Does Computer-Aided Distance Education Affect the Science Development of Special Needs Students?

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Abstract
During the COVID-19 pandemic, educators reported that the most affected group in distance education was special needs students. Educators also provided critical reports stating that special needs students miss or fail to understand activities in online education. The reason for this issue can be the lack of access to resources, the inability to benefit from resources, or the difficulty in following practices. This research was designed to investigate the effect of online implementation on students with special needs in science classrooms. For this purpose, a four-week online education was conducted by selecting a special needs 7th-grade student with mild intellectual disability. Before and after the implementation, an achievement test and an attitude scale were utilized to examine the academic success of the student and her attitudes towards science courses. As a result of the online intervention, it was observed that there was an enhancement in the student's attitude and academic success. Providing remote one-on-one support can offer contributions to the development of special needs students.

Keywords: COVID-19, Inclusion Student, Mild Intellectual Disability Student, Distance Education

Introduction

In line with the developments in the world, it has become increasingly common for special needs students (SNS) to receive education with their normal peers (Batu et al., 2004) by rights such as providing equal opportunities to each individual in education, and benefiting from health and transportation services (Cankaya & Korkmaz, 2012; Sart et al., 2004). Interest in inclusive practices in schools in developed countries continues to increase day by day. The basis of the regulations made for students with special needs in the member states of the European Union and Turkey has been carried out within the framework of the principle of inclusion/integration rather than separation (Sevim & Atasoy, 2020). In this respect, one of the best ways to apply equal opportunity in education to students with special needs is "Inclusive Education Practices" in regular classrooms (Balçın & Yıldırım; 2021; Cankaya & Korkmaz, 2012; Uzunoğlu & Denizli, 2017). Identifying the educational needs of individuals with special needs by taking into account their needs and what they can do is essential because each individual is unique. Students diagnosed with SNS are increasingly placed in inclusive classrooms with their peers receiving regular education (McLeskey, 2007). Today, students with SNS are subjected to inclusive education at a higher rate than any other student group in special education (Gargiulo & Metcalf, 2010). Learning difficulties are defined as difficulties in performing academically in school at a level identified as appropriate for students' age groups (e.g., UK Public General Act, 2014, Chapter 20) or accordingly defined as "significant, extensive, and long-lasting disability" (Kim & Fienup, 2021; OECD, 2007). Thus, general learning difficulties include students with general difficulties in learning that affect their performance in almost all school subjects. An IQ score between 50 and 90, slightly below average, is often used as an additional diagnostic criterion for SNS beyond general limitations in learning on a variety of subjects, but precise IQ thresholds differ among countries (OECD, 2007). An IQ score between 55 and 70 is called a mild intellectual disability (Krämer et al., 2021).

Children with learning disabilities are children who have a disability in one or more of the psychological processes in speaking, reading, writing, listening, or solving mathematical problems and using oral language (Battal, 2007). Since this study's focus is on a student with mild intellectual disability who has learning difficulties and receives education within the scope of inclusion, it is thought that it would play a complementary role in the integration of individuals with special needs into society, gaining independent living skills, and successfully conducting inclusion programs (Orel et al., 2004).

Since SNS are the most affected group in education during the pandemic (COVID-19) period, providing distance support to these students is critical. It has been observed that these students, who received distance education with their peers during the pandemic period, could not benefit enough in lessons. During the face-to-face education period, SNS received help in support rooms for science courses, but they could not benefit from this support during the COVID-19 period. This study was planned to provide remote support to students with special needs to overcome this deprivation. It can also be thought that such an immersion is vital in terms of the principle of social justice and making students with special needs scientifically literate (Ebenezer, 2013).

Previous studies showed that science education has an important place in the education of students with mild intellectual disabilites (Cawley, 1994; Kocadağ, 2009; Mastropieri & Scruggs, 1994; Patton, 1995). In their study, Scruggs and Mastropieri (1996) stated that students with mild intellectual disabilities were able to learn the applied science curriculum by using educational materials. Applied science education is effective in developing some skills such as thinking and problem solving in students with mild intellectual disabilities (Woodward, 1994). In addition, science is also vital in terms of teaching how to do things that require basic skills (Çevik, 2016). Applied science education has a positive effect on students with mild intellectual disabilities (Bay et al., 1992; Dalton et al., 1997; McCarthy, 2005). Some critical scientific institutions in the United States also state that applied science learning has a significant effect on students' permanent learning (Rutherford & Ahlgren, 1990). Science education, which has such significant outputs, is gaining more importance today and science education programs are frequently revised in line with the requirements of the age in order to reach the desired goals.

In recent years, technological tools as teaching materials have been actively included in educational environments and studies have been conducted to examine possible effects of technology use. Researchers emphasized that the use of technology can support the learning processes of students with and without special needs (Drigas & Ioannidou, 2013; King-Sears & Evmenova, 2007). In addition, there are studies highlighting the significance of technology integration into special education (Chang et al., 2011; Lin et al., 2008) and that the use of technology would positively affect students' academic achievement (Blackhurst, 2005).

The use of technology in special education is common and different technologies have been used to meet the different needs of people with special needs to eliminate problems they face and make them more independent and competent. However, the used technologies have changed over time by keeping up with developments and offered more effective solutions to problems experienced by individuals with special needs (Coklar et al., 2018; Doğan & Delialioğlu, 2020). When conducted studies on learning disabilities in recent years are examined, it is possible to see studies in which high-level technologies are frequently used (Ciullo et al., 2015; Doğan & Delialioğlu, 2020; Nelson & Reynolds, 2015; White & Robertson, 2015). In addition, in some studies, researchers used software and applications running on computers and mobile devices to minimize problems experienced in learning difficulties (Doğan & Delialioğlu 2020; Seo & Woo, 2010; Shin & Bryant, 2017). This study was planned to investigate the effect of distance (Web-supported) science activities on special needs students' academic success and attitudes toward science.

Providing remote support instead of using support rooms for students with mild intellectual disabilities who receive education within the scope of inclusion, it was thought that this study would play a complementary role in the integration of individuals with special needs into society, gaining independent living skills, and successful execution of inclusion programs.

Within the scope of this study, as the schools switched to distance education due to the pandemic,a 7th grade student with mild intellectual disabilities could not benefit from support education rooms and tried to learn subjects in online live lessons with their friends. It was determined that this student could not benefit from distance education sufficiently, and it was decided to provide one-on-one support for this student. This study was planned to show that the support education room practice for special needs students could be supported by distance education. The aim of this study was to implement distance WEB-supported activities for a 7th grade student with mild intellectual disability who received education in support rooms within the scope of inclusion and examine the effect of these activities on the student's academic success and attitudes towards science.

Method

This study is a case study. Situations are limited by time and activity, and researchers collect detailed information using various data collection tools during the identified process (Creswell, 2017). This research was designed based on the holistic single-case design. This design can be used in studies with extreme or idiosyncratic situations, unusual, deviating from daily events that do not comply with the determined standards (Yıldırım & Şimşek, 2013; Yin, 2018). There is only one unit of analysis in single-case designs, which can be an individual, an institution, a program, or a school. In this study, a full-time inclusion student, who had a mild mental disability report performing Web-supported activities within the scope of a science course,was holistically examined.

The Participant: The participant in this study was a 7th grade female student with a mild intellectual disability. The student had been receiving support education for 4 years, the parents were living together, and the income of the family was medium at the time of the study. The student was the only inclusive student in her classroom and was receiving support in a support education room apart from science lessons. "Support Education Room" is an educational environment created in schools and institutions by providing special equipment and educational materials in order for students with special education needs, who continue their education in the same class with their peers who do not have disabilities, within the scope of educational practices through inclusion/integration to make the most of the education services offered. In support education rooms, when students with special needs have issues that they cannot understand or miss in classroom environments, teachers provide one-on-one training to make up for their deficiencies. The participating student could not benefit from support education rooms as schools switched to distance education due to the pandemic and she tried to learn the subjects in online live lessons with her classmates. In such a distance education environment, the aim was to contribute to the development of the student by providing remote support.

Data Collection

This study was carried out in the 2020-2021 (COVID-19) academic year. An attitude scale and achievement tests were applied to the student at the beginning and at the end of the implementation of the subject to examine the change. In the research study, the scale developed by Taşkın and Aksoy (2019) was used to measure the student's attitudes toward science. This scale was chosen because it was thought that the scale would be understandable by the student and it was up-to-date. The scale is a five-point Likert type (Disagree, Strongly Disagree, Undecided, Agree, Strongly Agree) consisting of 12 items. The validity and reliability of the scale were established and the internal consistency coefficient (Cronbach alpha) was α=0.862. The scale consists of three parts: "attitudes towards science methods and techniques, attitudes towards associating science lessons with daily life, and attitudes towards science lesson content." The validity and reliability of the science achievement test consisting of 10 questions were calculated and applied as a pre-test and post-test.

Force and Energy Unit was taught to the student over four weeks with various teaching methods. While teaching the "Force and Energy" unit in the 7th grade science program besides traditional methods, simulations were used for the student to participate actively and facilitate her learning during distance education. It was planned to teach the subjects of physical work, kinetic energy, and potential energy to the student over four weeks. First, the basis of the subjects was taught with the help of visuals. Then, using simulation applications to observe the relations between the work done and the path taken, the work done and the applied force subjects were planned to teach. Before starting the implementation, the student was told how to use the simulation. The student was first expected to estimate the relationship between the work done and the force applied or the distance traveled. After saving the estimates, the path or force taken in the simulation was selected, the start button was pressed, and the work done was observed. After repeating this process twice, the student was asked to reconsider her prediction as a result of observations. When she thought that the initial prediction was correct, she marked the same option. If she made a different inference as a result of her observations, she marked another option and tried it one more time in the simulation. After finishing the whole process, the simulation provided feedback. The simulation explained the accuracy of her estimation and inference. While the student was examining the relationship between the work done and the path taken (Figure I), although she had fun in the simulation, she had difficulties in making inferences. While the student first predicted the correct answer, after observations she changed the answer instead of continuing with the correct answer. The reason for this was that the student thought that the work done decreased because she chose the path taken at the beginning and then reduced it. Necessary feedback and corrections were provided to the student so that she could understand her mistake. While examining the relationship between the work done and the applied force in the next stage, the student initially thought that there was no relationship between them, but she reached the right conclusion as a result of observations in the simulation. As a result of the implementation, the student learned that the work done is related to the applied force and the path taken by the object. Likewise, simulations were also used to show what the kinetic energy and gravitational potential energy depend on.

Implementation

A sample implementation in the study is shown below.

The simulation, which is available in the Education Information Network (EIN) application of the Ministry of National Education (MNE), was tested by making an initial prediction about the subject and testing the accuracy of the prediction. It was aimed to reach the correct answer by making inferences as a result of experiments and to ensure that the student learned the relationship of the concepts with each other permanently by trying herself and making inferences.

The student's predictions and choices in the simulation are shown in the figures below.

Figure 1 Relationship between Work Done and Path Taken

In Figure 1, the student tried to predict the relationship between work done and path taken in the simulation application and chose option B. In order to verify the prediction she chose, she pressed start button and observed the work done by the movement of the robot at the top of the simulation by selecting various path distances in the simulation.

Figure 2 Relationship between Work done and Path taken

In Figure 2, the student chose two path distances as 4m and 3m and observed the work done by the robot as 40j and 30j, respectively, on the paths she chose. After two trials, the simulation allowed the student to reconsider her predictions. The student would change her prediction according to her inferences or continue with the same thought. Since the participating student chose the distances from long distance to short distance, she experienced confusion and changed her choice. The student marked the option of "as the distance traveled increases, the work done decreases." The student made a final attempt based on her inference and the simulation provided the student a true or false warning.

Figure 3 Relationship between Work Done and Path Taken

In Figure 3, the student chose to reduce path distance again and when she chose the path taken as 2 m, it was observed that the work done was 20j. After the request, the simulation stated that prediction was correct but answer was wrong. Afterwards, it was discussed with the student why the answer was wrong and the truth was explained. A same request was applied about the work done with applied force, the relationship between kinetic energy and mass or speed, and the relationship between potential energy and height or mass. The student made a correct prediction in the first simulation and did not repeat the wrong inference.

At the end of each lesson held in four weeks, the student was assigned to do homework each week to reinforce what she learned. By giving examples from daily life, the student learned the relationship of the subject with events related to daily life. The student, who stated that it was difficult because she did not understand the simulation at the beginning, indicated that it was easier and more fun when she understood the simulation, and commented "If we had lessons with the whole class, it wouldn't have been my turn, I wouldn't have understood. It's better like this." While the student was dealing with the subject of physical work, she made inferences as "Teacher, then, while I sit and listen to a lesson, I am not doing a work, am I?" It was observed that the student did not know which energy type the given examples belonged to in the achievement test at the beginning but could notice which energy type from the examples after implementation and she could find additional examples herself. In addition, the student's interest in the lesson increased considerably. After the implementation, although the academic year was over, she contacted her teacher to inform that she wanted to do distance lessons as before and asked why the lessons did not continue. From this explanation, we can conclude that the student enjoyed the way of teaching.

Conclusion

At the end of lessons during the four weeks implementation process, the student was asked to do homework to reinforce what she learned each week. The participating student learned the relationship of the subject with events related to daily life by providing examples from daily life. At the end of the subjects, the student started to give examples about the events from daily life. The student stated that it was difficult and boring because she did not understand the simulation at the beginning. The student who learned the simulation application stated that it was fun. About the implementation, the student noted, "If we had lessons with whole class, it wouldn't have been my turn, I wouldn't have understood it. I understand better this way." While the student was dealing with the subject of physical work, she made inferences such as "Teacher, then, while I sit and listen to a lesson, I am not doing a work, am I?" It was observed that the student did not know which energy type the given examples belonged to in the achievement test at the beginning but could notice which energy type from the examples after implementation and she could find additional examples herself.

The student indicated that kinetic energy would increase as speed increases, based on the fact that kinetic energy is called the energy of motion, but she could not make any predictions about its relationship with the mass. At the end of the simulation practices, the student understood how speed and mass impact kinetic energy. When choosing variables affecting kinetic energy, the student could not think that the height had to be kept constant for the speed to be constant when mass was kept different, and she realized the mistake she made with the warning of the simulation. This was taken into account in the next practices.

The student received 60 points from the achievement test before implementation and 90 points after implementation. The academic success of the student increased by 50%.

From the student's answers to the attitude scale, she received a total of 18 points related to attitudes towards science methods and techniques before implementation, a total of 14 points related to attitudes towards associating science lessons with daily life, and a total of 6 points related to attitudes towards the content of science lessons.

From the student's answers to the attitude scale after implementation, she received a total of 21 points related to attitudes towards science methods and techniques, a total of 15 points related to attitudes towards associating science lessons with daily life, and a total of 7 points related to attitudes towards the content of science lessons. The results of the attitude scale of the student showed that the student's attitudes toward science courses were enhanced. Considering the results of this study, it was concluded that students with special needs should receive additional support. It was observed that the student both increased her academic achievement and attitude towards science.

Discussion

The aim of this study was to implement distance WEB-supported activities for a 7th grade student with mild intellectual disability who received education in support rooms within the scope of inclusion and examine the effect of these activities on the student's academic success and attitudes towards science. Students with special needs are known to be the most affected group during the online education period of the COVID-19 epidemic. Previous researchers determined that in distance education teachers notice less positive or negative behaviors of students with special needs and react less during lessons As a matter of fact in this study the student confirmed this situation by expressing, "If we had lessons with the whole class, it wouldn't have been my turn, I wouldn't have understood. It's better like this." This study was carried out because it was thought that special needs students could not benefit enough from the practices during the COVID-19 period and it was thought that a separate intervention should be done.

In their study, Kim and Fienup (2021) stated that practical interventions for students with special needs would be effective. In previous studies, it was indicated that the use of technology provides students more practice and opportunities to use technology repeatedly (Butterworth & Laurillard, 2010), provides instant and rapid feedback (Mohammed & Kanpolat, 2010), and offers students with the opportunity to control their learning process (Jones et al., 2006). Therefore, in this study, the development of the student was monitored by making practical training using simulations. In this study, it can be indicated that the academic success of participating student with special needs increased as she received hands-on training with simulations. The student began to associate the science subjects she learned with current events. While the student's score in the pre-test was 60/100, it increased to 90/100 in the post-test. The student's academic success was enhanced by 50%.

In addition to the academic success of the student, her attitudes towards science courses also developed positively. After the implementation was over, the student communicated with her teacher and indicated that she wanted to learn remotely as before. It is known that there is a directly proportional relationship between students' academic success and their attitudes (Altınok, 2004; Taşkın & Aksoy, 2019). The results of this study are consistent with previous studies. In this respect, students' attitudes towards science courses are of great importance in science education research. Considering the results of this study, it can be stated that providing distance support can increase the success of special needs students.

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