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Difficulties Encountered by a Dyslexic Secondary School Student in Learning Science and Suggestions for Solutions

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ABSTRACT This study aims to reveal the problems faced by a dyslexic student in learning science and determine what can be considered an effective science teaching method for this kind of learner. The case study design was used, and the study was conducted with a 7th-grade dyslexic female student. This study used observations and a semi-structured interview form as data collection tools. According to the findings, the problems faced by the student with dyslexia in learning science were generally compatible with the literature and immediately affected science learning. It was deduced that the student's reading skills, writing skills, motor skills, attention, memory and comprehension, language skills, use of sensory organs, and math skills are effective in learning science and that the development of these skills is necessary for understanding and comprehending science. In order to develop these skills, it is predicted that technology-based student-centered activities and individualized teaching may be beneficial, which is in line with the constructivist philosophy. In addition, it may be practical to give technology-supported reading extracts containing scientific texts, tasks involving social interaction, and writing tasks to improve students' reading, writing, and language skills.

Keywords Dyslexia, Learning, Problems, Secondary School Student, Science

1. INTRODUCTION

According to the World Health Organization [WHO] (2011), dyslexia is the unexpected and permanent discomfort in acquiring productive reading skills despite adequate intelligence, socio-cultural opportunities, and education applied to the individual. Since dyslexia is a concept that is not fully understood by society, it is often perceived as an intelligence problem. However, to be diagnosed with dyslexia, the individual's intelligence level must be within normal limits or above. (Er Nas, Gülay, Pehlevan, & Delimehmet Dada, 2018). In the 1920s, Neurologist Samuel T. Orton, one of the scientists who conducted the first studies on dyslexia, expressed the common features of dyslexia as follows:

- Difficulty learning and remembering words
- Skipping words while reading
- Difficulty in writing
- Reverse detection of the letters b and d, p and q, and the numbers 6 and 9; mixed perception of letters or numbers in words
- Mixing the sounds of syllables or displacing consonants, often making typos
- Delayed or inadequate speech
- Difficulty choosing the most appropriate word when speaking
- Problems perceiving direction (like up and down) and time (like before, after, yesterday and tomorrow)
- Problem establishing hand-arm coordination (Korkmazlar, 2009; Kolburan & Erbay, 2015).

In 2016, the concept of learning disability was redefined by the National Joint Committee on Learning Disabilities (NJCLD) in a way that supports and resembles previous definitions. According to this definition, dyslexia; is a neurological condition that affects a person's reading, writing, speaking, spelling, calculation and inference skills, attention and memory, coordination, social skills, and emotional maturity (NJCLD, 2014).

Science is complicated for some students because it includes a wide learning area (physics, chemistry, biology, environment, etc.) and is related to abstract topics (Okumuş & Doymuş, 2018a). In addition, students may

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have difficulties learning science because they do not effectively associate science subjects with daily situations (Kirman Bilgin & Yiğit, 2017; Okumuş & Doymuş, 2018b). Since the problems experienced by dyslexic students in fundamental areas such as reading and writing affect their learning, these students may encounter some problems in learning science. Dyslexic children often learn to read and write later than their peers. The literature states that this learning difficulty can be overcome with specific training, some exercises, and tests (Bonifacci, Montuschi, Lami, & Snowling, 2014). Dyslexia is just a learning difference. Dyslexic students need a personalized reading education that includes reading instructions more systematically and clearly than their peers, designed in line with their reading level. Dyslexic students have difficulty learning due to reading difficulties (Horton, Lovitt, & Bergerud, 1990; Olson & Platt, 2004; Ormsbee & Finson, 2000). It has been emphasized that reading education to be given to dyslexic students should include intervention strategies for the basic features of dyslexia. For example, studies such as multi-sensory approach sound awareness training, teaching letter-sound relationships, and use of fluency strategies are necessary (Bonifacci et al., 2014). A similar situation can be considered for writing skills. Dyslexic students often have poor writing skills and difficulty expressing themselves (Benedek-Wood, Mason, Wood, Hoffman, & McGuire, 2014: Horton et al., 1990; Olson & Platt, 2004; Ormsbee & Finson, 2000). Dyslexic students whose reading difficulties are resolved will be more successful in writing and science as their reading comprehension skills improve. Although dyslexia is not an intelligence problem, dyslexic students struggle with reading, writing, and language skills. Therefore, in the science teaching process, it would be beneficial for a teacher with a dyslexic student in his/her class to adapt his/her teaching method with regular students to the dyslexic student.

Dyslexic students have trouble understanding complex instructions. For this reason, it is essential to use instructions that they can understand during the lesson. For example, a dyslexic student can understand a concept in a science class experiment on his/her own. However, when that concept is used with other situations or concepts, it may not be understood by the student, or the student cannot generalize what he/she has learned to other situations (Kaldenberg, Watt, & Therrien, 2014; Melekoğlu & Çakıroğlu, 2017). Therefore, this situation will cause the student to lag behind his/her peers in the learning process. In light of this, teaching the process steps more slowly and repetitively would be appropriate, especially in processes that include steps such as experiments. In dyslexic students' science learning studies, students need additional learning (Therrien, Taylor, Hosp, Kaldenberg, & Gorsh, 2011). Also, it was determined that students could not associate abstract concepts with the natural world and their motivation toward science was low (Laine, Nygren, Dirin, & Suk, 2016). Studies on science learning of students with learning disabilities are available in the literature (Gebbels, Evans, & Murphy, 2010; Turan & Atila, 2021). For example, Turan and Atila (2021) determined that augmented reality technology positively affected the science learning of students with special learning difficulties. In their study, Scruggs, Mastropieri, and Boon (1993) taught two science units named "Magnetism and Electricity" and "Rocks and Minerals" to four students with special learning difficulties in a special education class using activity-based, inquiry-based, or textbook-based teaching approaches. At the end of the study, although the students' vocabulary acquisition in both units was limited, they performed significantly higher in the immediate and delayed tests when the students learned with the inquiry-based approach. If a dyslexic student receives supportive education, being in constant cooperation with the place where he/she receives support facilitates the process. In this way, keeping in touch helps the student to be better known by the teacher, and the science teaching process becomes effective. In the education of dyslexic students, it is crucial to close the gap between them and their peers by providing various support applications with the cooperation of the family and school in terms of the correct management of the process (Karaer & Melekoğlu, 2020).

Dyslexic students often have problems with math skills (American Association for the Advancement of Science (AAAS), 1993; National Research Council (NRC), 2000). Considering that science and mathematics are two essential and interrelated fields, it can be said that the students' inadequacy in mathematics will also directly affect science learning. In this context, dyslexic students need help adapting to the process with different strategies and practices to improve their math skills. It should not be forgotten that dyslexic learners have attention deficits. They cannot concentrate on a subject or situation for long periods.

For this reason, they also have difficulties in understanding subjects. In this process, the teacher must make interventions that facilitate learning. For example, since some dyslexic students write letters and numbers backward, it may help to focus students' attention if the teacher writes on the board more broadly and clearly and adjusts the tone so they can also hear clearly. Science courses are also important in attracting students' attention because science is fundamental as it develops the skills of dyslexic students, such as observing and classifying ordinary events (Karaer & Melekoğlu, 2020).

Another common characteristic of dyslexic students is that they often remain silent in the lessons. A quiet student may have problems fully understanding the lesson as he/she cannot tell the teacher what he/she does not understand. For this reason, students' language skills may also be insufficient. The teacher can encourage students in this situation to say things they do not understand. The

science includes verbal subjects as well as numerical subjects. Therefore, it would be appropriate for dyslexic students if the instructor gave plenty of examples so that everyone could understand the verbal parts of the lesson and put further instructions for the dyslexic student on the board. In this way, the student is encouraged. Another way to increase the interest of dyslexic students in a science classroom setting can be to show animation with colorful and moving objects (Karaer & Melekoğlu, 2020). Griffin, Simmons, and Kamenui (2006) stated in their study that graphic organizers make it easier for dyslexic students to understand various concepts. In addition, it is an effective way to give clues about the questions the dyslexic student could not solve during the lesson so that his/her interest in science does not diminish. This will contribute to the student's efforts to solve the question again and motivate him/her. Motivation increases the perceptive power of the individual. Strong motivation ensures that attention is focused on one point. In other words, the higher the individual's motivation, the higher his/her perception (Vatansever Bayraktar, 2015). Maybe this is about creativity.

There are not enough studies in the literature on teaching science to students with dyslexia (Dilber, 2017; Er Nas, Şenel Çoruhlu, Çalık, Ergül, & Gülay, 2019; İlik, 2009; Ward, 2010) and most studies are generally in the field of classroom education (Balcı & Çayır, 2017; Başar & Göncü, 2018; Çeliktürk Sezgin & Akyol, 2015; Dündar & Akyol, 2014; Fırat & Koçak, 2018). Er Nas et al. (2019) developed a science experiment guide for middle school students with learning difficulties and looked at its effectiveness. Accordingly, the developed guide positively affected students' conceptual understanding. Dilber (2017), in her study of science teachers, revealed that many teachers do not create or produce a special application for their students with learning difficulties; instead, they conduct the lessons the same way they do with other students. Keeping dyslexic students in the background in the teaching process does not comply with forming all students as science literate. In this respect, it is necessary to reveal the difficulties these students face in learning science and perform studies on this to integrate them into society. For this purpose, this study aims to reveal the problems faced by a dyslexic student in learning science and determine what can be considered for effective science teaching. For this reason, this research will contribute to the literature. In this study, answers to the following research questions were sought.

1. What are the problems a secondary school dyslexic student faces in the 7th-grade learning science in Turkey?

2. What are the points to be considered for effective science teaching to dyslexic students?

2. METHOD

In this study, the exploratory case study design was used as the aim was to reveal the problems faced by a 7th-grade secondary school dyslexic student in learning science and determine the points to be considered for effective science teaching. Stake (1995) stated that "A case study is expected to catch the complexity of a single case … Case study is the study of the particularity and complexity of a single case, coming to understand its activity within important circumstances." Yin (2003) emphasized the following for the case study: "In general, case studies are the preferred strategy when 'how' or 'why' questions are being posed, when the investigator has little control over events, and when the focus is on a contemporary phenomenon within some real-life context." For all these reasons, the exploratory case study pattern was used.

2.1 Participant

The study's participant consists of a dyslexic female student studying in the 7th grade of a secondary school in Turkey. The convenience sampling method was used in sample selection. The Provincial Directorate of National Education provided a list of schools with dyslexic students, and a suitable student sample was then selected by contacting the school administration and parents and obtaining their permission. The selected student's parents cooperate with the school for their children to learn better. In addition, the student was informed about the process. The student welcomed the observation. Other students in the class did not know that the dyslexic student was being observed.

2.2 Data Collection Tool

Observations and semi-structured interviews were used as data collection tools in the study. Accordingly, the student was observed in the science lesson with the observation form prepared in advance. Since the student was observed in her natural environment, natural and participatory observations were used since the researcher personally participated in the process. The observation form used was titled Dyslexic Secondary School Student Observation Form-DSSSOF. While creating the DSSSOF, the "Performance Determination Form for Individuals with Special Learning Disabilities," created by the General Directorate of Special Education Guidance and Counseling Services of the Ministry of National Education in Turkey, was used. In the form, reading skills, writing skills, motor skills, attention, memory and comprehension, language skills, use of sensory organs, and math skills were observed, and general observations were made. Observations continued for four weeks. The statements in the form were arranged within the science course framework and reviewed by an expert in science education. A pilot study was conducted on a dyslexic student to ensure the reliability of the DSSSOF. In this study, a semi-structured interview was used because it allowed the interview to be planned and prolonged. For this purpose, a Semi-Structured

Interview Form (SSIF) was developed. There are eight open-ended questions in the SSIF. Expert opinion was taken for the questions formed, and a pilot study of the SSIF was conducted with the dyslexic student.

2.3 Data Analyses

Qualitative data analysis was performed, and content analysis was applied to analyze the data collected from the DSSOF and the SSIF in depth. Firstly, the themes, codes, and sub-codes for the DSSSOF were created based on the existing themes and codes in the literature regarding the features examined in the observation form. Researchers created sub-codes by taking samples from previous studies and according to the frequency of the student's behavior. Each observation was analyzed according to this theme, codes, and sub-codes. The relationship of the related skill with science learning was analyzed in the sub-codes. Accordingly, the themes, codes, and sub-codes created for the DSSSOF are given in Table 1.

The content analysis of the DSSOF consists of eight themes, 24 codes, and 24 sub-codes. The data obtained from the SSIF were analyzed in two parts the student's interest in science, the parts with the most difficulty, and how much of the subjects she could understand. Accordingly, the themes and codes in the content analysis for the SSIF are given in Table 2. According to Table 2, the content analysis of the SSIF consists of three themes and nine codes.

Table 2 Themes and codes generated for the content analysis of the SSIF

Theme	Code
Interest in Science -IS	Positive
	Negative
Most Difficult Parts - MDP	Unit
	Teacher
	Content
Understanding the Topics - UT	Focusing
	Activity
	Content

2.4 Process

The DSSSOF and the SSIF were primarily developed during the study process. The validity and reliability of the DSSSOF and the SSIF were then provided. Subsequently, observations were performed for four weeks and 16 hours. Observations were collected during the four weeks when schools were open and the student attended school during the COVID-19 pandemic. After the observations were completed, the SSIF was conducted with the student. After the whole process was finished, the data analysis phase was initiated.

Table 1 Themes, codes, and sub-codes generated for the content analysis of the DSSSOF

Theme	Code	Sub-code (related to science)
Reading Skills- RS	Sufficient- S	High Level-HL
	Partially Sufficient - PS	İntermediate Level- IL
	Insufficient -I	Low Level-LL
Writing Skills- WS	Sufficient- S	High Level-HL
	Partially Sufficient - PS	İntermediate Level- IL
	Insufficient -I	Low Level-LL
Motor Skills- MS	Sufficient- S	High Level-HL
	Partially Sufficient - PS	İntermediate Level- IL
	Insufficient -I	Low Level-LL
Attention, Memory, Comprehension- AMC	Successful- Sc	High Level-HL
	Partially Successful - PSs	İntermediate Level- IL
	Unsuccessful-U	Low Level-LL
Language Skills- LS	Sufficient- S	High Level-HL
	Partially Sufficient - PS	İntermediate Level- IL
	Insufficient -I	Low Level-LL
Using the Sense Organs - USO	Successful- Sc	High Level-HL
	Partially Successful - PSs	İntermediate Level- IL
	Unsuccessful-U	Low Level-LL
Math Skills- MaS	Sufficient- S	High Level-HL
	Partially Sufficient - PS	İntermediate Level- IL
	Insufficient -I	Low Level-LL
General Observation - GO	High Level-HL	High Level-HL
	İntermediate Level- IL	İntermediate Level- IL
	Low Level-LL	Low Level-LL

3. RESULT AND DISCUSSION

3.1 Findings and Discussion Obtained from the DSSSOF

This study aimed to reveal the most critical problems facing a dyslexic student in learning science. Accordingly, the student's reading, writing, motor, attention, memory and comprehension, language skills, use of sensory organs, and math skills were observed. The findings obtained from the DSSSOF showing the change in student behavior for each theme in the study process are presented in Table 3.

According to Table 3, the student is partially sufficient in the reading skills theme. According to the notes taken during the observations, she cannot understand the text for the RS theme every week if she does not read it herself, and she is reluctant to read because long texts are boring, and she does not want to read until the end of the topic. Her ability to read texts in a book, notebook or 5in an activity description is partially sufficient. The fact that she gets bored quickly with the act of reading and cannot understand what someone else is reading causes her to reread the text. Therefore, she experiences a loss of time during the course process and does not want to read the subject to the end. This situation negatively affects her science learning. Also, she sometimes adds sounds and syllables to the text she is reading, misreads sounds and words, makes up the end of the word, and follows the text with her fingers while reading. These are common in dyslexia (Korkmazlar, 2009; Kolburan & Erbay, 2014; Taymaz Sarı & Biçer, 2020). In addition, she sometimes has difficulty answering the questions about the text she has read. Furthermore, her reading skill has an intermediate effect on learning the science lesson. Another noteworthy situation is that she constantly followed the writings with her fingers while reading. It can be deduced that all these behaviors make it difficult for her to understand the reading passage because it is observed that she sometimes has difficulty answering the questions about the text she has read. From the general observations, it is seen that the reading skill of the student affected the learning of the science lesson at an intermediate level. It is thought that developing her reading skills will enable her to understand science concepts more quickly. In this respect, it is recommended that the student regularly read texts on scientific subjects with traditional and technological tools to improve reading skills (Tangkakarn & Gampper, 2020). Because the Z generation has existed in technology, and some applications make life easier in many areas thanks to technology.

She is partially sufficient in the writing skills theme. Her writing is legible for the WS theme. The fact that she tries to write very quickly while taking notes is determined. This

Table 3 Findings from the DSSSOF

Theme	Code	Sub-code	Week 1	Week 2	Week 3	Week 4
RS	S	HL				
	PS	IL	x	x	x	x
	I	LL				
WS	S	HL				
	PS	IL	x	x	x	x
	I	LL				
MS	S	HL				
	PS	IL		x		
	I	IL	x		x	x
		LL				
AMC	Sc	HL				
	PSs	IL		x		
	U	LL	x		x	x
LS	S	HL				
	PS	IL	x	x	x	x
	I	LL				
USO	Sc	HL				
		IL		x	x	x
	PSs	IL	x			
	U	LL				
MaS	S	HL				
	PS	IL		x	x	x
	I	LL	x			
GO	HL	HL				
	IL	IL	x	x	x	x
	LL	LL				

situation causes her handwriting to be sometimes illegible because it is more legible when she is not trying to write quickly. She sometimes also skips syllables and letters, adds letters or syllables, and does not use punctuation marks in the appropriate place.

Additionally, she sometimes writes the words aloud and cannot write her thoughts in their entirety. That is, it also pronounces the word while typing. Therefore, she cannot put into writing what she says in language. Another remarkable aspect is that she tries to take notes on everything that is said. This situation prevents the student from focusing on the lesson. It is a typical situation that one who cannot focus on the lesson will not be able to fully understand the subject because the focus is essential for learning. In addition, she sometimes has difficulty writing down what is written on the board in her notebook. This shows the weakness in writing skills. Johnson (2013) determined that children who have difficulty reading also have problems in the field of writing, and he determined that systematic writing practices also accelerate reading (Taymaz Sarı & Biçer, 2020). In this context, reading and writing skills are essential in improving the student's science achievement and should be considered as a whole. From the general observations, the student's writing skill affects learning the science lesson at an intermediate level. Writing skills can be improved by giving the student various assignments that require writing regularly (in a way that does not cause boredom for the student) (Rodriguez-Hernandez & Silva-Maceda, 2021). For example, the student can be given the task of writing a composition about where she can use the information she learned in the science lesson that day in daily life. Alternatively, the student may be asked to write a list of the topics they understand best and have difficulty understanding in the science lesson that day.

She is generally inadequate in the motor skills theme. It is noteworthy that she holds the pencil tightly as if it will fall out of her hand at any moment. Her hand-arm coordination is weak. This situation causes the student to have difficulty doing assignments that require psychomotor skills. Hand-eye coordination is sometimes poor. In addition, she has severe problems converting homework into the material. This may be due to not fully understanding the purpose of the assignment. The fact that she is not very successful in material assignments may also be due to the teacher's attitude because their critical comments in response to her homework disrupted her motivation. This situation causes the student to develop a negative attitude towards the other assignments she has to do and reduces her interest in the lesson. Her weak motor skills and the teacher's attitude towards the materials they create negatively affect her science learning.

She is generally unsuccessful in terms of attention, memory, and comprehension skills. This finding is consistent with the literature (Başar & Göncü, 2018; Ekşi Sınır, 2020; Kesikçi & Amado, 2005). She sometimes gives irrelevant answers to the questions asked and refers to examples that are not relevant to the subject. In addition, she uses gestures and facial expressions more than necessary. Another excellent point about the student is her inability to plan the time correctly. For this reason, she cannot complete her work. She often finds it difficult to follow directions. Also, she confuses the order of events, especially when telling a story she has read or listened to. Furthermore, she does not know where to start the tasks she needs to fulfill. Confusing the order in a given situation is another critical issue. It is also known that individuals with dyslexia have 12-24% of attention deficit and hyperactivity disorder (Balcı, 2019; Shaywitz, Fletcher, & Shaywitz, 1994). This may be the reason for the student's behavior. The general observations show that the student's lack of attention, comprehension, and comprehension skills generally affects learning the science lesson negatively. Concepts are essential for science education. In this respect, necessary to perform various studies to reveal and develop the comprehension skills of dyslexic students for effective science learning.

She is partially sufficient in terms of language skills. She can generally express herself, sometimes use words with different meanings, and has difficulty finding the right word while speaking. It is also stated in the literature that the vocabulary of dyslexic students is limited (Bishop, McDonald, Bird, & Hayiou-Thomas, 2009; Delimehmet Dada & Ergül, 2020; Seçkin Yılmaz & Yaşaroğlu, 2020). In addition, she is excited while talking in a crowd and has difficulty expressing her feelings and thoughts. Dyslexic individuals get excited, stuck, and confused, especially when talking in public. While they are sometimes very self-confident in verbally expressing their thoughts and feelings, they are sometimes introverted. While they can communicate more efficiently with their close friends, they avoid making eye contact with strangers and prefer not to talk. This was also the case with our student. The results obtained are compatible with the literature (Seçkin Yılmaz & Şemşedinovksa, 2020), and this negatively affects the social relations of dyslexic individuals (Conti-Ramsden & Botting, 2004; Helland, Lundervold, Heiman, & Posserud, 2014). In the literature, dyslexic individuals also experienced these problems in terms of language skills (Seçkin Yılmaz & Sarı, 2020; Seçkin Yılmaz & Şemşedinovksa, 2020; Snowling, Hayiou-Thomas, Nash, & Hulme, 2019). In this respect, the results of this study are compatible with the literature. From the general observations, the student's language skills moderately affected the learning of the science lesson. Her ability to use the language effectively will contribute to correctly learning science concepts. There is a relationship between language skills and science learning (Delimehmet Dada & Ergül, 2020). Doing oral activities that improve the

student's language skills and ensuring the student's participation will positively affect science learning.

She is generally successful in using sensory organs (sense of sight, sense of hearing, and sense of touch) effectively. Although she does not experience any problems in seeing, hearing, and feeling, the perception of distance, depth, and size is not very good. The literature states that dyslexic students generally have no problems using their sensory organs (Korkmazlar, 2003). In this respect, the results of this study are compatible with the literature. She does not have difficulty distinguishing the objects. However, she sometimes cannot perceive one specific sound she hears simultaneously with other sounds. Also, she may sometimes have problems in grouping and matching objects. Therefore, it will be adequate to perform the applications in line with the experts' recommendations (special education specialists) so that she can use her sensory organs effectively. From the general observations, her ability to use her senses affects learning the science lesson at an intermediate level. Considering that the sufficient psychomotor skills of the student will facilitate understanding and learning, it is predicted that activities that will ensure the physical and mental development of the student as a whole will be practical.

Her math skills are partially sufficient. However, she does not like mathematical operations (She said that in the semi-structured interview. These were discussed in the SSIF analysis section.). Considering that many students see mathematics as a complex and boring subject, it can be said that children with learning difficulties do not like mathematics. Also, she confuses about math terms and concepts. It is not surprising that these behaviors, common in dyslexia (Taymaz Sarı & Biçer, 2020), are also present in this student. Complex symbols and terms reduced the student's interest in the lesson. In addition, she has difficulty following the steps to be followed while solving the problem and sometimes performing the four operations. She gets bored of studying the units or subjects required by mathematical operations, and this affects science learning. The general observations show that the math skill of the student affects the learning of the science lesson at an intermediate level. Many operations in science require mathematical processes. This is why students with weak mathematics have difficulty understanding science. In this respect, designing and implementing activities that improve the student's math skills will also increase the student's science achievement.

In general, when the student's academic achievement is considered, it is at an intermediate level compared to her classmates and age. Despite having a learning disability, she is not a student who does very poorly in the classroom. This shows that if a good education is provided, she has similar learning to her peers in the classroom. It has been observed that behaviors affect the student's learning. In this context, her acting without thinking, acting impatiently, and sometimes dropping out of assignments containing long texts can affect her learning. In addition, it can be deduced that the rapid decline of her self-confidence in unfamiliar environments or the presence of foreign people prevents the student from showing sufficient success in learning science. Better recognizing dyslexic students and identifying their needs will effectively ensure effective science learning.

3.2 Findings and Discussion Obtained from the SSIF

This section presents the findings obtained from the SSI conducted with the student after the observations were completed. In this context, the students' answers were analyzed by considering the themes and codes in the content analysis. Findings from the SSIF are given in Table 4.

According to Table 4, she gives a positive answer to the question "Do you like science? Are you interested in the lesson? Why?" for the interest in science theme. She enjoys research, learning, and discovering new things and sees the science lesson as a tool. However, she states that the verbal parts of the lesson do not attract her attention. She likes the science lesson but has difficulties with some parts. It can be said that she sees science as a way to learn and discover new things. The broad subject area of science is related to almost every field of the scientific world. In this respect, understanding science makes it easier to understand the world. It is gratifying that she is aware of

Table 4 Findings from the SSIF

Theme	Code	Student's statements
IS	Positive	*"Science class interests me. Because I enjoy researching, learning and discovering something new.."*
	Negative	*"Doesn't attract my attention when verbal issues are predominant."*
MDP	Unit	*"I had a very difficult time understanding the 'Cell and Divisions' unit. Because it was very abstract and I had a lot of trouble grasping it. I was so bored with this unit that I could easily get distracted. This made me focus on the lesson."*
	Teacher	*"Sometimes I have a hard time understanding. I can't understand because of the way our teacher explains the subject. I can't understand the subject or forget it quickly when it is only verbally explained and passed.."*
	Content	*"I have more difficulty in understanding verbal content. Because when someone else reads it, I can't understand the subject. I need to read that topic from beginning to end so that I can understand it. Otherwise, I cannot comprehend the subject and the lesson is very boring for me."*

Table 4 Findings from the SSIF (*Continued*)

Theme	Code	Student's statements
UT	Focusing	*"No, I'm not having trouble. It's fun to answer questions."*
		"I can focus on the lesson without being distracted from the beginning to the end of the lesson, but until 1 year ago, I could get distracted very quickly. I could stay fixed in one place for a long time and just dive in until someone warned me. Later, with the support of my family, teachers, and most importantly, my belief in myself, I was able to overcome this very big problem."
	Activity	*"No, I'm not struggling. On the contrary, I have a lot of fun doing it. Understanding by doing makes me more permanent. For example, whenever I see the subject that we did the experiment or the subjects that I learned in the form of a game, the experiment we did that day comes to my mind and I can remember it immediately."*
	Content	*"I have difficulty in understanding when there is a lot of verbal content and the experiment is not done and passed. But when I experiment and understand the subject, reading the activities becomes enjoyable and then I don't have any difficulties doing it anymore."*

discovering. However, she is bored with some verbal subjects in science. The fact that verbal topics contain long explanations may have reduced her attention in the lesson. This situation can cause the student to have difficulty understanding verbal subjects and result in a negative attitude towards understanding verbal subjects.

In the theme of the most difficult part, she answered the question "Which unit is the hardest for you to understand in science class? Why?" for the "unit" code and stated that she had difficulties in the "Cell and Divisions" unit. She attributes the reason for this situation to the abstractness of the unit. The science includes abstract concepts and explanations, especially in biology and chemistry (Okumuş & Doymuş, 2018a). This situation negatively affects her interest and understanding of science. In this context, it can be expected for dyslexic students not to understand the subject of cell divisions, while abstract subjects affect science achievement, even for students who do not have learning difficulties.

She answers 'the teacher's style' to the question "Do you ever have trouble understanding science? If your answer is yes, why?" for the "teacher" code in the theme of the most difficult part. Accordingly, she states that the teacher's monotonous and verbal teaching of the lesson made it difficult for her to understand it. Furthermore, the teacher's teacher-centered instruction during the lesson can negatively affect her understanding of the lesson. The fact that even students who do not have learning difficulties cannot show sufficient success in a teacher-centered education system, especially since the beginning of the 2000s, updates have been made in the programs within the framework of the constructivist learning approach in Turkey (Ministry of Education (MoE), 2013; 2018). In this context, she cannot learn science at the desired level with practices such as regular or basic lectures or boring lectures (Güven & Aydoğdu, 2009).

On the other hand, students in need of special education learn in a more complicated manner than their peers on a regular period. In this respect, using student-centered teaching models, methods, and techniques supported by technology and giving more space to individualized teaching will effectively engage students in need of special education in the teaching process. Furthermore, within the framework of the inclusive education program, students in need of special education in many schools at the secondary level receive lessons in the same classes as other students (Sarı & Biçer, 2020). However, it is stated in the literature that teachers do not have enough knowledge and skills to acquire special students and make them active in the lesson (Gök & Erbaş, 2011; Sucuoğlu & Akalın, 2010). Furthermore, Odom (2000) emphasizes that teachers play a main role in successful and qualified inclusive practices. Therefore, it will be effective for teachers of all subjects, including science, to receive in-service theoretical and practical training on practices that will enable students with special education needs to participate actively in the process.

In response to the question "Do you have a harder time understanding verbal or numerical content in science class? Why?" asks for the "content" code in the MDP theme, and she states that she has a more challenging time understanding verbal subjects. She also states that she can only fully understand the subject when she reads it herself. The student has more difficulty understanding verbal subjects in science. This may be due to her weakness in reading skills because she states that she can only fully understand the subject when she reads it herself. The science includes many scientific concepts, and this makes the course challenging. The fact that she has reading difficulties also increases the lesson's difficulty. In this context, applications such as the use of exciting texts and the case study method will effectively improve the student's reading skills and increase his/her interest in verbal subjects in science.

In understanding the theme of the topic, she answers that she does not have any difficulties with the question, "Do you have difficulty attending class in science class? If your answer is yes, why?" asks for the "focusing" code. In response to the question "How many minutes can you listen to the lecture without interruption in science class? Do you have problems concentrating in the lesson? If your answer is yes, why?" another question asks for the

"focusing" code in the UT theme, she states that she can focus throughout the course. When the student looks at it from her perspective, it has been determined that she sees herself well in the lessons. However, it was stated above that she had problems understanding the subjects, writing and reading, participating in the lesson, and expressing herself. She also states that she has improved herself on distraction and receives support in focusing this year. She mentions that with the support of her family and teachers, her self-confidence increases, and her focusing problem decreases.

In response to the question "Do you have difficulty in understanding activities such as experiments, games, and problem-solving in science class? If your answer is yes, which parts are the most difficult?" for the "activity" code in the UT theme, she states that she does not have difficulty in understanding activities such as experiments, games, and problem-solving in the science lesson. On the contrary, these applications make it easier to understand the lesson, and she attains more permanent learning when she learns by doing. Therefore, student-centered applications and activities supported by technology can make it easier for students to understand the lesson and enable them to learn science in a more fun way. The results obtained in studies conducted with secondary school students show parallelism with these results (Çalışkan & Kapucu, 2021; Demirel & Özcan, 2021; Eyecioğlu & Yeşilyurt, 2021; İdin & Aydoğdu, 2021). Within the framework of these results, applying different methods and techniques will successfully enable dyslexic students to learn science.

In response to the question "Do you have difficulty reading and understanding the activities in the science book? If your answer is yes, which parts are the most difficult?" asks for the "content" code in the UT theme, she states that she has difficulty in understanding when there is much verbal content, and the experiment is not done and passed. On the other hand, she says that she understands the activities supported by experiments more effortlessly and better. Since experiments constitute a large part of the science content, it can be understood from the student's explanation how important it is to include experiments in the course process. In studies conducted with secondary school students, generally, experiments are more effective in understanding and remembering the subject and improving scientific process skills (Aydoğdu & Ergin, 2008; Er Nas et al., 2019; Gilbert & Reiner, 2000). Similarly, experiments can be important in the science learning of dyslexic students with learning difficulties.

4. CONCLUSION

It is crucial to identify dyslexic students, recognize dyslexia correctly, and analyze these symptoms well. It is even more critical for the teacher to be aware of a dyslexic student and to manage the process considering this situation, especially in lessons that include abstract concepts such as science lessons. Thus, the teacher can help the student to overcome the problems encountered in the learning process. In this study, the problems faced by a dyslexic student in learning science are examined, the results are generally compatible with the literature, and it is concluded that this situation has a moderate effect on science learning. It is deduced that her reading skills, writing skills, motor skills, attention, memory and comprehension, language skills, use of sensory organs, and math skills are effective in learning science and that the development of these skills is necessary for understanding and comprehending science. Technology-based student-centered activities and individualized teaching may benefit from developing these skills, which aligns with the constructivist philosophy. In addition, it may be helpful to give reading extracts containing scientific texts, tasks involving social interaction, and writing tasks to improve students' reading, writing, and language skills. Also, educational and attention-grabbing activities may improve students' math skills. In addition, it will be appropriate to use experiment activities that facilitate remembering and learning and that appeal to many senses so that the dyslexic student can be provided with permanent and practical learning in science learning.

Considering that there are inclusive students in almost every school in Turkey, it will be easier for teachers from all branches of education to receive theoretical and practical in-service training on special education at regular intervals and to initiate updates in training in the education process of children with special education needs. It is crucial to act according to experts' recommendations and provide psychological support to adapt and include dyslexic students in the science learning process and facilitate learning. In addition, the importance of helping and guiding all members of the family and school organization in this process cannot be denied.

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