Osmangazi Journal of Educational Research **Volume 8(2), Fall 2021**

RESEARCH Open Access

Suggested Citation: Balbağ, M. Z., & Aksoy, K. (2021). Problems and solutions for science education and training in secondary school students with special needs in Turkey. *Osmangazi Journal of Educational Research, 8*(1), 121-148.

Submitted: 07/09/2021 **Revised:** 29/11/2021 **Accepted:** 30/11/2021

Problems and Solutions for Science Education and Training in Secondary School Students with Special Needs in Turkey

***M. Zafer Balbağ, **Kadir Aksoy**

Abstract. In this study, it is aimed to examine the research published between 2015 and 2020, which has content related to the problems encountered for science education and training in secondary school students with special needs in Turkey and solution suggestions. With this purpose, a literature review was performed and 52 studies on the subject were included. In the study, the literature review method was used, and the analysis of the data was carried out by descriptive analysis method. The findings are classified into two sub-themes as "problems" and "solution suggestions". "Problems" theme is divided into five categories as originating from the teacher, originating from the student, originating from the environmental conditions, originating from the curriculum and origination from the family. "Solution suggestions" theme is divided into six categories as teacher-oriented, student-oriented, physical environment-oriented, curriculum-oriented, family-oriented, and researcher-oriented.

Keywords. Science education, student with special needs, special education.

* Prof. Dr. Eskisehir Osmangazi University, Faculty of Education, Eskisehir, Turkey

e-mail: zbalbag@ogu.edu.tr

** Eskisehir Osmangazi University, Faculty of Education, Eskisehir, Turkey

e-mail: aksoykadirr@gmail.com

Developmental areas of human consist of some parts such as physical, cognitive, emotional, social, language and psycho-motor (Kuru, 2009). The person is affected by environmental factors as well as hereditary factors while developing (Jersild, 1947). Although all people have common developmental duties during the developmental stages such as infancy and childhood, the genetic and environmental differences cause individuals to have different developmental characteristics. One of the basic principles of development, "There are individual differences in development", states that each individual is unique and different from the others (Kaya, 2019). Due to hereditary and environmental differences, it is inevitable to see developmental differences between the people at the same developmental stages. However, between some individuals, the size of difference is quite large (Kırcaali-İftar, 1998). Individuals who have these differences may have special needs according to their peers. In The Ministry of National Education's Decree Law on Special Education No. 573 (1997), "individual requiring special education" term was used for individuals with special needs and defined as "for various reasons, individuals who differ significantly from their peers in terms of their individual characteristics and educational competence". According to Fırat and Koyuncu (2018), individuals with special needs may differ significantly in terms of cognitive, physical, and adaptive skills compared to their peers.

It is seen that, in the literature, there are some classification studies considering the needs of individuals with special needs. According to Çakıroğlu (2018), inadequacy of individuals with special needs are classified as mental deficiency, hearing deficiency, orthopedic deficiency, visual mental deficiency, hearing deficiency, orthopedic deficiency, language and speech difficulties, deficiencies due to muscle and nervous system deficiencies, special learning difficulties, multiple disability, emotional and behavioral disorders, chronic illness, attention deficit and hyperactivity disorder, autism, superior ability. Norman (2020) classified the inadequacies of individuals with special needs as mental deficiency, hearing deficiency, visual deficiency, orthopedic disorders, special learning disabilities, language and speech disorders, autism, emotional and behavioral disorder, attention deficit and hyperactivity disorder, multiple disability, and children with special talents.

If one or more of the deficiencies included classifications is found in the student, the role of classroom teachers in the detection of these deficiencies is great (Çuhadar,

2017). When the classroom teacher finds any deficiency in a student compared to his/her peers, he/she should take precautions in line with the possibilities for this deficiency, and the guidance counselor should make evaluation about the deficiencies detected (Yılmaz and Batu, 2016). If the precautions are not sufficient, the diagnostic process should be initiated to determine their educational needs (Özak, Vural and Avcıoğlu, 2008). In such a case, a medical examination for the student's deficiency is required (Birkan, 2005). If medical diagnostics conclude that the student require special needs, the doctor writes a report, and the educational diagnostic process is initiated by the Guidance Research Center (RAM). With the educational diagnostic process, it is determined what kind of special education the student will be subjected to (Birkan, 2005) and the education of the student continues accordingly.

Educational practices based on the needs and individual differences of students with special needs are called "special education" (Güven, 2015). As of the 2019-2020 academic year, there are 425774 students subject to special education in Turkey (Ministry of National Education, n.d.). This significant figure expresses the importance of special education as mathematically. Diken and Batu (2015) state that individualized teaching must be provided to meet the learning needs of the students. With this view, Slavin's (1994) view that "in order to carry out a quality education, the characteristics of individuals must be taken into account" supports the necessity of special education.

Since the needs and individual differences of students are considered in special education, it is necessary to prepare an Individualized Education Program (IEP) to carry out the education. IEP, which was made mandatory in our country in 1997 (Vuran, 2005), is defined in the Regulation on Special Education Services published by Ministry of National Education (MNE) (2018) as "Special education program prepared to achieve the targeted objectives in line with development characteristics, educational needs and performances which is based on the program followed by individuals with special educational needs and including support training services to be given to these individuals". Thanks to IEP, it is aimed that the student benefits from the teaching activities carried out in the classroom at the highest level (Baltacı, 2016). In addition, IEP provides that the student is monitored during the education process and developments are recorded (Ministry of National Education General Directorate of Special Education Guidance and Counseling Services, 2004). The job of preparing the IEP is not only the

duty of the class/branch teacher (Kargın, 2007). A unit is created to prepare the IEP and consists of the principal or assistant principal, guidance teacher, student's classroom teacher, field teachers, parents, and student (Ministry of National Education, 2018). IEP includes long and short-term objectives which requires teaching for students to reach throughout the year (Ministry of National Education General Directorate of Special Education Guidance and Counseling Services, 2010). These objectives vary according to the courses in which the student is educated. The courses in which the student is educated vary according to the educational placement environments.

For students in need of special education, educational placement environments are classified as full-time general education class, part-time general education class, special education class, daytime special education school, boarding special education school and home/institution/hospital from the least restrictive environment to the most restrictive environment (Ataman, 2013). The courses to be processed in these educational placement environments and the number of these courses on a weekly basis are included in the weekly course schedules published by the MNE. When these charts are checked, it is seen that there is no science course in the weekly course schedule prepared for the second tier (secondary school level) of the special education practice school. On the other hand, all weekly course schedules prepared for special education secondary schools (mild mental retardation secondary school, secondary school for hearing impaired, secondary school for vision impaired, orthopedic disability secondary school) include weekly four course hours of science at fifth, sixth, seventh and eighth grade levels (https://orgm.meb.gov.tr/www/ortaogretim-haftalik-ders-cizelgeleri/icerik/669).

Since the students who are educated at home or in hospital and enrolled in a special education secondary school are subject to the same program, they also have science education. In addition, special needs students who are trained full and part-time in general education classes are also studying science as part of their program. In short, students who are educated at special education secondary schools and students who receive inclusive education take science courses.

When the science course curriculum, which is also about for students with special needs who are subjected to science education in accordance with the curriculum applied in the institution in which they are registered, is checked, it is seen that there are four

subject areas in the program which are "Earth and Universe", "Living Things and Life", "Physical Events" and "Matter and Nature". These subject areas are common in all secondary school grade levels, but the topics and objectives of these subjects are different at each grade level (Ministry of National Education, 2018). During the determination of long and short-term objectives which are applied for an academic year; these topics, objectives and report prepared for the special needs student are considered. For the specified purposes, science course teaching is carried out.

When the literature review was performed, some studies with the content that there are some problems in science education for secondary school students with special needs were identified (Balçın, Yavuz Topaloğlu and Balkan Kıyıcı, 2016; Cengiz, 2019; Dağlı, 2019; Denizli, 2015; Kızılaslan and Sözbilir, 2017; Köse, 2017; Yazıcı, 2017). Moreover, it was observed that between 2015 and 2020, a review study was not carried out about the problems encountered during the science education and training of secondary school students with special needs in Turkey and solutions. It is thought that a study in which the problems encountered in science education and training for students with special needs in our country and solution proposals are presented as a whole is necessary for the literature. In this way, it may be possible to gain a wider perspective to researchers who will work on a similar subject.

Therefore, we decided to perform this study due to the lack of research on this subject, which includes the problems and solutions together. In this study, we aimed to analyze the articles and theses, from 2015 to the end of 2020, that include the problems encountered during science education and training in secondary school students with special needs and solution suggestions. Based on the data obtained, it will be provided that the problems and solution suggestions related to the subject are presented with a wider perspective. In this study, answers to two sub-problems were sought:

1- What are the problems encountered for science education and training in secondary school students with special needs in Turkey between 2015 and 2020?

2- What are the solution suggestions for science education and training in secondary school students with special needs in Turkey between 2015 and 2020?

Method

In this study, we aimed to determine the problems encountered for science education and training in secondary school students with special needs by examining the articles, thesis and paper studies published between 2015 and 2020. Literature review method was used in the study. With this method, studies on a specific subject in the past can be examined and these studies can be analyzed (Gürbüz and Şahin, 2018).

Data Collection and Data Analysis

In the literature review, Eskişehir Osmangazi University library database, Council of Higher Education Thesis Center and Google Scholar were used. The studies decided to be examined within the scope of the literature review should be capable of creating a response to research problems (Creswell, 2001). In this context, 52 studies that were thought to be suitable for the research topic were examined. Among these researches included in the study are 30 articles, 14 master's theses, 7 doctoral theses and 1 paper.

The studies examined within the scope of the study were determined according to some criteria. These criteria;

- Published between 2015 and 2020,
- To be related to the education and training of science for individuals with special needs,
- To be related to secondary school students,
- To be related to the science education and training in Turkey.

During the analysis of the data, the descriptive analysis method was used. In descriptive analysis method, which is a qualitative analysis method, the data obtained by the researcher are summarized according to the themes created in accordance with the research subject and transferred to the reader (Yıldırım and Şimşek, 2003).

Researches considered suitable for the study were examined and notes were taken about these researches. After the note-taking process was completed for all the researchers examined, the researches were classified according to the themes. After the classification process, the researches in each theme were analyzed and interpreted in themselves and the findings were obtained.

Results

The findings of this study are collected under two main headings as "problems" and "solution suggestions".

Problems

This title consists of five subheadings: problems originating from the teacher, problems originating from the student, problems originating from the environmental conditions, problems originating from the curriculum and problems originating from the family.

Problems originating from the teacher. It is known that the role of the teacher is great in achieving the targeted success in education and training. This is also valid in the science education and training for individuals with special needs. In the process of science education and training for secondary school students with special needs, the teacher may need to do some procedures and apply different methods, techniques. If there is a deficiency at this point, there is a possibility that the targeted success in education and training will not be achieved.

When literature review was done on the science education and training for secondary school students with special needs, it was observed that some of problems caused by the teacher. In the study, done by Balbağ, Leblebiciler, Karaer, Sarıkahya and Erkan (2016), related to the science education and training problems in our country, it was stated that some teachers had insufficiency about the special education. In Nas and Dilber (2020)'s article on students with learning difficulties and in Yazıcı (2017) and Okcu (2016)'s doctorial theses on students with visual impairments; similarly, it was stated that teachers have lack of knowledge about the methods and techniques that can be used in special education. Another study on visually impaired students stated that the teacher did not know the Braille alphabet (Atila, 2017). Köse (2017) concluded in master's thesis, which is about the views of science teachers who give inclusive education and inclusive students who attend science courses that some teachers felt inadequate about IEP preparation and communicating with inclusive students. In Dilber (2017)'s master's thesis, some science teachers stated that it is not possible to process courses by sticking to IEP in science education and training for inclusive students.

One of the reasons why the teacher lacks knowledge is that he has not learned enough about science education for students with special needs in undergraduate education (Kızılaslan, 2016; Macaroğlu Akgül and Mertoğlu, 2020). Akkuş (2019)'s master's thesis, which is about the investigation of the opinions of science teachers who provide inclusive education, it is determined that some science teachers do not prefer the inclusive education. In that study, it was concluded that

the biggest reason of why some science teachers do not prefer inclusive education is since the teachers did not have enough training about this case. Cengiz (2019) also prepared a master's thesis which is examining the views of science teachers on inclusive education, and some of the science teachers who participated in the study stated that they did not have sufficient training about inclusive education.

In master's thesis, Çağlar (2016) received the opinions of teachers and administrators regarding the training process given in the support training rooms. In this study, a group of teachers, including a science teacher, stated that "teachers who provide support training should receive in-service training about this process.". Dağlı (2019), received the opinions of science teachers who teach gifted students in his master's thesis, and it is stated that some science teachers feel inadequate yourselves in science class and these teachers have educational insufficiencies.

Studies about the science education and training for secondary school students with special needs were also examined in terms of the methods and techniques used by teachers during the course and it was observed that there were some deficiencies. Kızılaslan, Zorluoğlu, Sözbilir and Teke (2020); had research on science education in classrooms with visually impaired students and it was concluded that applications for the needs of individuals with special needs were not done. In the failure to perform appropriate methods and techniques, considering some experiments as risky for students with special needs (Atila, 2017) and teachers' inability to allow enough time (Cengiz, 2019) has an effect. It is also known that some teachers do not have activities just for students with special needs, but the same activities are done for non-special needs students (Köse, 2017; Nas and Dilber, 2020).

In Denizli (2015)'s master's thesis, it was stated that some science teachers did not teach in accordance with the understanding level of special needs students. Similarly, in a study on the teaching of science concepts to students with visual impairment, it was stated that the individual needs of the students were not considered, and the concepts were not embodied (Zorluoğlu and Sözbilir, 2017). In the master's thesis study of Yazçayır (2020), a science exam applied to the student with special needs is examined and it is found that the exam was not prepared considering the individual needs of the student. It is also found that the same exam was applied to students who were developing normally.

In a master's thesis on concept teaching to sixth-grade students with visual impairment, Yazıcı (2017) stated that the teacher did not process student-centered courses, the students were not actively

involved in the teaching process and the course processing method was not intended to attract the student's attention, and the mislearning was not immediately resolved. Similar findings were found in the study prepared by Yazıcı and Sözbilir (2020) on science teaching to sixth graders with visual impairment.

In Denizli and Uzoğlu (2016)'s study, in which they got teacher opinions about the science education process for inclusive students, some science teachers stated that they had difficulty about controlling the classroom during the lecture.

It has been determined that the problems originating from the teachers in science education and training for students with special needs between 2015 and 2020; individual needs of students are not considered, not enough time is allocated to students with special needs, appropriate methods and techniques are not used during lecture, traditional lecturing, not having training about special education intended for teachers, and lack of knowledge.

Problems originating from the student. The student is at the center of the education and training. The main goal in education and training is to bring the desired objectives to the student. To achieve a success, the student must have several duties and responsibilities. If the student does not have his duties and responsibilities, disruptions may occur. Accordingly, researches with content for problems encountered in science education and training for individuals with special needs were examined and it is determined that some of these problems were caused by the student.

When the literature on the relevant subject was examined, it was observed that some studies indicated that there were problems due to the inadequacy of individuals with special needs. Karaer and Melekoğlu (2020), in their reviewing study for students with special learning disabilities, concluded that there were deficiencies in the reading skills of the students which prevents the understanding of science subjects. In Denizli and Uzoğlu (2016)'s article and Denizli (2015)'s master's thesis, 9 out of 28 science teachers stated that inclusive students had problems with reading and writing. Similar results were reached in the studies of Aslan (2020) and Atila (2017) on the insufficiency of special needs students about reading and writing.

In a master's thesis which have content related to problems caused by the student's insufficiency, it was stated that students with hearing impairment had problems in science education (Aslan, 2020). Eser (2019) had a master's thesis based on the opinions of science teachers who have students with visual impairment and concluded that the rate of understanding of students' science objectives has changed according to the level of visual impairment. The study noted that partially

sighted students mostly understood the science objectives, but students who never saw had a lower percentage of understanding on science objectives.

Balçın, Yavuz Topaloğlu and Balkan Kıyıcı (2016) had a paper on the problems faced by inclusive students in science courses. According to this study, inclusive students had difficulty about understanding the exams applied to them and the expressions in the science textbooks. Moreover, they did not tell teacher what they did not understand.

In the studies examined, it was determined that another problem caused by the student was behavioral problems of students. Behaviors of some students with special needs that will disrupt the course, among the problems caused by the student in science courses (Akkuş, 2019; Aslan,2020; Denizli, 2015). On the other hand, it has been stated that sometimes students with special needs are also subjected to disturbing behavior by their peers (Denizli and Uzoğlu, 2016; Uzoğlu and Denizli, 2017).

Lack of motivation is another problem caused by the student which is included in some studies. Aslan (2020)'s master's thesis it is founded that some inclusive students lacked motivation in science courses. Dilber (2017) stated in the master's thesis that when science teachers are interested to special needs students in lecture, there was a loss of motivation in students who were developing normally.

In the doctoral thesis of Yazıcı (2017), it was stated that visually impaired students had problems in science courses due to lack of knowledge about past years' science objectives and these students came to the course without any preparation.

When the relevant studies are examined, it is seen that the problems caused by the student are insufficiency about reading - writing and reading comprehension; behavioral problems; lack of motivation; the lack of knowledge from past years and the student's unprepared attendance to lectures.

Problems originating from environmental conditions. For education and training to be performed to the targeted extent, the physical conditions of the environment must be appropriate. When the studies on this subject were examined, it was determined that there were also problems caused by environmental conditions in the science education and training for individuals with special needs.

According to researches, one of the problems with environmental conditions is that the number of students in the class is greater than it should be (Akkuş, 2019; Aslan, 2020; Denizli, 2015). Köse (2017) stated that due to the crowded classrooms, a noisy environment occurred during lecturing and

therefore there was a problem in science education. According to Nas and Dilber (2020), teachers have difficulty applying methods and techniques for the individual needs of inclusive students due to the crowded classrooms. In Dilber (2017)'s master's thesis, it was stated that science teachers were not able to spend enough time with inclusive students during the course since the number of students in the classrooms was greater than ideal and therefore there was a problem about implementation of IEP. In addition, it was stated in the same study that the physical infrastructure of the school was not sufficient, therefore there was a problem.

In the study done by Dağlı (2019), it was stated by science teachers that there is a lack of materials in the environment in which the training is carried out and therefore methods and techniques for gifted students cannot be applied. Pemik (2017) has a master's thesis for education given to gifted students. The science teacher who participated in this study stated that there are not enough tools to make applications in the support training room. Atila (2017) stated in its master's thesis that lack of tools caused the failure of experiments and applications, these case cause students to have problems working for exams.

According to the some researches, some environments where visually impaired students are studying science are not designed in accordance with the needs of the students (Kızılaslan and Sözbilir, 2017; Yazıcı, 2017). In the studies of Yazıcı and Sözbilir (2020), Uzoğlu and Denizli (2017), it was stated that the students had difficulty reading the texts because the materials such as books used in the course were not prepared considering the needs of the students.

In Cengiz (2019)'s master's thesis, the science teacher who participated to the research stated that they had problems in science education and training because they were the only teachers in the course and the students were not trained in support training rooms.

When the relevant studies on problems caused by environmental conditions were examined, it was determined that there was a problem due to the high presence of students in classroom, lack of materials, preparation of the materials without considering the individual needs of the students, not designing the educational environment for the individual needs of the students, not having another teacher to help the classroom teacher during the lesson, and not training some students with special needs in support training rooms.

Problems originating from the curriculum. In science education it is aimed the training individuals who are literate in science. Accordingly, the science curriculum and the implementation

of this curriculum are very effective in achieving this goal. When the literature review was performed, it was determined that there were some problems caused by the curriculum and its implementation.

According to Karaer and Melekoğlu (2020), students with special learning disabilities have difficulty about understanding abstract and foreign concepts in science education. Yazıcı (2017) had a similar conclusion in the master's thesis and stated that the presence of too many images in science courses was a problem for visually impaired students. In addition, sows and graphics found in science curriculum are also a problem for visually impaired students (Atila, 2017). According to Okcu, Yazıcı and Sözbilir (2016), science course is perceived as one of the most difficult courses by visually impaired students due to its visual elements. In Denizli (2015)'s study, it was stated that students with special needs have more difficulty in some science subjects than other subjects.

There is also no science curriculum for students with special needs (Dağlı, 2019; Kızılaslan and Sözbilir, 2017). The current curriculum has an intensive content (Dilber, 2017) and therefore the time problem of science teachers in terms of raising objectives (Denizli and Uzoğlu, 2017) also cause problems in science education and training for individuals with special needs. The science teacher who participated in Sezer (2015)'s research also stated that he wants to answer the questions of the gifted students during lecturing, but the time allocated to the course is not enough.

Denizli and Uzoğlu (2017) say that in the central exams including the science course, not applied a separate exam as content to students with special needs. In the research of Nas and Dilber (2020), it was stated that this situation leads to the application of the same methods and techniques to individuals with special needs and students who develop normally.

When the relevant studies on the problems originating from the curriculum were examined, it was determined that there were problems due to the presence of abstract and foreign concepts in science subjects; the presence of visuals, figures and graphics; the lack of a curriculum for the individual needs of students with special needs; the time problem during the implementation of the curriculum; and the fact that the central exams were the same as the exam applied to students who normally developed as content.

Problems originating from the family. The role of the family for providing a successful education is quite large. Thanks to the cooperation of teachers and parents, the probability of achieving the targeted point in education can be increased. When the studies on the science education and training of individuals with special needs were examined, a study with problems related to the family was encountered.

According to Yazıcı (2017), one of the problems that visually impaired students face in science education and training is related to the family. In this research, it was stated that there was a problem in science teaching because parents did not take care of their children's education enough. In addition, according to the same study, the fact that the science course has numerical content makes it difficult for parents to help their children for this course.

When the relevant studies on family problems were examined, it was determined that there was a problem due to the fact that the science course has numerical content and parents do not adequately follow their children's education and training status.

Solution Suggestions

This title consists of six sub-headings as teacher-oriented solution suggestions, student-oriented solution suggestions, physical environment-oriented solution suggestions, curriculum-oriented solution suggestions, family-oriented solution suggestions and researchers-oriented solution suggestions.

Teacher-oriented solution suggestions. After the literature review, it was found that there are some studies with content related to solution suggestions for the teacher. Some of these studies are related to the methods and techniques that the teacher should use in the course. According to Denizli (2015), teachers should apply appropriate methods and techniques both during the lecturing and during the evaluation in inclusive training. In the study of Karaer and Melekoğlu (2020), for students with special learning difficulties; in the study of Mete, Çapraz, and Yıldırım (2017), for students with intellectual disabilities, it was stated that appropriate methods and techniques should be used in science lessons. In the master's thesis of Yazıcı (2017), it was stated that the use of different methods and techniques will contribute to the inclusion of the student in the educational process.

Uzoğlu and Denizli (2017) stated that methods and techniques should be used according to the individual needs of the students in the science course in inclusive education. For example, Zorluoğlu and Kızılaslan (2019) stated that, in science class, a material introduction should be made for visually impaired individuals by using a method related to a sense other than the visual senses. In the research of Kızılaslan and Sözbilir (2018), it was stated that teaching methods should be used in such a way that vision is at the forefront for students who see little, and other teaching methods should be preferred for students who never see. In the Yazıcı and Sözbilir (2020)'s study performed with the participation of 15 visually impaired students in the sixth grade, techniques except for vision used for students who could not see at all during the teaching of "Respiratory System", and for low-vision

students, teaching was made in a way that emphasized their eyesight. Then, a significant increase in the success of the students was observed at the end of the application.

In Zorluoğlu, Çetin, Aşık, Gündüz and Mertol (2020)'s study with science teachers working in science and arts centers; it has been stated that to perform an effective education, teachers should know the characteristics of their students well, and different methods - techniques and evaluation tools should be used for the characteristics of the students. In the paper of Balçın, Yavuz Topaloğlu and Balkan Kıyıcı (2016), it was stated that inclusive students want more experiments in science lessons and use of visual materials. The use of different methods and techniques in science education for individuals with special needs also provides that learning is permanent. (Nas, Çoruhlu, Çalık, Ergül and Gülay, 2019).

Yazıcı and Sözbilir (2020) stated that methods and techniques which supports the creativity of the student with special needs should be preferred to get away from memorizing education techniques.

In some studies, about the science education and training of individuals with special needs, the effectiveness of these methods and techniques was investigated. Çapraz (2016)'s master's thesis, a science subject for secondary school students with mental disabilities was processed by direct teaching method and it was concluded that this method was effective. In the research of Çıkılı Soylu, Dağseven Emecen and Yıkmış (2018), it was stated that direct teaching and teaching with schematic regulators methods were effective in science course in students with mental disabilities. Similarly, Mete (2016) concluded in master's thesis that the direct teaching method was effective in science lessons for students with mental disabilities. Türker (2018) had research for students with intellectual disabilities and stated that effective science teaching can be performed by using the direct teaching method and the diagnostic branched tree technique together. In another study about the methods used in the teaching of science for individuals with special needs, it was concluded that the material-supported 5 E model contributed to the increase in success (Zorluoğlu and Sözbilir,2017).

In a study conducted by Bilgiç and Şafak (2020), it was stated that schematic regulators can be used in science subjects for students with multiple disabilities, and that schematic regulators have a positive effect on student success. In a master's thesis conducted with the participation of four secondary school students who are in the fifth grade of special education classes and visually impaired schools Yılmaz (2017) also concluded that schematic regulators with direct teaching method increases science success and permanence of knowledge.

Among the studies investigating the effectiveness of various methods and techniques, there are also some studies about STEM. In a study conducted by Balçın and Yıldırım (2020), it was suggested that STEM studies increase success and student motivation in science education for inclusive students, so a support training room should be opened for inclusive students and STEM activities should be held under teacher guidance in the support training room. Ayverdi (2018) stated in his doctoral thesis that STEM applications in science education make special gifted secondary school students more creative.

The effectiveness of the use of technological tools has been investigated in some of studies with content related to the solution to increasing the success of science in individuals with special needs. In the study conducted by Sola Özgüç and Cavkaytar (2016) with the participation of 11 students with mild mental disabilities in special education secondary school, it was concluded that the use of technological tools in science education increases the effectiveness of science education. Like Sola Özgüç and Cavkaytar's results, Yenioğlu (2020) also concluded in his master's thesis that the use of tablet computers in inclusive education increases success and permanence of knowledge in students with special learning disabilities.

"The teacher should have special education training" is an another finding regarding the solution suggestions for the teacher. The science teachers who participated in Denizli (2015)'s master's thesis stated that they needed in-service training to address their shortcomings in preparing plans for inclusive education. In master's thesis, in which he received the opinions of science teachers about integration education, Köse (2017) stated that teachers should be trained about the communication with individuals with special needs. In the same study, it was stated that science teachers should get help from educators in preparing an IEP.

There are also some studies which state that science teachers should have courses about special education in undergraduate education. In the master's thesis of Kızılaslan (2016) and Yazıcı (2017), it was stated that science teachers should have training related to science education for individuals with visual impairments both during the undergraduate education and when they are teachers. Similarly, in Cengiz's (2019)'s master's thesis it is stated that it is necessary to have inclusive education and IEP preparation courses in undergraduate education for the problems faced in science education for inclusive students. In Aslan (2020)'s master's thesis, it was stated that teachers should be trained about inclusive training and IEP preparation, and more time should be devoted to preparing IEP in the "special education and inclusive" course which exists in the undergraduate education

program. In addition, in the studies of Aslan (2020) and Atila (2017), it was stated that science teacher candidates should attend classes in classrooms with special needs students during undergraduate education, so that teacher candidates can be experienced.

Among the findings obtained in studies about the science courses for students with special needs is that the training should be processed according to the needs of the students (Kızılaslan, 2016). In the studies done by Zorluoğlu and Kızılaslan (2019) and Kızılaslan and Sözbilir (2017) for visually impaired students, it was stated that verbal communication and descriptions should be performed during the lecture, enough time should be given to the student for the applications and the evaluation tools should be prepared for the needs of the student. In addition, Zorluoğlu and Kızılaslan (2019) suggested that a classmate can accompany a visually impaired student for doing laboratory applications without problems.

Atila (2017) recommends for students with visual impairment that the science exams' formats should be prepared considering the inadequacy of the student. In addition, it is among the suggestions that a virtual environment can be established where information can be shared to cooperate on the problems of visually impaired students. Cengiz (2019) also states that cooperation between branch teachers is important in inclusive science education.

In his master's thesis, Yazıcı (2017) stated that various activities should be included in the science courses for students with visual impairment and if any material is to be used in the event, these materials should be introduced to the students. In the study of Mete and Yıldırım (2018), it was stated that the tools and equipment used in science courses for students with mental disabilities should be the kind that students may encounter in daily life.

When the studies related to the solution suggestions for the teacher in science lessons are examined, it is seen that the suggestions such as using appropriate methods and techniques, considering individual needs of students, organizing student-centered lessons, using technological tools, training of the teacher, accompanying another classmate to the student who has a insufficiency for laboratory applications, introducing the materials to be used during the application to the student with special needs, cooperating with other branch teachers on special education and creating a common virtual environment stand out.

Student-oriented solution suggestions. When the studies which are considered suitable for the research subject were examined, it was found that the solution suggestions for the student were limited.

Karaer and Melekoğlu (2020) stated that applications for individual needs can be carried out from an earlier age to increase the science success of students with special learning disabilities.

When the studies on solution suggestions for the student were examined, it was suggested that the applications for students with special needs in science education could be applied at an earlier age.

Physical environment-oriented solution suggestions. In the studies examined within the scope of the research, it was found that there were different solutions for physical environmental conditions.

Some of the solutions about physical environmental conditions are related to "material". In order to overcome some of the problems encountered in science education and training due to environmental conditions, in some articles and theses it is stated that materials should be provided for the needs of individuals with special needs (Çapraz, 2016; Dilber, 2017; Kızılaslan, 2016; Kızılaslan and Sözbilir, 2017; Mete, Çapraz and Yıldırım, 2017; Sözbilir, Zorluoğlu and Kızılaslan, 2019; Zorluoğlu and Sözbilir, 2017; Zorluoğlu, Çetin, Aşık, Gündüz and Mertol, 2020).

Regarding the supply of materials for individual needs, Yazıcı (2017) stated that science books should be designed according to the degree of inadequacy of students with visual impairments; large font and colorful design should be used for partially sighted students, and relief books should be prepared for students who have never seen. Eser (2019) stated that to increase the science achievement of students, the number and use of materials for touch and hearing senses, experimental materials, three-dimensional models, large font books and relief books should be increased in schools for students with visual impairments. According to Yazıcı and Sözbilir (2020), text should be preferred instead of tables in books which are prepared students with visual impairments and schools should have a 3D printer to meet the need for materials. With this way, it is possible to embody abstract contents in science subjects (Öner, 2018; Yazıcı and Sözbilir, 2020). Atila (2017) stated that students can detect laboratory materials thanks to Braille alphabet labels prepared for students with visual impairment.

Ayverdi (2018) proposed that the necessary materials should be provided and more STEM activities should be included in the textbooks for the implementation of STEM practices maintained in BILSEM.

Another solution suggestion for problems origination from the physical environment is arranging the area. There are some studies stating that the environment should be organized according

to the individual needs of special needs students to realize a successful science education and training, (Çapraz, 2016; Kızılaslan, 2016; Mete, Çapraz and Yıldırım, 2017; Yazıcı, 2017; Zorluoğlu and Sözbilir, 2017). In the master's thesis, where science teachers and special needs students received their opinions, Denizli (2015) stated that the seating arrangement should be adjusted according to the inadequacy of the students, the classrooms should not be crowded, and students with special needs should benefit from support education rooms. Similarly, Uzoğlu and Denizli (2017) stated that the classrooms where students with special needs are studying science should not be crowded, while Kızılaslan and Sözbilir (2017) stated that the classroom should be designed in such a way as not to restrict the movement of students. Zorluoğlu and Kızılaslan (2019) stated that light should be used for the needs of partially sighted students in classrooms where science lessons are handled for students with visual impairments.

Cengiz (2019) recommended that undergraduate students studying in the faculty of education participate in science courses for individuals with special needs and to assist the science teacher.

In the master's thesis of Dilber (2017), she received the opinions some of the science teachers to solve the problems faced by inclusive students with learning difficulties in science courses. In this study, science teachers made suggestions such as creating classes with adequate materials and appropriate environment in line with the needs of students with special needs, and students receiving science education in these classes. Dağlı (2019) received the opinions of science teachers for the science education of gifted students in the master's thesis. In this study, science teachers proposed a solution that "gifted students should study science in classrooms consisting of only gifted students."

When studies which have content related to solutions on environmental conditions are examined, suggestions such as eliminating the lack of materials, selecting the materials to be provided considering the individual needs of the students, regulating the environment of science education considering the inadequacies of students with special needs, obtaining classes with the ideal number of students, providing science education to students with special needs in support training rooms, participating of under-graduate students in the faculty of education to the classes with special needs students and assisting the course teacher stand out.

Curriculum-oriented solution suggestions. When the literature was reviewed, it is encountered some studies which offer solutions to the problems in the science curriculum and the implementation of curriculum.

In Çapraz (2016)'s thesis on students with mental disabilities, it is stated that the curriculums should be prepared with the individual needs of the students. Kızılaslan (2016), conducted a research about the training of a science unit in its master's thesis on students with visual impairments and proposed to reorganize the content of the lesson considering the inadequacies of the student. Dağlı (2019) stated that a different science curriculum should be prepared for gifted students.

In the studies examined, it was determined that there were solutions regarding the duration of lectures. It was suggested by the science teachers who participated in the research of Eser (2019) that the time allocated for science courses in the classroom of students with visual impairment should be greater. In addition, in the same study, it was stated that the teachers who are supervisors in science exams should be individuals who have already been trained in the needs of special needs students. A science teacher who participated in Yazıcıoğlu and Kargın (2018)'s research on students with cerebral palsy stated that the number of lessons in support training rooms may be more.

When the studies about solution suggestions for the curriculum are examined, it is seen that the preparing a science curriculum for the individual needs of special needs students, increasing the duration and number of course, determining the science teachers who have already been trained about individuals with special needs as observer stand out.

Family-oriented solution suggestions. When the studies suitable for the research subject were examined, it was found that there were some studies with solution proposals for the family, but the recommendations in these studies were similar.

Köse (2017) stated that cooperation with the parent is necessary to reach the targeted point in science course of inclusive training. Ayverdi (2018) suggested that cooperation with the parent can be made during STEM activities. Cengiz (2019) stated that the parent should also take part in the inclusive training of science courses, and Eser (2019) stated that parents should provide more support to the students with visual impairment in science education.

When the studies with content related to solution suggestions for the family are examined, it is seen that the suggestion about cooperating with the parent during education and training of science for special needs students stands out.

Researchers-oriented solution suggestions. Among the studies examined within the scope of the study, in a study carried out by Mete, Çapraz and Yıldırım (2017), it was stated that there were not enough studies in the literature on science education for students with mental disabilities so more scientific research should be done on this subject.

Discussion and Conclusion

Within the scope of the research, 52 studies published between 2015 and 2020 with content related to the problems encountered for science education and training in secondary school students with special needs in Turkey were examined.

Problems encountered in science education and training classified under five main headings as problems originating from the teacher, from the student, from environmental conditions, from the curriculum and from the family. The ones that stand out of the problems originating from the teacher; it has been determined that science teachers have a lack of knowledge about special education, the appropriate methods and techniques are not used in the science course, individual needs are not considered, the science course is not processed as student-centered, and not enough time allowed for students with special needs. Those that stand out from the problems originating from the student; deficiencies of students with special needs in more basic skills such as reading and writing, students with special needs have behavioral problems, classmates behave disturbingly to students with special needs, lack of motivation towards the course, lack of knowledge and the student comes unprepared for the course. Those that stand out from the problems originating from environmental conditions; crowded classrooms in which the science lectures are realized, that the environmental conditions of the class are not suitable for the inadequacies of the students, that there is a lack of materials that can be used in science courses or that the materials found are not regarding to the individual needs of the students, that there are no assistant teachers in science courses and that some special needs students do not take science courses in support training rooms. Highlights of the problems originating from the curriculum; abstract and foreign concepts found in science, visual elements such as shape and graphics, not implementing the science curriculum which is prepared with considering the individual needs students with special needs, having a time problem in science courses, the content of the central exams is standard for all students. As problems originating from the family, ,t has been determined that parents have difficulty helping their children for science lesson because it contains numerical elements. Moreover, some parents do not follow the student's educational status, including science course.

Solutions suggested for science education and training are classified under six main headings: teacher-oriented solution suggestions, student-oriented solution suggestions, physical environment-oriented solution suggestions, curriculum-oriented solution suggestions, family-oriented solution suggestions and researchers-oriented solution suggestions. Highlights of the teacher-oriented solution

suggestions; the use of appropriate methods and techniques in the science course, to know of characteristics of the student by the science teacher, in-service training of science teachers with a lack of knowledge about special education, increasing the number of courses which are about science education and training for students with special needs in undergraduate education, considering the individual needs of the student during lecture and evaluation stage, processing science courses as student-centered, using technological tools, collaborating on special education between the science branch and other branches, introducing the materials used in the course to students with special needs previously, and accompanying students with special needs by peers in science laboratory. Under the heading of student-oriented solution suggestions, one suggestion stands out such as to "start the practice of science courses at an earlier age in order to address the individual needs of students with special needs". Highlights of physical environment-oriented solution suggestions; providing materials that can be used in science classes and designed for individual needs, designing the environment for science education according to the individual needs of special needs students and reducing the number of students in the classrooms, enabling science teacher candidates studying in the faculty of education to assist the course teacher by assigning them, and providing science education in the support training room to students with special needs. Highlights of the curriculum-oriented solution suggestions; preparation of the science curriculum which considers individual needs, changes in the number of courses and duration of the course hours, and the accompanying of teachers who are experienced and trained in special education to the students in the science exams. As a family-oriented solution suggestion, the only suggestion to "cooperate with the family in the process of science education and training" stands out. Researchers-oriented solution suggestion heading includes one suggestion as "further scientific research on science education and training for students with mental disabilities".

When the five headings about problems are examined separately, it is seen that there are the least problems under the heading "problems originating from the family". The other four titles have a balanced distribution. When the six topics about solution suggestions were examined separately, it was determined that there were the most solution suggestions under the heading "teacher-oriented solution suggestions", and that there were fewer solution suggestions in the headings "student-oriented solution suggestions", " family-oriented solution suggestions " and "researchers-oriented solution suggestions " compared to the other three topics.

Although there is a balance between the number of problems originating from the family and number of solutions, it may be appropriate to conduct more research on this issue. Moreover, when

the number of problems originating from the student and student-oriented solution suggestions were compared, it was observed that although there were more problems, the amount of solution proposals was less. In this case, it was concluded that there was no balance between "problems originating from student" and "student-oriented solution suggestions".

In 52 studies examined, when looking at the types of requirements of special needs students, the researches were carried out on students with vision impairment, special learning disabilities, mental disabilities and gifted students; it has been concluded that fewer studies have been done on students with other types of special needs.

Recommendations

The recommendations is presented under two headings as "for the science education and training of secondary school students with special needs" and "for researchers".

Recommendations for Science Education and Training of Secondary School Students with Special Needs

1. The individual needs of students should be considered during science lessons.

2. Materials, methods, and techniques should be used in accordance with the individual needs of the students.

Recommendations for Researchers

1. Number of research on solutions for problems originating from the student should be increased.

2. Research should be done on special requirement types about which less scientific research has been done.

About Authors

First Author: Mustafa Zafer BALBAĞ is a member of Eskişehir Osmangazi University. He works at the Faculty of Education. He is currently working at the Mathematics and Science Education Department. He completed his doctorate at Eskişehir Osmangazi University and his subject is on Physics. He mainly works in the fields of Science and Physics Education.

Second Author: Kadir AKSOY is a graduate student of Eskişehir Osmangazi University. He is also science teacher and works in Bilecik. He completed the undergraduate education at Middle East Technical University (METU) Elementary Science Education department.

Conflict of Interest

There is no conflict of interest.

Funding

No funding was received.

ORCID

M. Zafer Balbağ https://orcid.org/0000-0002-2328-0848

Kadir Aksoy https://orcid.org/0000-0002-7176-6164

References

Akkuş, A. N. Ş. (2019). *Fen bilimleri dersine giren öğretmenlerin kaynaştırma eğitimine yönelik görüşlerinin incelenmesi* (thesis). Sakarya.

Aslan, K. (2020). *Kaynaştırma eğitimine ilişkin fen bilimleri öğretmenlerinin ve öğrencilerin görüşleri* (thesis). Amasya.

Ataman, A. (2013). Özel eğitimin anlamı ve amaçları. In A. Cavkaytar (Ed.), *Özel Eğitim* (Vol. 1). essay, Vize Basın Yayın.

Atila, G. (2017). *Ortaokul düzeyindeki görme engelli öğrencilerin fen bilimleri dersinde karşılaştıkları sorunlar* (thesis). Erzurum.

Ayverdi, L. (2018). *Özel yetenekli öğrencilerin fen eğitiminde teknoloji, mühendislik ve matematiğin kullanımı: Fetemm yaklaşımı* (thesis). Balıkesir.

Balbağ, M. Z., Leblebiciler, K., Karaer, G., Sarıkayha, E., & Erkan, Ö. (2016). Türkiye'de fen eğitimi ve öğretimi sorunları. *Eğitim ve Öğretim Araştırmaları Dergisi*, *5*, 12–23.

Baltacı, R. (2016). Üstün yetenekli öğrenciler için bireyselleştirilmiş eğitim planı geliştirme. *Üstün Zekâlılar Eğitimi ve Yaratıcılık Dergisi*, *3*(1), 33–41.

Balçın, M. D., & Yıldırım, M. (2020). Kaynaştırma öğrencilerinin fen bilimleri dersi STEM çalışmalarının değerlendirilmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*. https://doi.org/10.21565/ozelegitimdergisi.660695

Balçın, M. D., Yavuz Topaloğlu, M., & Balkan Kıyıcı, F. (2016). (rep.). *Kaynaştırma öğrencilerinin fen bilimleri dersinde karşılaştıkları sorunlar* (pp. 417–418). Antalya, Türkiye.

Bilgiç, H. C., & Şafak, P. (2020). Çoklu yetersizliği olan öğrencilere doğrudan öğretimle sunulan şematik düzenleyicinin bir fen konusunun öğretimine etkisi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*. https://doi.org/doi: 10.21565/ozelegitimdergisi.629598.

Birkan, B. (2005). Erken özel eğitim hizmetleri ve özel gereksinimi olan çocukların farkına varılması. In O. Gürsel (Ed.), *Bireyselleştirilmiş Eğitim Programlarının Geliştirilmesi* (3rd ed., pp. 13–30). essay, Anadolu Üniversitesi.

Cengiz, M. (2019). *Fen bilimleri öğretmenlerinin kaynaştırma becerileri öz değerlendirmeleri ve kaynaştırma eğitimine ilişkin görüşlerinin incelenmesi* (thesis). Antalya.

Creswell, J. W. (2001). *Educational research: Planning, conducting and evaluating quantitative and qualitative research*. Pearson.

Çağlar, N. (2016). İlköğretim kurumlarındaki "destek eğitim odası (deo)" uygulamasına ilişkin okul yöneticileri ve öğretmenlerin görüşlerinin incelenmesi (thesis). Ankara.

Çakıroğlu, O. (2018). Özel eğitimde temel kavramlar. In V. Aksoy (Ed.), Özel Eğitim (2nd ed.). essay, Pegem Akademi.

Çapraz, C. (2016). Ortaokul özel alt sınıfında öğrenim gören zihinsel yetersizliği olan öğrencilere doğrudan öğretim yöntemiyle bazı maddelerin "katı-sıvı-gaz" hallerinin öğretimi (thesis). Erzurum.

Çıkılı Soylu, D., Dağseven Emecen, D., & Yıkmış, A. (2019). Zihinsel yetersizliği olan öğrencilere fen konularının öğretiminde doğrudan öğretim yöntemi ile şematik düzenleyiciyle öğretim yönteminin karşılaştırılması. Kalem Eğitim Ve İnsan Bilimleri Dergisi, 9(1), 1–25. https://doi.org/10.23863/kalem.2019.118

Çuhadar, S. (2017). İlköğretim sınıf öğretmenlerinin bakış açılarıyla gönderme öncesi süreç ve öğrencilerin ayrıntılı değerlendirme için gönderilmesi. Trakya Üniversitesi Eğitim Fakültesi Dergisi, 7(2), 526–549. https://doi.org/10.24315/trkefd.307946

Dağlı, T. (2019). *Üstün yetenekli öğrencilere verilen fen eğitimine yönelik fen bilimleri öğretmenlerinin görüşleri* (thesis). Konya.

Denizli, H. (2015). *Fen bilimleri dersi öğretmenlerinin ve fen bilimleri dersini alan kaynaştırma öğrencilerinin kaynaştırma eğitimi uygulamaları sürecine ilişkin görüş ve önerileri* (thesis). Giresun.

Denizli, H., & Uzoğlu, M. (2016). Fen bilimleri dersi öğretmenlerinin kaynaştırma uygulamaları sürecine ilişkin görüşlerinin belirlenmesi. *Türk Fen Eğitimi Dergisi*, *13*, 3–37. https://doi.org/10.12973/tused.10158a.

Diken, İ. H., & Batu, S. (2015). Kaynaştırmaya giriş. In İ. H. Diken (Ed.), *İlköğretimde Kaynaştırma* (3rd ed., pp. 1–30). essay, Pegem Akademi.

Dilber, Y. (2017). *Fen bilimleri öğretmenlerinin öğrenme güçlüğü tanılı kaynaştırma öğrencileri ile yürüttükleri öğretim sürecinin incelenmesi* (thesis). Trabzon.

Eser, Ş. (2019). *Görme engelliler ortaokulunda görev yapan fen bilimleri öğretmenlerinin görüşlerine göre fen bilimleri dersi kazanımlarının gerçekleşebilme durumunun belirlenmesi* (thesis). Isparta.

Fırat, T., & Koyuncu, İ. (2018). Lise öğrencilerinin özel gereksinimli bireylere yönelik sosyal kabul düzeyleri. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *39*(1), 503–525. https://doi.org/10.17152/gefad.431264

Gürbüz, S., & Şahin, F. (2018). *Sosyal Bilimlerde Araştırma Yöntemleri Felsefe - Yöntem - Analiz* (5th ed.). Seçkin Yayıncılık.

Güven, Y. (2015). Özel eğitime giriş. In A. Kulaksızoğlu (Ed.), *Farklı Gelişen Çocuklar* (pp. 45–81). essay, Nobel Yayıncılık.

Jersild, A. T. (1947). *Child psychology* (3rd ed.). Prentice-Hall.

Karaer, G., & Melekoğlu, M. A. (2020). Özel öğrenme güçlüğü olan öğrencilere fen bilimleri öğretimi üzerine yapılan çalışmaların incelenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, *21*, 789–818. https://doi.org/10.21565/ozelegitimdergisi.532903

Kargın, T. (2007). Baş makale: rğitsel değerlendirme ve bireyselleştirilmiş eğitim programı hazırlama süreci. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Egitim Dergisi*, *8*(1), 1–13. https://doi.org/10.1501/ozlegt_0000000103

Kaya, H. (2019). *Aysel gürmen'in "Selen'in öyküleri" üzerine çocuğun dil ve kişilik gelişimine katkısı bağlamında bir değerlendirme* (thesis). İstanbul.

Kırcaali-İftar, G. (1998). Özel gereksinimli bireyler ve özel eğitim . In S. Eripek (Ed.), *Özel Eğitim* (pp. 1–13). essay, Anadolu Üniversitesi.

Kızılaslan, A. (2016). *İlköğretim 8. sınıf görme engelli öğrencilere "maddenin halleri ve ısı" ünitesi ile ilgili kavramların öğretimi* (thesis). Erzurum.

Kızılaslan, A., & Sözbilir, M. (2017). Görme yetersizliği olan öğrencilere yönelik geliştirilen fen etkinliklerin değerlendirilmesi: ısı ve sıcaklık. *Ege Eğitim Dergisi*, *18*, 914–942.

Kızılaslan, A., & Sözbilir, M. (2017). Görme yetersizliği olan öğrencilerin "maddenin halleri ve ısı" ünitesini öğrenmeye yönelik ihtiyaç analizi. *Atatürk Üniversitesi Kazım Karabekir Eğitim Fakültesi Dergisi*, 274–290.

Kızılaslan, A., & Sözbilir, M. (2018). Görme yetersizliği olan öğrencilere yönelik tasarlanan etkinliklerin değerlendirilmesi: ısı alışverişi ve sıcaklık Değişimi.

Erzincan Üniversitesi Eğitim Fakültesi Dergisi, 20, 121–139. https://doi.org/10.17556/erziefd.325956

Kızılaslan, A., Zorluoğlu, S. L., Sözbilir, M., & Teke, D. (2020). Görme yetersizliği olan öğrencilere yönelik geliştirilen fen etkinliklerinin analizi: madde ve ısı. *Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, 8,* 19–32.

Kuru, O. (2009). *Dokuz yaş çocuklarının psiko-motor gelişimlerinde oyunun etkisi* (thesis). Elazığ.

Köse, K. (2017). *Fen bilimleri dersinde uygulanan kaynaştırma eğitiminin fen bilimleri öğretmenleri ve öğrenci görüşlerine göre değerlendirilmesi* (thesis). Konya.

Macaroğlu Akgül, E., & Mertoğlu, H. (2020). Öğretmen yetiştirme programlarında otizm farkındalığı: fen bilgisi eğitimi örneği. *Journal of Induvidual Differences in Education, 2,* 31–41.

Mete, P. (2016). *Ortaokul özel alt sınıfta öğrenim gören zihinsel yetersizliğe sahip öğrencilere bazı maddelerin "sert-yumuşak" özelliklerinin doğrudan öğretim yöntemiyle öğretimi* (thesis).

Mete, P., & Yıldırım, A. (2018). Zihinsel yetersizliğe sahip öğrencilere "sert-yumuşak" maddelerin öğretimi için öğretim materyallerinin seçim süreci. *Kastamonu Education Journal, 26*(5), 1527–1538. https://doi.org/10.24106/ kefdergi.2138

Mete, P., Çapraz, C., & Yıldırım, A. (2017). Zihinsel yetersizliğe sahip öğrenciler için fen eğitimi. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 21,* 289–304.

Ministry of National Education. (2018). Fen bilimleri dersi öğretim programı (ilkokul ve ortaokul 3, 4, 5, 6, 7 ve 8. sınıflar). Ankara.

Ministry of National Education. (2018, July 7). Özel eğitim hizmetleri yönetmeliği. Ankara.

Ministry of National Education. (n.d.). Milli Eğitim istatistikleri örgün eğitim. Ankara.

Ministry of National Education. (n.d.). *Özel eğitim hakkında kanun hükmünde kararname*. https://orgm.meb.gov.tr/meb_iys_dosyalar/2012_10/10111011_ozel_egitim_kanun_hukmunda_kararname.pdf.

Ministry of National Education General Directorate of Special Education Guidance and Counseling Services. (2004). Bireyselleştirilmiş eğitim programı yol haritası. Ankara.

Ministry of National Education General Directorate of Special Education Guidance and Counseling Services. (2010). Okullarımızda neden niçin nasıl kaynaştırma yönetici, öğretmen ve aile klavuzu. Ankara.

Ministry of National Education General Directorate of Special Education and Guidance Services. (2019, September 5). https://orgm.meb.gov.tr/www/ortaogretim-haftalik-ders-cizelgeleri/icerik/669.

Nas, S. E., & Dilber, Y. (2020). Fen bilimleri öğretmenlerinin öğrenme güçlüğü tanılı kaynaştırma öğrencileri ile yürüttükleri öğretim sürecinin incelenmesi. *Kastamonu Education Journal, 28,* 1800–1816.

Nas, S. E., Çoruhlu, T. Ş., Çalık, M., Ergül, C., & Gülay, A. (2019). Öğrenme güçlüğü yaşayan ortaokul öğrencilerine yönelik fen bilimleri deneyleri kılavuzunun etkililiğinin incelenmesi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi, 20,* 501–534. https://doi.org/10.21565/ozelegitimdergisi.484937

Norman, G. (2020). *Özel eğitim okullarında görev yapan özel eğitim bölümü mezunu öğretmenler ile beden eğitimi öğretmenlerinin mesleki yeterliliklerinin analizi* (thesis). Malatya.

Okcu, B. (2016). *İlköğretim 8. sınıf görme engelli öğrencilere "yaşamımızdaki elektrik" ünitesi ile ilgili kavramların öğretimi* (thesis). Erzurum.

Okcu, B., Yazıcı, F., & Sözbilir, M. (2016). Ortaokul düzeyindeki görme engelli öğrencilerin okuldaki öğrenim sürecine dair görüşleri. *Amasya Üniversitesi Eğitim Fakültesi Dergisi, 5*, 51–83.

Öner, G. (2018). Zihinsel engelli öğrencilere fen bilimleri dersinde canlıların sınıflandırılmasının bilgisayar destekli bireyselleştirilmiş öğretim yöntemiyle öğretiminin etkisi (thesis). Konya.

Özak, H., Vural, M., & Avcıoğlu, H. (2008). Rehberlik araştırma merkezi müdürlerinin gönderme tanılama yerleştirme izleme ve değerlendirmeye ilişkin görüş ve önerileri. Abant Ýzzet Baysal Üniversitesi Eðitim Fakültesi Dergisi, 8(1), 189–206.

Özel Eğitim Hakkinda Kanun Hükmünde Kararname. (1997, June 6). Retrieved from https://mevzuat.gov.tr/MevzuatMetin/4.5.573.pdf.

Pemik, K. (2017). *Özel yetenekli öğrencilere destek odasında verilen eğitime ilişkin okul yöneticilerinin ve öğretmenlerin görüşleri* (thesis). İstanbul.

Sezer, Ş. (2015). Üstün yeteneklilerin sınıf içindeki olumsuz davranışları ve yönetilmesine ilişkin öğretmen görüşleri. *Uluslararası Türk Eğitim Bilimleri Dergisi,* 317–333.

Slavin, R. E. (1994). *Educational psychology: Theory and practice* (Vol. 4). Allyn and Bacon.

Sola Özgüç, C., & Cavkaytar, A. (2016). Zihin yetersizliği olan ortaokul öğrencilerinin bulunduğu bir sınıfta öğretim etkinliklerinin teknoloji desteği ile geliştirilmesi. *TED Eğitim Ve Bilim, 41*(188), 197–226. https://doi.org/10.15390/eb.2016.6691

Sözbilir, M., Zorluoğlu, S. L., & Kızılaslan, A. (2019). Görme yetersizliği olan öğrencilere yönelik geliştirilen fen etkinliklerinin bilimsel süreç becerileri öğrenimine etkisi. *Cumhuriyet International Journal of Education, 8*(1), 172–192. https://doi.org/10.30703/cije.463801

Türker, Ç. (2018). *Zihin yetersizliği olan öğrenciye fen bilimleri dersinde uygulanan tanılayıcı dallanmış ağaç tekniğinin etkililik ve verimliliklerinin incelenmesi* (thesis).

Uzoğlu, M., & Denizli, H. (2017). Fen bilimleri dersini alan kaynaştırma öğrencilerinin kaynaştırma uygulamaları sürecine ilişkin görüşleri. *Mersin Üniversitesi Eğitim Fakültesi Dergisi, 13,* 1271–1283. https://doi.org/http://dx.doi.org/10.17860/mersinefd.372160

Vuran, S. (2005). Bireyselleştirilmiş eğitim programları (bep). In O. Gürsel (Ed.), *Bireyselleştirilmiş Eğitim Programlarının Geliştirilmesi* (3rd ed., pp. 1–12). essay, Anadolu Üniversitesi.

Yazıcı, F. (2017). *6. Sınıf görme engelli öğrencilere "vücudumuzdaki sistemler" ünitesinde yer alan kavramların öğretimi* (thesis). Erzurum.

Yazıcı, F., & Sözbilir, M. (2020). 6. sınıf görme engelli öğrencilere destek ve hareket sistemi konusundaki kavramların öğretimi. *Eğitimde Kuram Ve Uygulama, 16,* 231–250.

Yazıcı, F., & Sözbilir, M. (2020). 6. sınıf görme engelli öğrencilere solunum sistemi kavramlarının öğretimi. *Erciyes Journal of Education, 4,* 68–97.

Yazıcı, F., & Sözbilir, M. (2020). Görme engelli altıncı sınıf öğrencilerine hücre konusunun öğretimi. *Eğitim Ve Bilim, 45,* 227–250. https://doi.org/10.15390/EB.2020.8765

Yazıcıoğlu, T., & Kargın, T. (2018). Serebral palsili öğrenciler için düzenlenmiş bir okulda gerçekleştirilen kaynaştırma modeline ilişkin paydaş görüşleri. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, *19*(4), 643–678. https://doi.org/10.21565/ozelegitimdergisi.335365

Yazçayır, G. (2020). *Özel gereksinimli öğrencilere yönelik destek eğitim odası uygulamalarının incelenmesi* (thesis). Eskişehir.

Yenioğlu, S. (2020). *Kaynaştırma öğrencilerine fen konularının öğretiminde tablet bilgisayar aracılığıyla sunulan fen deneylerinin etkililiği* (thesis). Eskişehir.

Yıldırım, A., & Şimşek, H. (2003). *Sosyal bilimlerde nitel araştırma yöntemleri*. Seçkin Yayınları.

Yılmaz, E., & Batu, E. S. (2016). Farklı branştan ilkokul öğretmenlerinin bireyselleştirilmiş eğitim programı, yasal düzenlemeler ve kaynaştırma uygulamaları hakkındaki görüşleri. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Özel Eğitim Dergisi*, *17*(3), 247–268. https://doi.org/10.21565/ozelegitimdergisi.266140

Yılmaz, H. C. (2017). *Çoklu yetersizliği olan az gören çocuklara doğrudan öğretimle sunulan şematik düzenleyicinin bir fen konusunun öğretiminde etkisi* (thesis). Ankara.

Zorluoğlu, S. L., & Kızılaslan, A. (2019). Görme yetersizliği olan öğrencilere fen eğitimi: ilkeler ve stratejiler. *Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi*, *51*, 315–337.

Zorluoğlu, S. L., & Sözbilir, M. (2017). Birbiri içinde çözünmeyen sıvılarda yoğunluk kavramının görme yetersizliğinden etkilenen öğrencilere öğretimi. *Eğitimde Kuram Ve Uygulama*, *13*, 211–231.

Zorluoğlu, S. L., & Sözbilir, M. (2017). Görme yetersizliği olan öğrencilerin öğretmenlerini destekleyici ihtiyaçlar. *Trakya Üniversitesi Eğitim Fakültesi Dergisi*, *7*(2), 659–682. https://doi.org/10.24315/trkefd.279369

Zorluoğlu, S. L., Çetin, Y., Aşık, A., Gündüz, Z. N., & Mertol, H. (2020). Bilim ve sanat merkezlerindeki fen bilimleri öğretmenlerinin özel yetenekli öğrencilerini değerlendirmelerine yönelik görüşleri. *Talent*, *10*(1), 95–109. https://doi.org/ https://doi.org/10.46893/talent.758691