araştırmada elde edilen veriler çizgi grafiğe dönüştürülmüştür. Çocukların yaşı basit hareketleri karmaşık hareketlere göre daha çabuk öğrendikleri sonucuna varılmıştır. Uyarlanmış oyun temelli hareket eğitim programının down sendromlu çocukların psikomotor becerilerinin gelişiminde etkili olduğu sonucuna ulaşılmıştır.
Anahtar kelimeler: Down sendrom, Eğitsel oyun, Eğitim

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INTRODUCTION

Play is one of the most important tools through which we can observe children's development from every aspect. In addition to contributing to the development of children, games are also seen as an educational tool through which children spend their energy and interact with their peers. It is commonly recognized that games help children with normal development as well as those with Down syndrome, who are categorized as children with special needs, to advance their knowledge, abilities, and mental and physical capacities (Gözün-Kahraman and Kılınç, 2022).

Down Syndrome (DS) is one of the developmental disorders caused by chromosomal disorder (Sugimoto et al., 2016). Chromosome variations are the only distinguishing factor between individuals with Down syndrome and the ones without DS. These who have one more chromosome than the normal human being, have physical differences due to their extra chromosome. Children with DS show some deficits in psychomotor, cognitive and emotional domains. These deficiencies restrict DS children's daily living activities and their ability to learn and perform appropriate movements (Horvat et al., 2013). When the activities or physical activities of children with Down Syndrome are examined, it is known that they participate in or prefer different sports such as walking, swimming, bowling, dancing and team sports (Bardak et al., 2022; Gutiérrez-Vilahú et al., 2016; Pitteti et al., 2012; Popa and Galeru, 2012).

Children with DS may experience delays in motor development and other areas. It is known that motor development in these children requires twice the time required by an average normal child. Children with DS acquire gross motor skills at different ages than typically developing children, and as the skills become more complex, the difference in the process of acquiring the skills increases (Pereira et al., 2013). As it is known, gross motor skills include skills such as walking, running, jumping, etc. performed by large muscle groups. In addition, it is known that there are skills such as hitting a stationary ball, bouncing the ball, catching, throwing and rolling the ball, which are known as manipulative skills (Breckenridge and Vincet, 1955; Davis, 1984; Davis and Burton, 1991; Gallahue, 1996; Wickstrom, 1977). Children with DS enjoy physical activities and participate in them more easily; it has been revealed that those with poor motor skills and lack of coordination are less interested in physical activity (Barr and Shields, 2011). It is known that he willingly participates in such game activities, the most important of which is games. Normally, when a child starts playing with other children, he compares himself and begins to see his own strengths and weaknesses. He tries to compare himself with others during games. He realizes his adequacy and deficiencies (Aracı, 1999).

In terms of the physical development of DS children through games, as well as the development of their gross motor skills and manipulative skills, games adapted to these features can help DS children develop social adaptation and skills. When the literature is examined, it is thought that more studies on sports activities in children with Down syndrome (Ilkım et al., 2018; Uğur-Mutlu and Haşıl-Korkmaz, 2021) are necessary. There are not many studies on adapted games for children with Down syndrome. In line with all this information, this study aimed to determine whether there are differences in the skill levels of primary school children with Down syndrome who regularly participate in adapted games in the development of their gross motor and manipulative skills.

MATERIAL AND METHODS

Research Model

Among the single-subject research models, the single-start, multiple-probe across-behavior model was used. In the multiple probe model between behaviors with a single initial probe phase, it is a research model in which measurements are made throughout the study in order to follow the same behavior after a measurement is made about the target behavior before the study (Karasar, 2022; Özdamar, 2003; Sarı, 2015; Şata 2020).

Research Group

The population of the research consists of children with Down syndrome between the ages of six (6) and ten (10) living in Isparta. The sample for the research was created with two (2) children determined by simple random sampling method from among the families that constitute the population and agreed to participate in the research voluntarily. Written consent was obtained from the children's families to provide educational game activities to the selected children.

Procedures

The research lasted seventeen (17) weeks in total, including one (1) week of observation and sixteen (16) weeks of application. During the research, the same educational game program was applied to both (2) children. The children participating in the research were able to walk to the determined target in accordance with the tempo, to run to the determined target in accordance with the tempo, to walk through obstacles, to run through obstacles, to walk on a balance board, to jump from the step board to the ground with two feet, to jump from the ground to the step board with two feet, to reach the target with both hands. It is aimed to develop the skills of throwing the ball, throwing the ball to the target with the right hand, and throwing the ball to the target with the left hand. While teaching these skills, a program prepared in educational game format was applied.

Ethical Approval

Ethics committee approval was received for this study from SDU Faculty of Medicine Clinical Research Ethics Committee (E- 87432956-050.99-621066, Date:07.11.2023).

Data Collection Tools

A behavior observation form was used to collect data. It is used if the aim is to increase or decrease the number of a behavior. Behavior must have a clear beginning and end. In this type of recording, the observer counts the number of times the behavior occurred during the specified observation time (Vuran, 2017).

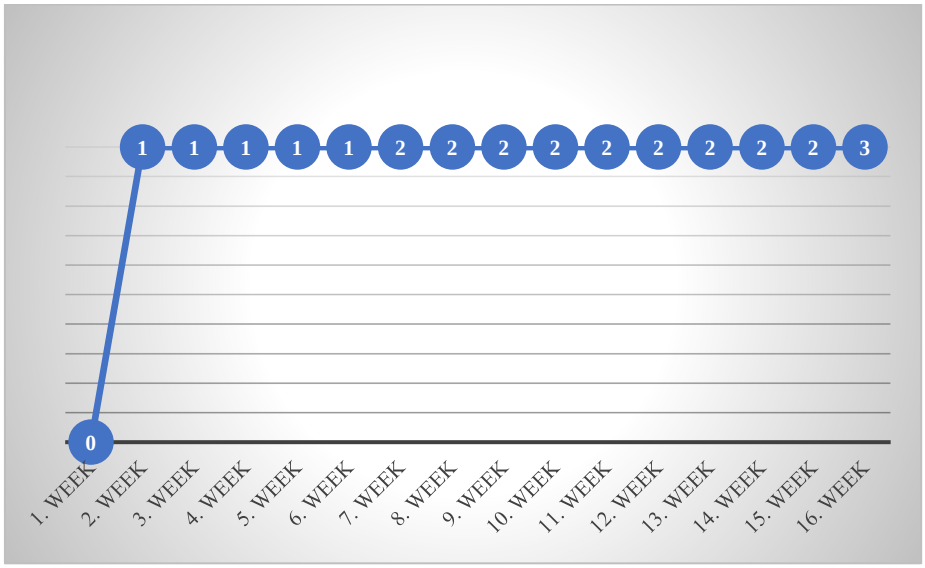
Analysis of Data

The data obtained at the end of the application was analyzed by showing it on a graph. Since the number of participants in the research was two (2), the data obtained during the sixteen (16) week period was converted into point scores in accordance with the scale protocol and turned into a line graph to reveal the change (Özdamar, 2013).

FINDINGS

This section includes the reporting of the data obtained from the education program applied to the children participating in the research in the form of graphic analysis. In order to respect personal rights, the children's names and surnames are not clearly written. Children were coded as Participant 1, Participant 2.

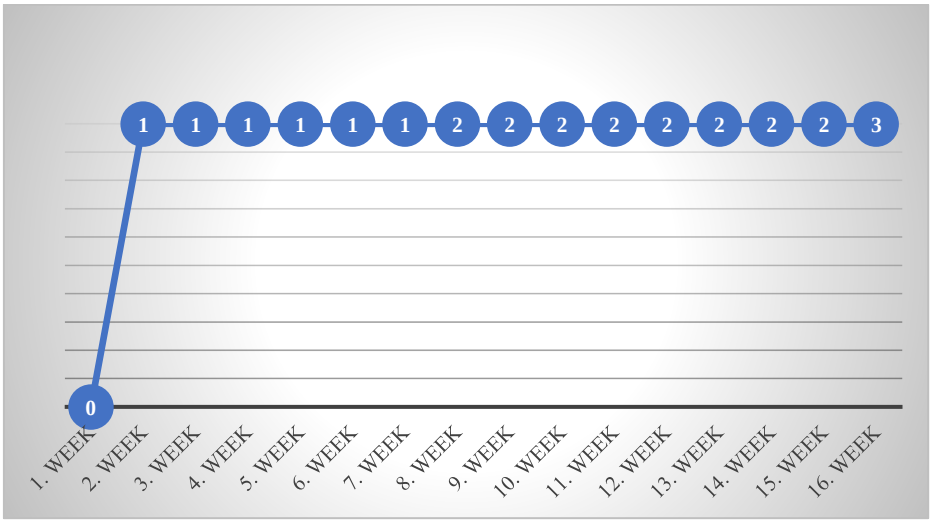
Analysis results of the first participant child



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 1. Walks in accordance with the tempo between the determined target(10m)

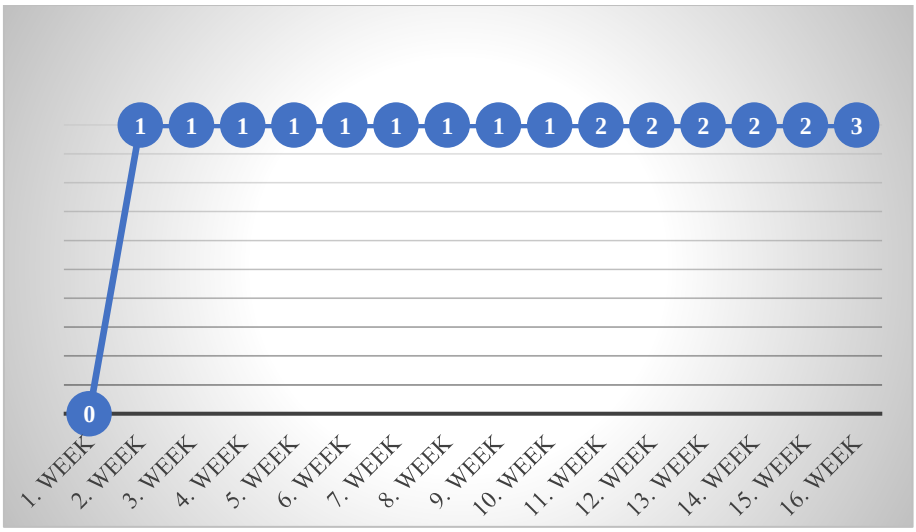
Looking at the results in Figure 1, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and sixth weeks, the child could perform the same movement as desired with physical assistance. Between the seventh and fifteenth weeks, it was observed that he could do the movement with the help of a model. In the sixteenth week, it was observed that the child could perform the movement independently and as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 2. Runs according to the tempo between the determined target(10m)

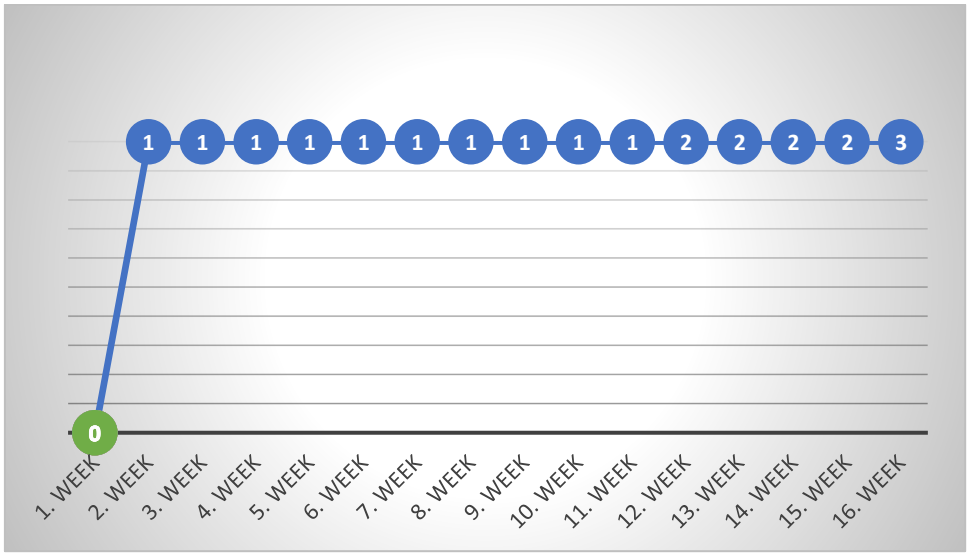
Looking at the results in Figure 2, it was seen that the child could not perform the skill requested from him in the first week in the desired way. In the second and seventh weeks, it was observed that the same movement could be performed as desired with physical assistance. Between the eighth and fifteenth weeks, it was observed that he could do the movement with the help of a model. At the sixteenth week, it was observed that the child could perform the movement independently as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 3. Walks through obstacles (5 obstacles)

Looking at the results in Figure 3, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and tenth weeks, the same movement could be performed as desired with physical assistance. It was observed that the child could perform the movement with the help of a model between the eleventh and fifteenth weeks. At the sixteenth week, it was observed that the child could perform the movement independently as desired when given a command.

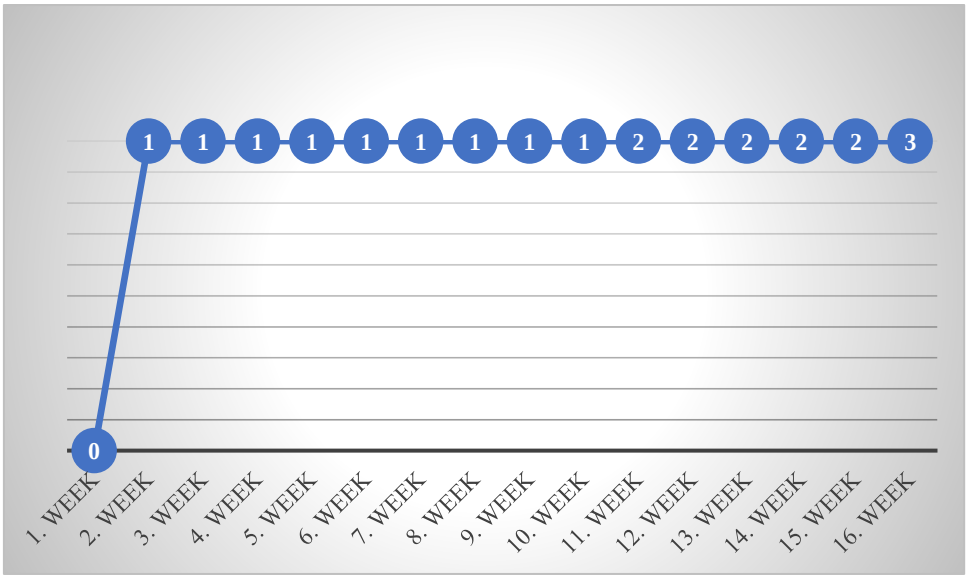


1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 4. Runs through obstacles (5 obstacles)

Looking at the results in Figure 4, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and eleventh weeks, the child could perform the same movement as desired with physical assistance. It was observed

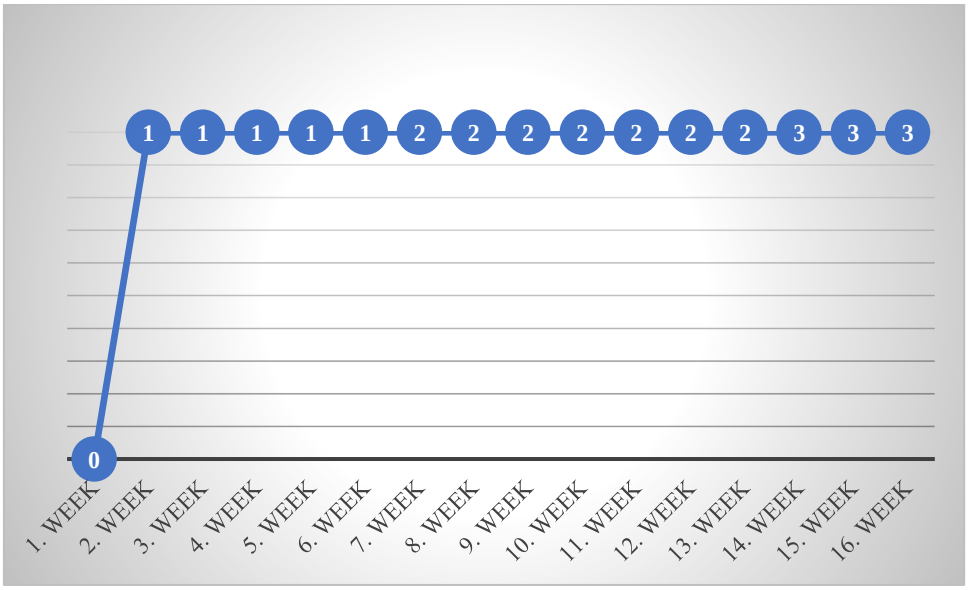
that the child could perform the movement with the help of a model between the eleventh and fifteenth weeks. At the sixteenth week, it was observed that the child could perform the movement independently as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 5. Walks on balance board (10cm width, 3m length)

Looking at the results in Figure 5, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and tenth weeks, the child could perform the same movement as desired with physical assistance. Between the eleventh and fifteenth weeks, it was observed that he could do the movement with the help of a model. At the sixteenth week, it was observed that the child could perform the movement independently as desired when given a command.

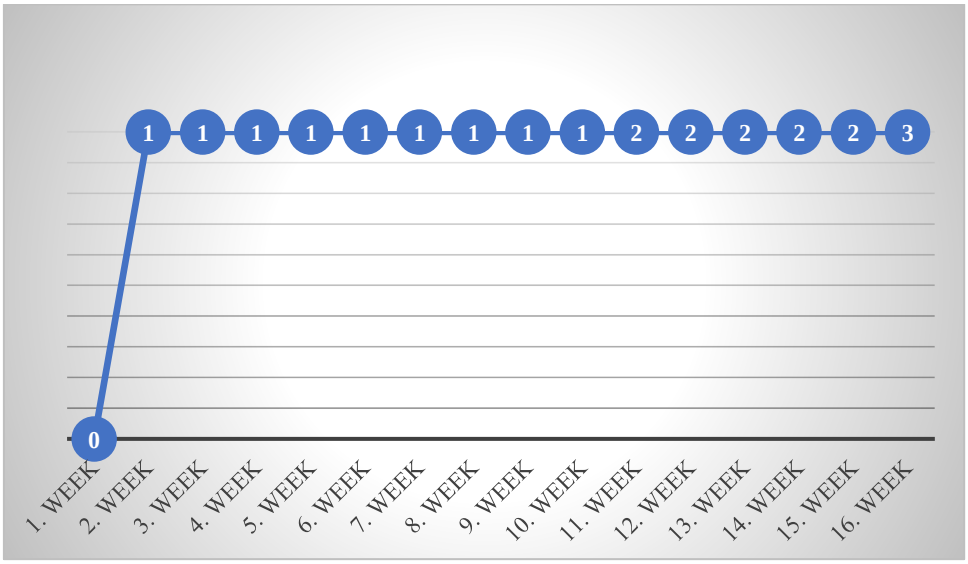


1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 6. Double foot jumps over the step board to the ground (10cm high)

Looking at the results in Figure 6, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and sixth weeks, the

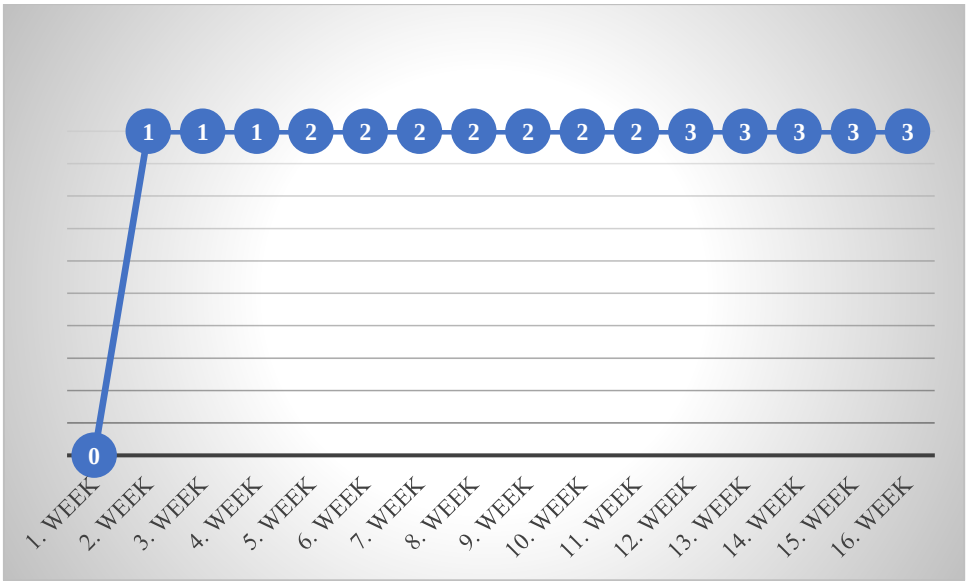
child could perform the same movement as desired with physical assistance. Between the seventh and thirteenth weeks, it was observed that he could do the movement with the help of a model. Between the fourteenth and sixteenth weeks, it was observed that the child could perform the movement independently when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 7. Double feet jump from the ground onto the step board (10cm high)

Looking at the results in Figure 7, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that the child could perform the same movement as desired with physical assistance in the second and tenth weeks. Between the eleventh and fifteenth weeks, it was observed that he could do the movement with the help of a model. At the sixteenth week, it was observed that the child could perform the movement independently as desired when given a command.

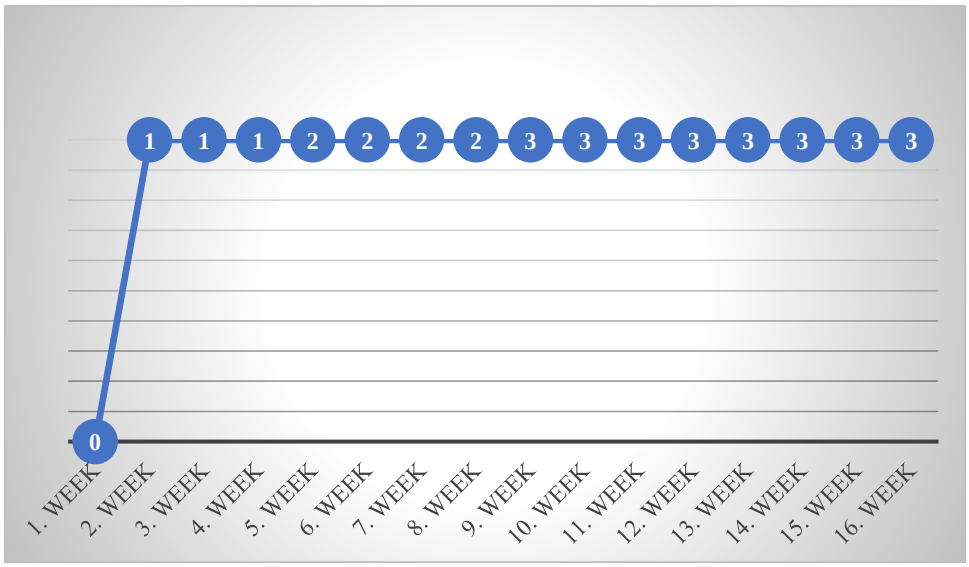


1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 8. Throwing a ball to the target with two hands (3m distance)

Looking at the results in Figure 8, it was seen that the child could not perform the skill requested in the first week in the desired way. In the second and fourth weeks, it was observed that the same movement could be performed as desired with physical assistance. It was observed that

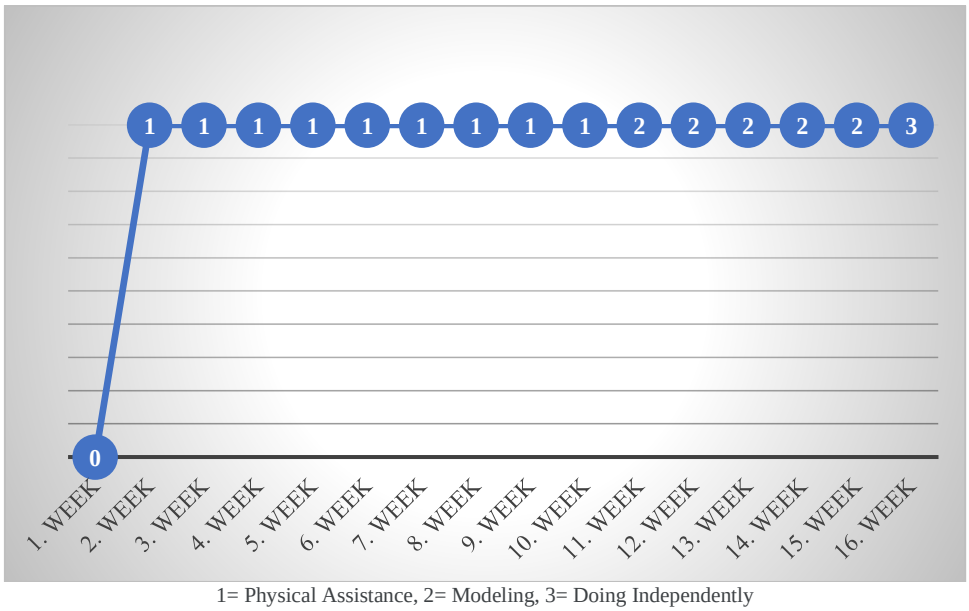
the child could perform the movement with the help of a model between the fifth and eleventh weeks. In the twelfth to sixteenth weeks, it was observed that the child could perform the movement independently when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 9. Throwing the ball to the target with right hand (3m distance)

Looking at the results in Figure 9, it was seen that the child could not perform the skill requested in the first week in the desired way. In the second and fourth weeks, it was observed that the same movement could be performed as desired with physical assistance. It was observed that the child could perform the movement with the help of a model between the fifth and eighth weeks. Between the ninth and sixteenth weeks, it was observed that the child could independently perform the movement as desired when given a command.



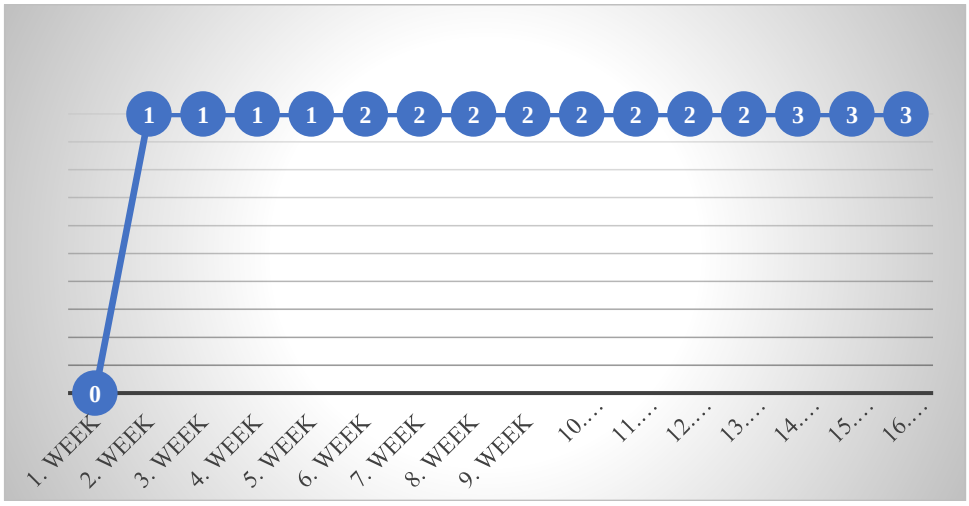
1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 10. Throwing the ball to the target with left hand (3m distance)

Looking at the results in Figure 10, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and tenth weeks, the same movement could be performed as desired with physical assistance. Between the eleventh and fifteenth weeks, it was observed that he could do the movement with the help

of a model. At the sixteenth week, it was observed that the child could perform the movement independently as desired when given a command.

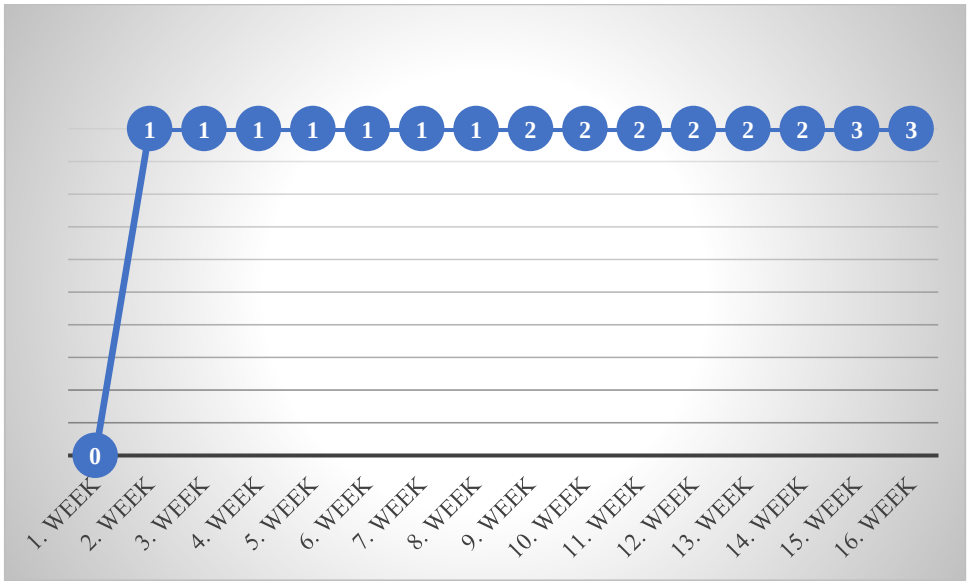
Analysis results of the second participant child



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 11. Walks in accordance with the tempo between the determined target (10m)

Looking at the results in Figure 1, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and fifth weeks, he could perform the same movement as desired with physical assistance. Between the seventh and thirteenth weeks, it was observed that he could do the movement with the help of a model. In the fourteenth to sixteenth weeks, it was observed that the child could perform the movement independently and as desired when given a command.

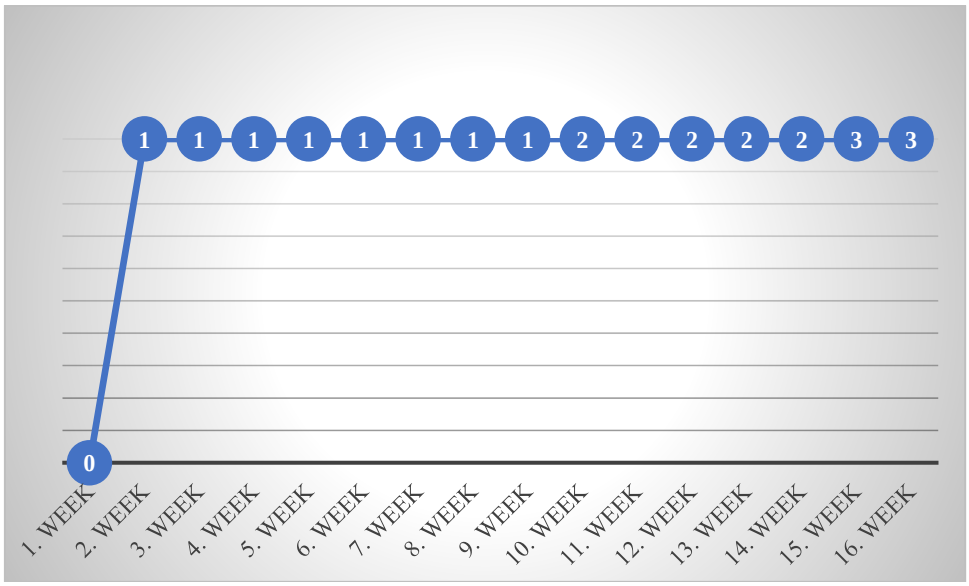


1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 12. Runs according to the tempo between the determined target (10m)

Looking at the results in Figure 2, it was seen that the child could not perform the skill requested from him in the first week in the desired way. It was observed that in the second and eighth weeks, he could perform the same movement as desired with physical assistance. Between the ninth and fourteenth weeks, it was observed that he could do the movement with the help of a

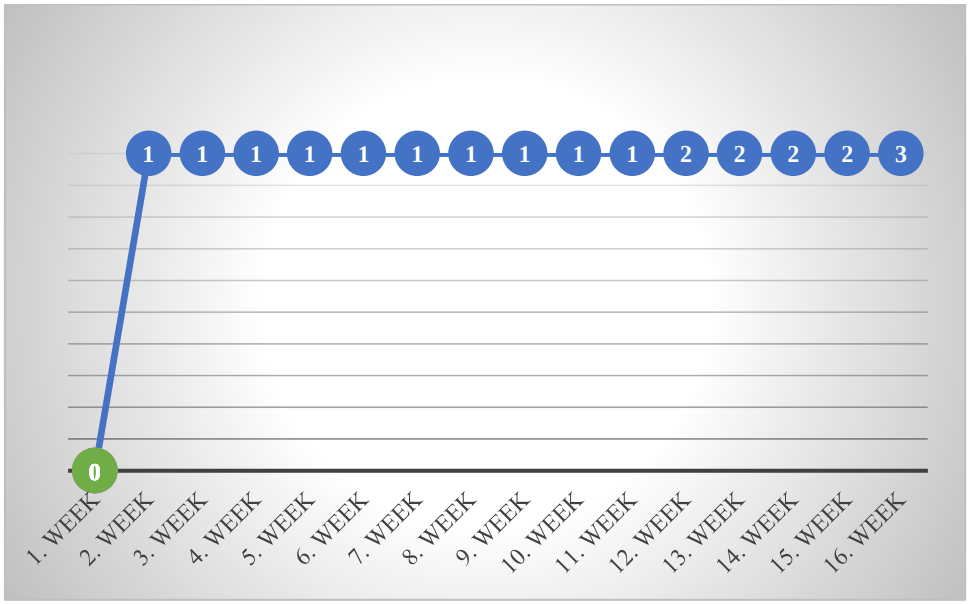
model. In the fifteenth and sixteenth weeks, it was observed that the child could perform the movement independently and as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 13: Walks through obstacles (5 pieces)

Looking at the results in Figure 3, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and ninth weeks he could perform the same movement as desired with physical assistance. Between the tenth and fourteenth weeks, it was observed that he could do the movement with the help of a model. In the fifteenth and sixteenth weeks, it was observed that the child could perform the movement independently and as desired when given a command.

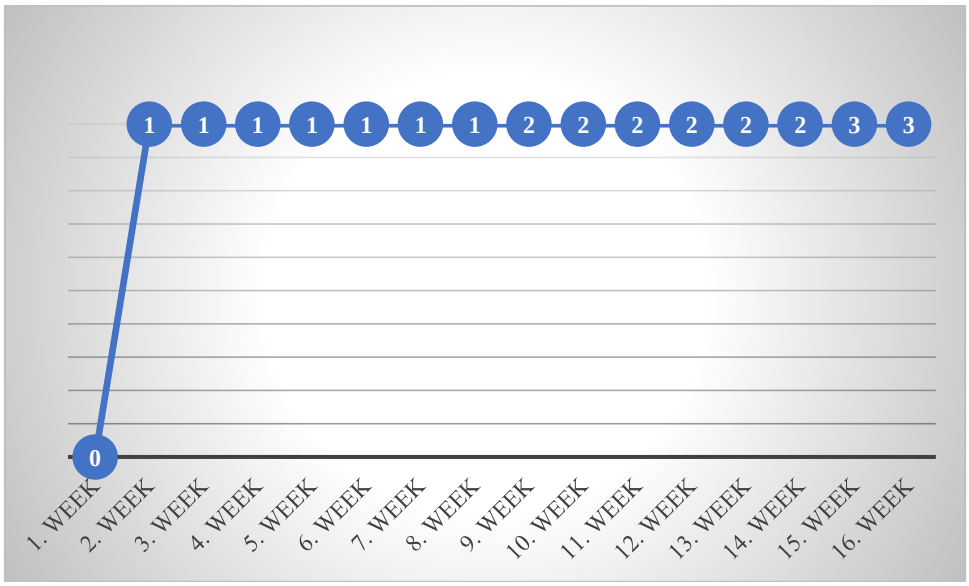


1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 14. Runs through obstacles (5 obstacles)

Looking at the results in Figure 4, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and eleventh weeks he could perform the same movement as desired with physical assistance. Between the twelfth and fifteenth weeks, it was observed that he could do the movement with the help of a model.

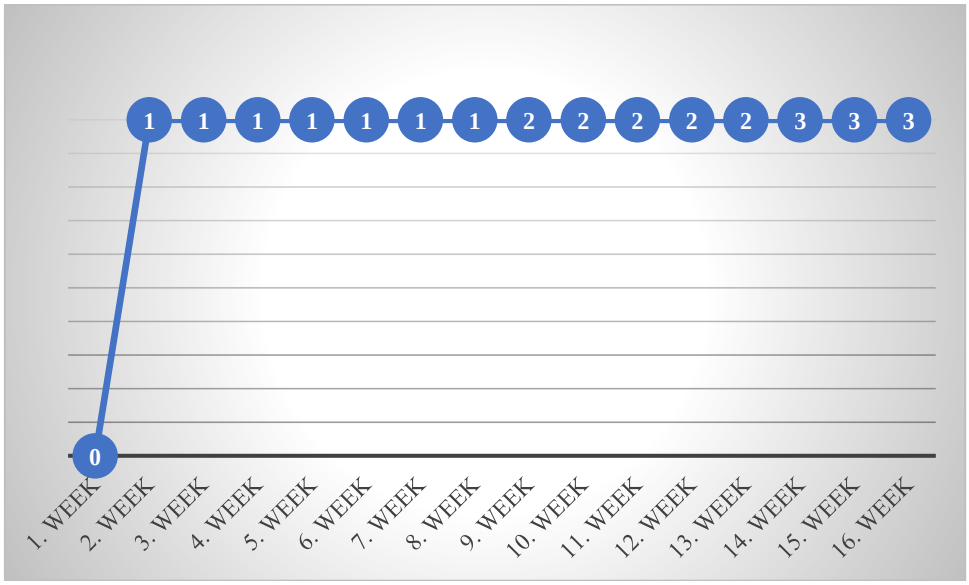
In the sixteenth week, it was observed that the child could perform the movement independently and as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 15. Walks on obstacle board (10cm wide)

Looking at the results in Figure 5, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and eighth weeks, he could perform the same movement as desired with physical assistance. Between the ninth and fourteenth weeks, it was observed that he could do the movement with the help of a model. In the fifteenth and sixteenth weeks, it was observed that the child could perform the movement independently and as desired when given a command.

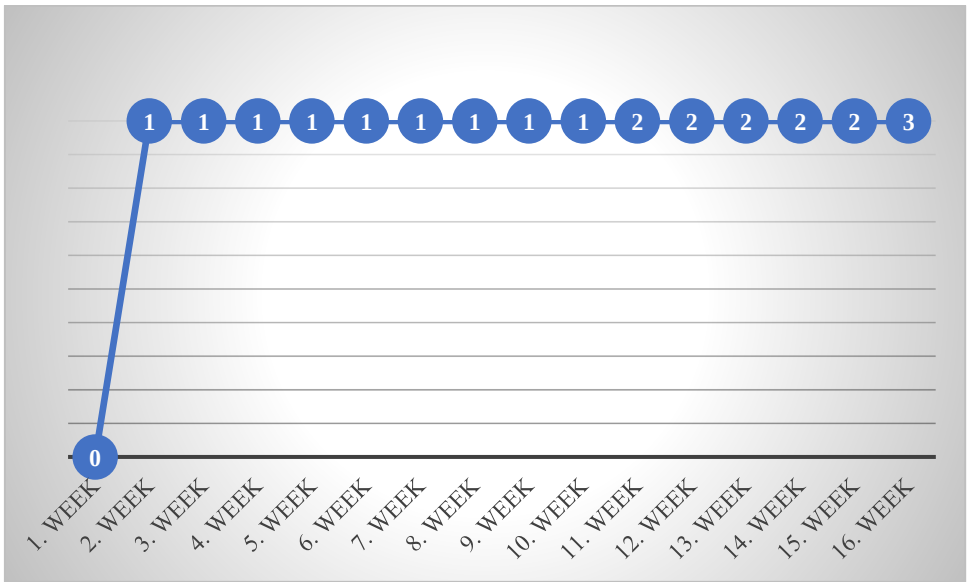


1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 16. Bounce from the double footstep board to the ground (10cm high)

Looking at the results in Figure 6, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and eighth weeks, he could perform the same movement as desired with physical assistance. Between the ninth and thirteenth weeks, it was observed that he could do the movement with the help of a model. In

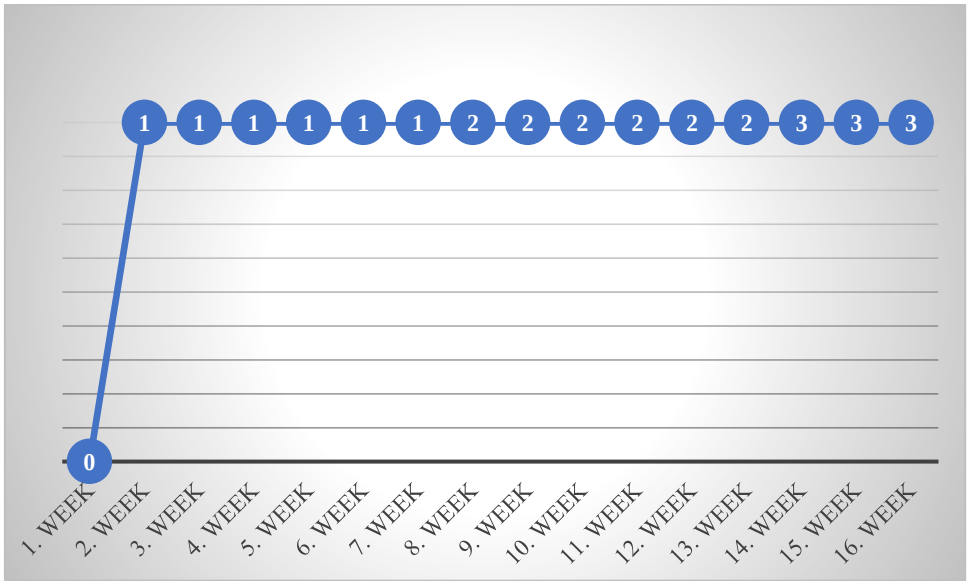
the fourteenth and sixteenth weeks, it was observed that the child could perform the movement independently and as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 17. Bounce from the double footstep board to the ground (10cm high)

Looking at the results in Figure 7, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and tenth weeks he could perform the same movement as desired with physical assistance. Between the eleventh and fifteenth weeks, it was observed that he could do the movement with the help of a model. At the sixteenth week, it was observed that the child could perform the movement independently and as desired when given a command.

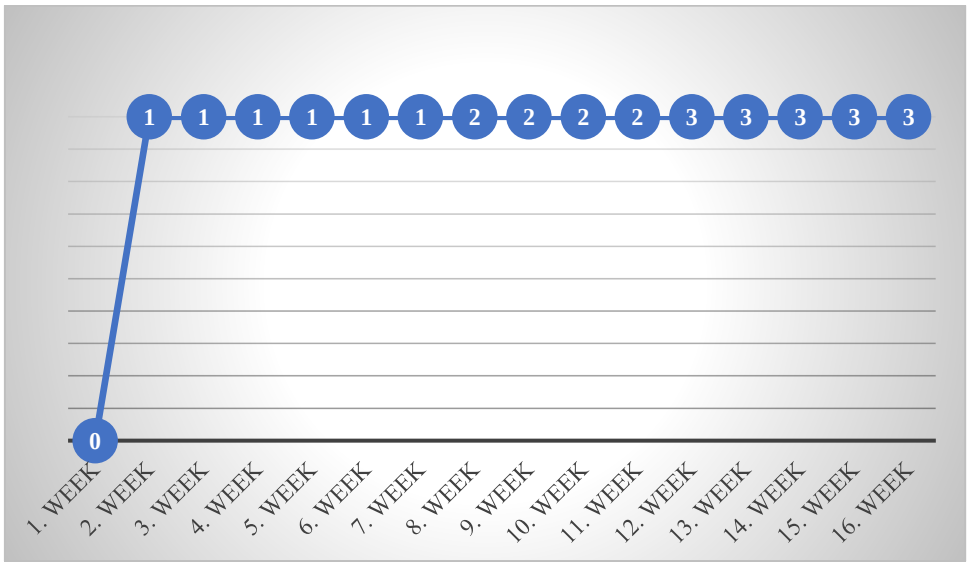


1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 18. Throwing a ball to the target with two hands (3m distance)

Looking at the results in Figure 8, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and seventh weeks, he could perform the same movement as desired with physical assistance. Between the eighth and thirteenth weeks, it was observed that he could do the movement with the help of a model. In

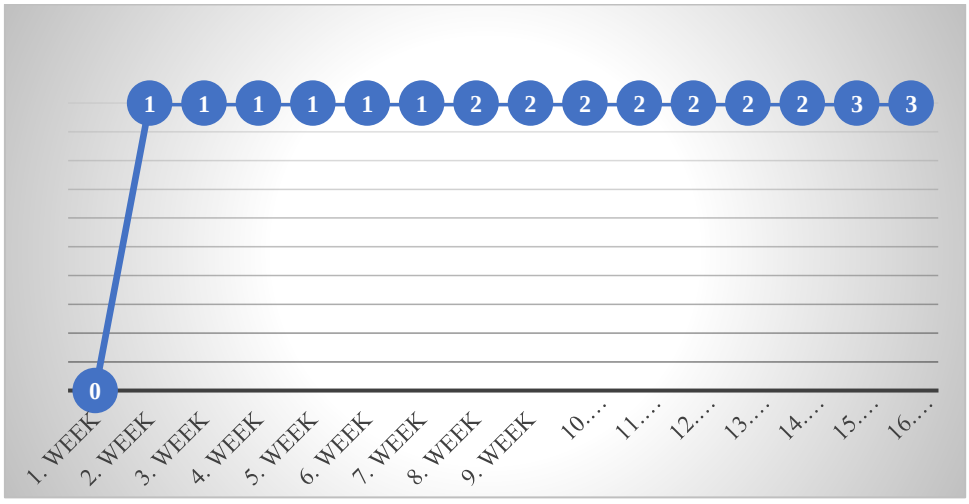
the fourteenth and sixteenth weeks, it was observed that the child could perform the movement independently and as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 19. Throwing the ball to the target with right hand (3m distance)

Looking at the results in Figure 9, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and seventh weeks, he could perform the same movement as desired with physical assistance. Between the eighth and eleventh weeks, it was observed that he could do the movement with the help of a model. In the twelfth and sixteenth weeks, it was observed that the child could perform the movement independently and as desired when given a command.



1= Physical Assistance, 2= Modeling, 3= Doing Independently

Figure 20. Throwing the ball to the target with left hand (3m distance)

Looking at the results in Figure 10, it was seen that the child could not perform the skill requested in the first week in the desired way. It was observed that in the second and seventh weeks, he could perform the same movement as desired with physical assistance. Between the eighth and fourteenth weeks, it was observed that he could do the movement with the help of a model. In the fifteenth and sixteenth weeks, it was observed that the child could make the movement independently and as desired when given a command.

DISCUSSION

When the results obtained from the research were evaluated, it was determined that both children were inadequate in exhibiting the motor skills required from them at first. As the study continued, it was observed that they were able to perform the skills gradually. It has been observed that activities prepared and implemented in accordance with children's developmental levels are effective in the development of children's motor skills. It was determined that as the level of movements became more difficult for both children, there was also a difference in the time it took to perform the movements independently. In other words, while they were able to perform easy movements independently in a shorter time, it was observed that the time to perform more difficult movements independently increased. When the research findings are examined, it has been determined that the independent performance of movement skills that require strength, balance, speed and coordination is longer. Based on all these findings, it can be said that play activities prepared according to the development levels of children influence the development of motor skills of children with Down syndrome.

Considering the results of the studies obtained in the literature review, it is reported that people with Down syndrome are behind their peers with and without special needs, especially in motor skills, and that their participation in sports is extremely important for the development of their motor skills (Boer, 2023; Cai and Baek, 2022). In Nalbant's (2011), doctoral thesis study on people with Down syndrome, he concluded that there was a continuous increase in the locomotor skills of individuals with Down syndrome who participated in a physical activity program during the fourteen-week period. As a result of Şenlik's (2017), study with children with Down syndrome, it was determined that physical education lessons had positive effects on both the motor skills and psychological adaptation levels of children with Down syndrome. In the study conducted by Karabürk (2019), it was concluded that sports training applied with the traditional method could improve balance in 6 weeks in children with Down syndrome in the similar age group.

As a result of the study conducted by Mirze (2020), it was determined that the program of adapted physical education and game activities applied for 16 weeks had a positive effect on the physical fitness and motor skills of individuals with Down syndrome. As a result of Uzuner's (2016) study, children with Down syndrome are slower than their peers in terms of fine motor skills, strength and agility, balance, and motor skill levels including upper, lower extremity and manual coordination, and therefore children with down syndrome should be treated as early as possible. It has been determined that including physical activities that will improve motor skills is important in the development of motor skills. As a result of his study, Demir (2021), found that the motor skills of children with Down syndrome can be improved through physical exercises. As a result of Yana's (2021), study, she found that sensory integration exercises have a positive contribution to the development of motor skills of children with Down syndrome. As a result of his study, Özata (2023,) determined that physical activities are important in developing the balance, coordination and motor skills of children with Down syndrome. In the study conducted by Çoban (2019), it was reported that exercise caused changes in individuals' skills such as balance, focus, and attention. As a result of the research conducted by Kulak et al. (2011), and Covain et al. (2023), they reported that physical activities contribute to the development of balance, flexibility, and speed skills.

CONCLUSION

While children could not independently perform the desired behaviors before starting the training, it was observed that when the children were given the opportunity to repeat the activities prepared and implemented in accordance with their developmental levels with intermittent repetitions, they were able to perform the desired movements independently and showed improvement. It was also determined that the children's age contributed to the ease of movement on the materials consisting of large surface floors and learning. It was concluded that children learn simple movements faster than complex movements. It has been observed that children can use these sides better because their right side is dominant. It was concluded that the adapted game-based movement training program was effective in the development of psychomotor skills such as walking, running, jumping and throwing for children with mild Down syndrome.

RECOMMENDATIONS

Nowadays, when the importance of doing game-based activities is increasing, different studies can be carried out by involving different disciplines on how sports skill performance can be increased to a higher level, as well as being effective in the motor skill development of individuals, especially in childhood.

Conflict of Interest: There are no personal or financial conflicts of interest among the authors regarding the scope of the study.

Authors' Contribution: Study Design; HA, EÇ –Data Collection; HA, EÇ –Statistical analysis; HA –Manuscript Preparation; HA, EÇ.

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