The Effect of OpenDyslexic Font on Fluent Reading and Reading Comprehension Skills of Students with Dyslexia

 Nur Karatay, Teacher, Corresponding Author
Ministry of National Education, Türkiye
karataynur14@gmail.com
Orcid ID: 0000-0002-0798-2647

 Emre Ünal, Prof.Dr.
Niğde Ömer Halisdemir University, Türkiye
dr.emreunal@gmail.com
Orcid ID: 0000-0002-1213-3965

Abstract

In this study, the effect of OpenDyslexic font on increasing the reading fluency and reading comprehension skills of students with dyslexia was investigated. For this purpose, the effect of OpenDyslexic font on increasing the reading speed, reading accuracy, prosodic reading levels, reading levels and reading comprehension levels of students with reading difficulties was examined. Three students with a diagnosis of "Learning Disability" and a subdiagnosis of "Mixed-Type Disorder in Scholastic Skills" participated in the study. Participants are 10 years old and fourth grade level. In the study, "Inter-Subject Multiple Probe Model", one of the single-subject research designs, was used. In order to collect the research data, texts suitable for the fourth grade level were used. At the beginning level of the research, the texts in the font used in the textbooks were studied, and in the application phase, the texts were converted to OpenDyslexic font. Research results show that OpenDyslexic font is effective in increasing reading fluency and reading comprehension level in all three students. There was an increase in participants' reading speed, reading accuracy, prosodic reading and reading comprehension skills. It is recommended to include texts prepared with OpenDyslexic font in school textbooks.

Keywords: Dyslexia, OpenDyslexic, learning disability, specific learning disability, mixed-type disorder in scholastic skills.

Introduction

Reading is becoming more and more important in the academic, social and personal development of individuals. However, there are several students who have reading problems in schools (Bingöl, 2003). One of the most important causes of reading problems is known as "dyslexia". Dyslexia; which is a genetically based neurodevelopmental reading disorder characterized by reading, decoding and spelling problems at the word level and disorders in oral reading fluency and usually manifests as a deficiency in phonological abilities. (Rello and Baeza-Yates, 2013; Hoien and Lundberg, 2000).

Dyslexia is commonly classified as acquired and developmental dyslexia. Acquired dyslexia is a reading disorder caused by brain damage, also known as "alexia" or "traumatic dyslexia". It is a condition that is generally seen in adults, and it is a condition that occurs when the reading ability, which is fully acquired and developed before, is lost as a result of accident, tumor, stroke, drugs used, psychiatric disorders or damage to the brain due to aging (Brunswick, 2009; Doyle, 2002). Those having reading loss are divided into groups according to the reading or spelling mistakes they make, or the specific literacy skills they seem to lack (Doyle, 2002). Accordingly, the most known types of acquired dyslexia are deep dyslexia, surface dyslexia and phonological dyslexia. Although there is no single universally accepted definition of developmental dyslexia, many proposed definitions generally describe its symptoms and point to the possible cause. The American Psychiatric Association (APA) defines developmental dyslexia as an unexpected, specific, and persistent failure to acquire productive reading skills despite traditional teaching, adequate intelligence, and sociocultural opportunities (Nicolson & Fawcett, 2008).

A good number of hypotheses have been put forward to use in the diagnosis and treatment of individuals with dyslexia in order to eliminate reading difficulties. One of these hypotheses, the "Magnocellular Deficiency Hypothesis", shows that the magnocellular systems of dyslexics are different from each other as responsible for their reading difficulties. This hypothesis is based on the fact that the magnocellular system is very actively involved in the saccadic movement of the eyes during reading (Vellutino, Fletcher, Snowling, & Scanlon, 2004; Vender, 2017). Proponents of the Magnocellular

Deficiency Hypothesis claim that the magnocellular system is not active in the normal order of functioning in relation to the reading difficulties experienced by dyslexics, and they show the problems they experience in the visual focus of attention, timing and tracking of eye movements in dyslexics. The fact that the magnocellular system is responsible for detecting visual movement, sensing the direction of movement, controlling eye movement, timing and tracking eye movements, and changes in the focus of visual attention and eye movements have led them to this conclusion (De Leeuw, 2010; Stein, 2018; Wilsenach, 2006). The lack of the magnocellular system makes it difficult to control eye movements, causing the reader to be unable to position the letters and see the letters moving as they slide over each other (De Leeuw, 2010; Wilsenach, 2006). Changing the place of letters is one of the most common situations in dyslexics. This is due to the inability to direct both eyes to the same point steming from the inability to control eye movements, which leads to 'reverse' letter effects (Goswami, 2014). The visual confusion of the letters or their reverse order causes the visual form of the words not to be transferred to the visual dictionary or memory, which is emphasized in reading, and thus, spelling skills cannot be acquired (Wilsenach, 2006).

Individuals with dyslexia who are exposed to these difficulties cannot make positive progress with traditional teaching methods. The British Dyslexia Association (2021) and Bender (2012) stated that while dyslexic individuals resist standard intervention methods, their difficulties can be alleviated with appropriate special intervention methods. One of the special intervention methods for individuals with dyslexia is the use of special tools such as adapted typography. According to Zelinkova (2003), the reading performance of students with dyslexia is significantly affected by the graphic qualities of the text, such as font and size, line spacing or letter spacing. Dyslexic readers must put more effort in word recognition and focus more on the text compared to other readers, making them more sensitive to all visual aspects of the text (Zikl et al., 2015). This finding prompted the authors to further examine the effect of visual features of text on reading in individuals with dyslexia.

Recent studies on dyslexia have emphasized that it may be beneficial to prepare the texts they read in a different quality from those presented to normal readers in order to enable dyslexics to read in better conditions. Therefore, different fonts have been designed that are claimed to make it easier for individuals with dyslexia to read. One of them is the OpenDyslexic font, which is the subject of our research.

OpenDyslexic Font

Many fonts are designed differently to provide better reading performance for dyslexics. Among these, apart from "OpenDyslexic" (Gonzalez, 2021), which is the subject of our study, there are also "Lexie Readable" (Bates, 2021) and "Dyslexie" (Dyslexie Font, 2021). The common feature of the designed fonts is the use of simple handwriting forms of certain letters and avoidance of letter symmetry in order to increase the reading performance of dyslexic readers, as well as increasing the spacing between letters, words and lines in the text (Harle et al., 2013).

OpenDyslexic is an open source font created to increase the readability of texts for individuals with dyslexia (Laddusaw and Brett, 2019). The OpenDyslexic font is designed to assist with the most common reading difficulties in dyslexics. The first of these is the confusion of letters that are similar to each other, as in the example of 'b' and 'd'. In the OpenDyslexic font, this problem was tried to be solved by giving fullness in different directions to make the letters distinguishable from each other (see Figures 1 and 2). According to Laddusaw and Brett (2019), the design of letters with fullness in different

directions and their unique shapes help prevent the mind of the dyslexic reader from moving and turning the letters.

Figure 1. OpenDyslexic letter notation (OpenDyslexic, 2021)

Figure 2. OpenDyslexic comparison (OpenDyslexic, 2021)

The OpenDyslexic font has been widely used on many platforms such as Wikipedia, Amazon Kindle Paperwhite and Koboe Reader, since it is open source after its design (Laddusaw and Brett, 2019). In the studies conducted, it has been determined that the OpenDyslexic font reduces the reading anxiety and reading errors of dyslexics, keeping their concentration on the text more intensely and enabling them to read for a long time (Zikl, et al., 2015; Laddusaw and Brett, 2019; Wery and Diliberto, 2016; De Leeuw, 2010).

Studies have also found that positive results will increase due to the increase in the experience of students using the OpenDyslexic font (Zikl, et al., 2015; Barsky and Grigorovich, 2013). Therefore, it is expected that the positive results from the first use of the OpenDyslexic font will be further enhanced by the increasing familiarity of the students with the font. This can be achieved by using the same font throughout a long process, starting from the first step of their education life to the end. In addition to the positive results obtained in the use of the OpenDyslexic font, studies concluded that no positive or negative difference was observed or they did not provide positive contributions. In these studies, although the OpenDyslexic font was found to be more readable and more suitable for dyslexics, it was also found that it did not significantly contribute to reading speed and did not shorten the eye fixation time (Zikl, et al., 2015; Wery and Diliberto, 2016; De Leeuw, 2010; Rello and Baeza-Yates, 2013).

In this research, the effect of OpenDyslexic font on improving reading fluency and reading comprehension skills of students diagnosed with dyslexia was examined. For this purpose, the effect of OpenDyslexic font on improving a) oral reading speed, b) reading accuracy, c) prozodic reading levels, d) reading levels and e) reading comprehension levels of students with reading difficulties has been looked at.

Method

This section is explained under six sub-titles: (a) research design, (b) dependent and independent variables, (c) participants and their selection, (d) data collection tools, (e) data collection, (f) data analysis.

Research Design

In this study, quasi-experimental research method, one of the experimental research methods, was used to determine the effect of OpenDyslexic font on increasing fluent reading (reading speed, reading accuracy, prosodic reading) and reading comprehension skills of students with reading difficulties. In our study, which was conucted with the participation of three students diagnosed with dyslexia, the multiple probe model between subjects, which is one of the single-subject experimental research designs, was used. Under the heading of experimental research, two groups of research are mentioned, namely real/full experimental research and quasi-experimental research, according to the way the participants are selected. One of the main factors that determines the difference between fully experimental and quasi-experimental research is whether the participants are selected by unbiased assignment. Since the participants of single-subject experimental studies are selected from among those who already have problematic behaviors or need to gain new behaviors, research participants cannot be determined by impartial assignment (Aydın, Tekin-İftar, & Rakap, 2019). In our study, students with reading difficulties were determined and those who met the prerequisites were included in the study.

Multiple probe models aim to evaluate the effectiveness of a teaching or behavior change program in more than one situation (Aydın, Tekin-İftar, & Rakap, 2019). Multiple probe models; are examined in three groups as (a) inter-behavioral multiple probe model, (b) inter-participant multiple probe model, (c) inter-environment multiple probe model. The multiple probe model among participants is a research model in which the effectiveness of an independent variable is examined on at least three different participants (Tekin-İftar, 2018). The model does not require an effective application, withdrawal and continuous baseline data collection, which provides ease of implementation (Tekin-İftar, 2018).

Dependent and Independent Variable

The independent variable of the study is OpenDyslexic font, while the dependent variable is the participants' reading speed, reading accuracy, reading prosody and reading comprehension skills.

Participants and Their Selection

This study was conducted with three fourth grade students who were attending public schools in Aksaray in the 2020-2021 academic year. After obtaining the necessary permissions to determine the students to participate in the research, fourth-year students with a diagnosis of special learning disability (SLD) and mixed-type disorder in scholastic skills were identified at Aksaray Guidance and Research Center. Preliminary information about the student was obtained from the teachers and parents by contacting the schools of the identified students. Three students, two ten-year-old boys and one girl, who were willing to work from the collected information, were included in the study.

Information of the Students Participating in the Study

Table 1. *Information of the participants*

Student	Gender	Pre-School Education Status	Number of siblings	Mother's Education	Mother's Occupation	Father's Education	Father's Ocuupation
1.Participant	Female	Yes	3	High School	Housewife	Secondary School	Mechanic
2.Participant	Male	Yes	3	Elementary School	Houswife	Elementary School	Builder
3.Participant	Male	Yes	3	Elementary School	Houswife	Elementary School	Turnspit

In order to get to know the students better and to evaluate the observations more accurately, a parent interview was held before the study and some questions were asked to the parents. The answers given by the parents to the questions are presented below.

Student 1

Researcher: "Have you had any problems in your child's physical and mental development since your pregnancy?"

Mother: "My pregnancy was very difficult. I was fainting all the time. When she was 40 days old, they said that her heart was punctured. She had three holes in her heart. Her lips became bruised when she cried a lot. She was treated until the age of 2.5. It closed spontaneously without surgery."

Researcher: "Did you detect any differences in your child during and after pre-school education?"

Mother: "She went to kindergarten for a period when she was 6 years old. At that time, she used to paint at home and play with her sister. We started having problems in the 1st grade. When she started the 1st grade, she was constantly forgetting the things we said while studying at home. Even though we repeated it, she didn't remember it. She was mixing the letters "d" and "b" and writing the numbers backwards. She always confused the words "elek, felek, kelek" in my mind. She did not learn for a long time. We couldn't teach the subject of rounding to tens in the math class, no matter what we did. We had very difficult times. The class teacher wanted us to take her to a psychiatrist. We were in Istanbul at that time. A diagnosis of dyslexia was made. Her teacher said that when I attend a meeting and when I was going to have a reading, she started to tremble when I approached her. We had never experienced anything like this at home. I was also angry with your teacher, sice she did not tell me the issue before. She went to the Quran course during the summer vacation. An older sister, whom she loved very much, was teaching there. It trembled there too. We came to Aksaray ehen she was in the 3rd grade. I moved to Aksaray mostly for my child. There are grandparents and relatives here. The psychiatrist said it would be good for her to be with her loved ones, with whom she felt comfortable. As for Aksaray, the Guidance and Research Center did not give us a report. They told us to visit them during the 2nd term. She had been receiving support training for 5-6 months. She did not like school very much, but she went to the special education and rehabilitation center more willingly. She was very reluctant about everything related to the lesson, her favorite thing was painting. She could paint for hours without getting up."

Researcher: "When was your child first diagnosed with dyslexia?"

Mother: "When she had difficulty in reading, the class teacher directed her to a psychiatrist in the first grade. A dyslexia report was issued at Bakırköy Psychiatric Hospital."

Researcher: "How does your child spend time at home?"

Mother: "She watches cartoons, draws, plays with the computer. She is very active at home. She loves animals and imitates their voices very well. She loves watching documentaries."

Researcher: "Would you introduce your child to me?"

Mother: "She is shy, anxious, introverted. She doesn't like to go to public places, and even if she does, she doesn't play with anyone. She plays alone. She doesn't talk to strangers, she won't say her name even if asked. Later, she always says the same thing, "I'm ashamed" when I ask why you didn't speak. She forgets. She doesn't even say what she knows. She doesn't like to talk outside or at home. She talks a lot with her older sister. She loves to travel, loves to eat. She doesn't like to read at all."

Researcher: "Does any other family members have reading-writing difficulties?"

Mother: "No. Her elder sister is merit student, very sociable, sociable, and her courses are very good. Her teachers love her."

In the first interview with the student, during the stage of determining the reading level, I tried to motivate the student for about 20 minutes. While the student was rubbing his hands, I tried to relax and establish a sincere relationship. It was observed that after the student was persuaded to read, he read in a very weak and timid tone.

Student 2

Researcher: "Have you had any problems in your child's physical and mental development since your pregnancy?"

Mother: "He was born when I was 7 months pregnant because I have high blood pressure. He slept in an incubator for 3 months. When he was born, they said he had blisters in his brain. Doctors said he might have trouble walking. Then we went to a special education and rehabilitation center. They said that this child cannot walk or talk, but we did not have these problems. we didn't."

Researcher: "Did you detect any differences in your child during and after pre-school education?"

Mother: "He went to kindergarten when he was 5 years old. Then we sent him to the 1st grade. He started having difficulties in reading. He read letters "d" instead of "b". He wrote missing letters when writing his name. He said to think about it. He started a special education and rehabilitation center in the 3rd grade. He did not like to write at all, but after he started there, his reading improved a bit."

Researcher: "When was your child first diagnosed with dyslexia?"

Mother: "I hear the word dyslexia from you first. No one has mentioned it until now, but it is in the hospital reports. Since last year, he has been going to the rehabilitation center."

Researcher: "How does your child spend time at home?"

Mother: "He likes playing with his toys. He plays by himself for a long time. He watches cartoons on TV a lot. He watches a lot of videos on the phone. If I don't take it away from him, he watches it from morning to night."

Researcher: "Would you introduce your child to me?"

Mother: "Actually, he is sociable, that is, he likes to talk, asks a lot of questions. He doesn't care about the lesson, but he likes to fix it with the screwdriver. He forgets the lesson, but never forgets something he does with pleasure. He does not have a daily study schedule. He does homework by force. The child doesn't understand very well, neither do I. He reads well when he wants to. When a new story is received, he reads it eagerly but cannot finish it. He gets bored quickly."

Researcher: "Does any other family members have reading-writing difficulties?"

Mother: "His brother also had difficulties. His brother is 20 years old. He is at university now. My eldest son had even more difficulty in reading. I also have reading difficulties. I get excited when I read."

The student is friendly, imaginative, talkative, very active and does not like to sit in the classroom for a long time. The level of awareness of the father about the student's situation is higher. The mother has difficulty even writing the name of her child, skipping letters. In addition to supportive education, the student also receives private lessons at the special education and rehabilitation center. He does not like school, but expresses that he is happy when he goes to support education and private lessons.

Student 3

Researcher: "Have you had any problems in your child's physical and mental development since your pregnancy?"

Mother: "In the sixth month of my pregnancy, doctors said that the baby had water in his brain, but nothing came out after he was born. He was very pale when he was a baby. He would usually look sleepy if his head was to the right or left."

Researcher: "Did you detect any differences in your child during and after pre-school education?"

Mother: "He went to kindergarten for 2 years at the age of 5 and 6. It was a little difficult. He spoke late, walked late anyway. I took his to RAM in both years, but they said there was nothing wrong. Then I took his to Kayseri and they said there was no problem there, either. I struggled a lot, but they said there was nothing wrong with the boy."

Researcher: "When was your child first diagnosed with dyslexia?"

Mother: "In the 1st grade, they were misdiagnosed as mildly mentally retarded. They gave me a form, I marked them as insufficient so that they could receive a support education report. Later, I regretted that this report would always be in front of my child. He was diagnosed with a learning disability in the 2nd grade. Then our neighbor's daughter recommended the movie "Stars on the Ground." I watched it. I thought he had dyslexia from there. Then I read a book about dyslexia. It was like he was describing my child."

Researcher: "How does your child spend time at home?"

Mother: "He loves puzzles. He even makes cartoons with gum. He makes a car out of play dough. He plays with whatever he has in his hand for hours."

Researcher: "Would you introduce your child to me?"

Mother: "His visual memory is very strong. He does not forget details. He remembers even the person he saw when he was very young. He forgets things about the lesson because he is reluctant. He is very panicked. When his father comes home in the evening, he constantly asks, "When will my father come?" He panics, "I cannot sleep without my father." On the way to his class, he repeatedly askes if we are late. He has sudden anger. He becomes stubborn and angry because I don't do his homework."

Researcher: "Does any other family members have reading-writing difficulties?"

Mother: "Father has reverse writing. While writing he skips letters."

In the first interview with the student, it was observed that the student's perception skills and fine motor skills were low. When he goes to the toilet, he asks his mother for help to open and close the button of her pants. The mother is very upset about the inadequacy of her child, especially in perception and reading skills. She states that she has been looking for a remedy since kindergarten but could not get any results. She stated that she took her child to a psychiatrist many times in Konya and Kayseri, but there was no apparent problem and his tests were clean. The child has been receiving supportive education in a special education and rehabilitation center since the 2nd grade and expresses that he likes supportive education more than his own school.

Data Collection Tools

In order to determine the effectiveness of the OpenDyslexic font, the texts taught in the 4th grade Turkish textbooks by the Ministry of National Education were used as a data collection tool. The texts were selected from the texts in the last themes of the Turkish textbooks that the students had never read before. In order to determine the student's reading speed, the number of words read correctly in one minute was recorded. In order to determine the reading accuracy, the number of correct words read in the text and the words pronounced incorrectly were recorded. "Prosodic Reading Scale" developed by Keskin, Baştuğ, and Akyol (2013) was used to determine the prosodic reading level. "False Analysis Inventory" was used to determine the reading levels of the participants. In order to determine the reading comprehension levels, the reading comprehension scale, which was prepared by taking the evaluation questions of the texts in the textbook, was used. The students were allowed to answer the text questions in both written and oral ways. Before the implementation, the video recorder, the text to be read and the text questions were prepared in advance, and the student was informed about why the video recorder was used. Before starting the implementation, the environment was made suitable and the student was motivated to read.

Prosodic Reading Scale

The Prosodic Reading Scale is a five-point Likert-type, fifteen-item scale developed to measure fluent reading. The highest score that can be obtained from the scale is 60. Students who get 50% or more out of the total score are considered prosodically sufficient. If the student has not gained enough reading skills and makes too many reading mistakes, it is recommended not to continue the assessment (Keskin, Baştuğ, & Akyol, 2013). While scoring the students according to the Prosodic Reading Scale, the items were marked by listening to the videos recorded during reading repeatedly. Since one of the

students made too many mistakes while reading, this scale was used with the other two students. While using the scale, every sentence of the student was listened carefully while they were reading the text, and evaluation was made according to the whole text.

False Analysis Inventory

After the video recordings were taken during the students' reading aloud, the mistakes made by the students in the text were determined by the researcher with the "False Analysis Inventory" and the percentage of word recognition was determined. The "False Analysis Inventory" used to determine students' reading and reading comprehension levels was adapted from Ekwall and Shanker (1988) and Akyol (2011) (Sezgin & Akyol, 2015).

Reading Comprehension Scale

As a reading comprehension scale, the measurement criteria in the False Analysis Inventory were used by making use of the related text questions in the 4th grade Turkish textbook. According to this inventory, 6 questions, 3 simple and 3 in-depth comprehension questions, were asked. 2 points are scored for fully correct answers to simple comprehension questions, 1 point for semi-correct answers, and 0 points for unanswered questions. For deep understanding questions, 3 points are scored for complete and effective answers, 2 points for answers that are close to the expected but incomplete, 1 point for questions with very incomplete answers, and 0 points for questions that are not answered at all. While making use of the font written in the textbook for the beginner level data, the text questions for the application phase were converted to OpenDyslexic font and the implementation was made.

Data Collection

Baseline data for reading speed and prosody were collected at one-day intervals until stability was achieved in at least three sessions. While texts written in the font written in school textbooks were used for the baseline data, the texts were converted to OpenDyslexic font for the application phase data. During the application process, five texts translated into OpenDyslexic fonts were used. For the baseline data, the texts named "Oldman and Money Father", "Pinti", "About Smiling and Smiling" prepared for fourth grades in the Turkish textbooks of the Ministry of National Education were used. During the implememtation process, the texts "Oh Heidi, Where Are You?", "Learning and Marie Curie", "Silkworm", "What's the Brain For", "Joking Elephant" were used. Face-to-face training was conducted in the first two weeks of the studies. However, a curfew was declared in Turkey due to the Covid-19 epidemic that gripped the whole world during the research process, which started to be implemented in the spring term of the 2020-2021 academic year. Therefore, distance education was conducted during the two-week period of the research. With the easing of the bans, the last two weeks of the implementation process were completed with face-to-face training. The baseline data for reading comprehension were collected from the questions of the text named "Old Man with Money". The texts "Oh Heidi, Where Are You?", "What is the Brain For" were used for the implementation phase data. Reading comprehension exercises with the texts "Learning and Marie Curie" and "Silkworm" were processed as live lessons due to the pandemic, and the reading comprehension scales could not be answered in written form. Therefore, the reading comprehension scales of these texts were not included in the scoring. The study was completed in 16 sessions, 23 course hours in total.

Baseline and Probing Sessions

Before starting the study, the students were informed about the implememtation and the materials to be used. One copy of the reading text was taken by the researcher and the other was presented to the student. The student was told to start reading when he was ready by being motivated. Video recording was started from the moment the student started to read. The student was allowed to read the entire text without any intervention. The words that the student could not read were read by the researcher after waiting for three seconds. The student's line skipping errors were immediately corrected, and the skipped line was shown to continue. The student's reading video was listened carefully by the researcher after the session, and the number of words he read correctly in one minute was determined, and the reading errors were recorded on the chart. After listening to the student's reading video several times, the prosodic reading scale was scored. For the reading comprehension initiation level data, the text written in the text "Oldman and the Rich Man" was studied in the font written in the textbook, and for the application phase data, "Oh Heidi, Where Are You?", "Learning and Marie Curie", "Silkworm", "What is the Brain For". The questions were answered by converting the texts to OpenDyslexic font. The questions were prepared as three activities: guessing the words in the text, questions about the text, the subject of the text and the main idea of the text. The questions were read to the volunteer student and each student was asked to answer on their own paper. Students with writing difficulties were asked to answer the questions orally, and the correct answers verbally were also noted.

Data Analysis

As for the beginner level, the texts in the font used in the textbooks and the data collected were analyzed. For the implementation phase, data analysis was made with texts translated into OpenDyslexic font. Data on participants' reading speed, reading accuracy, prosodic reading, reading levels and reading comprehension scores were collected, recorded and graphed. Reading speed was calculated by subtracting the number of errors made from the number of words read by the participant in one minute (Deeney, 2010).

Accuracy was measured by the number of correctly defined words for each text. Adding, skipping, misreading, not being able to read at all, or words that the participant read with help were scored as reading errors. The percentage of reading accuracy was calculated by dividing the number of words read correctly and multiplying by 100 (Dowhower, 1987).

The scores obtained from the prosodic reading scale developed by Keskin, Baştuğ, and Akyol (2011) for prosodic reading were recorded and the data were graphed. Keskin (2012) does not find it appropriate to use the scale for students who have not gained enough reading skills and make too many reading mistakes. The prosodic reading scale data of the first and second participants wereevaluated. However, the prosodic reading scale of the third participant was not taken into consideration due to too many reading errors.

Word recognition and reading levels were determined with the False Analysis Inventory, which was used to determine reading levels. In order to determine the level of reading comprehension, the answers given by the participants to the text questions were scored. The answers of the participants were taken verbally and in writing for each activity. Unanswered questions or incorrect answers were not scored, and missing answers were scored as half of the value of each question.

Ethical Permision of the Research

In this study, all the rules specified to be followed within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were complied with. None of the actions specified under the title of "Actions Contrary to Scientific Research and Publication Ethics", which is the second part of the directive, were not carried out.

Information about Ethical Permision of the Research:

Title of the committee that made the ethical evaluation= Niğde Ömer Halisdemir University Ethics Committee

Date of ethical review decision=24.02.2021

Ethical assessment certificate issue number=03.03.2021-25998

Findings

In this study; The effect of OpenDyslexic font on increasing the fluency and reading comprehension levels of students with reading difficulties was investigated. In this section, the findings and comments obtained at the end of the research are given. Findings are listed according to research purposes.

The Effect of OpenDyslexic Font on Reading Speed

The research was completed in 16 sessions, 23 course hours in total, in a 6-week period. A total of 8 reading data, 3 at the beginning level of the research and 5 at the implementation phase, were recorded. Reading data were recorded for 1 minute for each text. At the beginning level of the reading speed study, 3 text reading data were taken in the font used in the fourth grade textbook. During the implementation phase, five texts in the fourth grade textbook were translated into OpenDyslexic font and read and reading speed data were obtained.

Participant I

3 session baseline data were obtained from the first participant. According to these data, the reading speed of the first participant was 48, 47, 45 words, respectively. The average reading speed of the participant was calculated as 47 words. Due to the stability of these data at the baseline level, the application phase was started with the first participant. 5 sessions of data were collected from the first participant during the implementation phase. The participant's reading speed was 55, 58, 69, 59, 79 words, respectively. The data in the implementation phase of the participant is generally increasing.

Compared to the baseline data of the first participant, which consisted of texts prepared in standard fonts, the reading speed of the application phase texts prepared with OpenDyslexic increased from the first application. The average reading speed of the participant in the application phase was calculated as 64 words. The average reading speed of the first participant at the baseline level increased from 47 words to 64 words. When calculated as a percentage, there was a 48% increase in the participant's reading speed compared to the initial level.

Participant II

3 session baseline data were obtained from the second participant. According to these data, the reading speed of the second participant was 52, 58, 55 words, respectively. Average reading speed was

calculated as 55 words. Due to the stability of the data at the baseline level, the application phase was started with the second participant.

5 sessions of data were collected from the second participant during the implementation phase. The participant's reading speed was 66, 64, 83, 62, 77 words, respectively. When the baseline data of the second participant and the application phase data were compared, an increase in reading speed was observed. The average reading speed of the participant in the application phase is 70 words. The average reading speed of the second participant increased from 55 words to 70 words, and a 27% increase in reading speed was observed.

Participant III

4 session baseline data were obtained from the third participant. According to these data, the reading speed of the third participant was 10, 7, 6, 7 words. The average reading speed of the third participant was calculated as 8 words. With the stability of the data at the baseline level, the application phase was started with the third participant.

5 sessions of data were collected from the third participant during the implementation phase. The participant's reading speed is 8, 13, 13, 12, 14 words. According to the baseline data of the third participant, there was an increase in the reading speed in the application phase. The average reading speed in the application phase is 12 words. The average reading speed of the third participant increased from 8 words to 12 words. 50% increase in the participant's reading speed was observed.

The data on the effect of the OpenDyslexic font on increasing the reading speed of students with reading difficulties are shown in Figure 3.
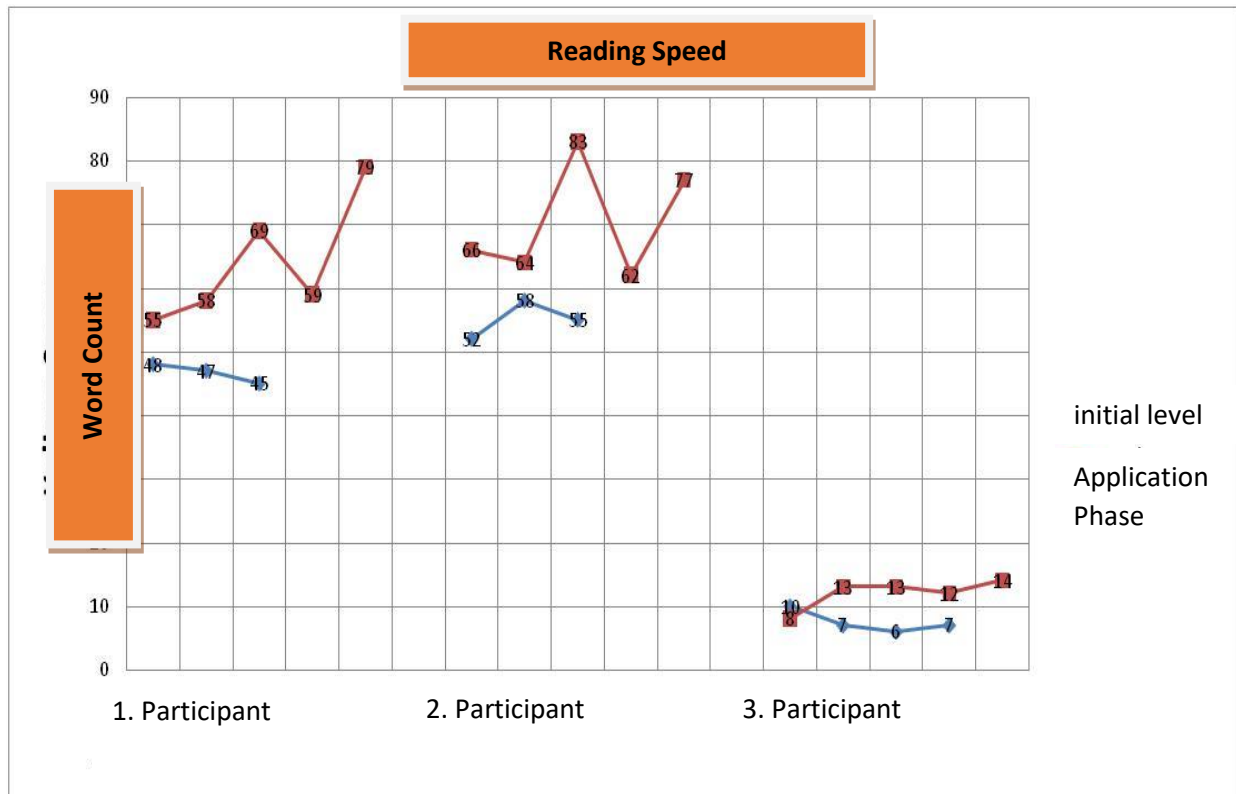

Figure 3. Reading speed of the participants

The Effect of OpenDyslexic Font on Reading Accuracy

In the study, a total of 8 data were collected for reading accuracy; 3 at the baseline level and 5 at the application stage. As for reading accuracy, 3 text reading data were taken in the font used in the fourth grade textbook at the beginner level. During the implementation phase, 5 texts in the fourth grade textbook were translated into OpenDyslexic font and read and reading accuracy data were obtained.

Participant I

Three session baseline data were obtained from the first participant. According to these data, the percentage of reading accuracy was calculated as 93.57%, 95.89% and 95.62%, respectively. The average percentage of reading accuracy at the participant's baseline level is 95.02%. Since the data at the baseline level showed stability, the application phase was started with the first participant.

Data were collected in the implementation phase of the first participant during five sessions. According to these data, the percentage of reading accuracy was calculated as 96.37%, 98.52%, 96.30%, 96.69% and 98.73%, respectively. The participant's average reading accuracy percentage was 97.32%. Although there were fluctuations in the participant's practice phase data points, the percentage of reading accuracy increased overall. The first participant's percentage of reading accuracy showed a 2.3% increase in the average of practice data compared to the baseline data average.

Participant II

Three session baseline data were obtained from the second participant. According to these data, the percentage of reading accuracy was calculated as 96.94%, 95.20% and 96.20%, respectively. The average percentage of reading accuracy at the participant's baseline level is 96.11%. Since the data at the baseline level showed stability, the application phase was started with the second participant.

Data were collected in the implementation phase of the second participant during three sessions. According to these data, the percentage of reading accuracy was calculated as 98.85%, 98.81%, 98.52%, 98.49% and 100%, respectively. The participant's average reading accuracy percentage was 98.93%. The second participant's percentage of reading accuracy showed a 2.82% increase in the average of the practice data compared to the baseline data average.

Participant III

Data were collected in the implementation phase of the first participant during four sessions. According to these data, the percentage of reading accuracy was calculated as 31.19%, 32.87%, 27.69% and 33.23%, respectively. The average percentage of reading accuracy at the participant's baseline level was 31.24%. Since the data at the baseline level showed stability, the application phase was started with the third participant.

Data were collected during the implementation phase of the third participant during five sessions. According to these data, the percentage of reading accuracy was calculated as 25%, 37.14%, 46.42%, 42.85% and 43.45%, respectively. The participant's average reading accuracy percentage was 38.97%. The third participant's percentage of reading accuracy showed a 7.73% increase in the average of the practice data compared to the baseline data average.

Data on the effect of the OpenDyslexic font on increasing the reading accuracy of students with reading difficulties are shown in Figure 4.
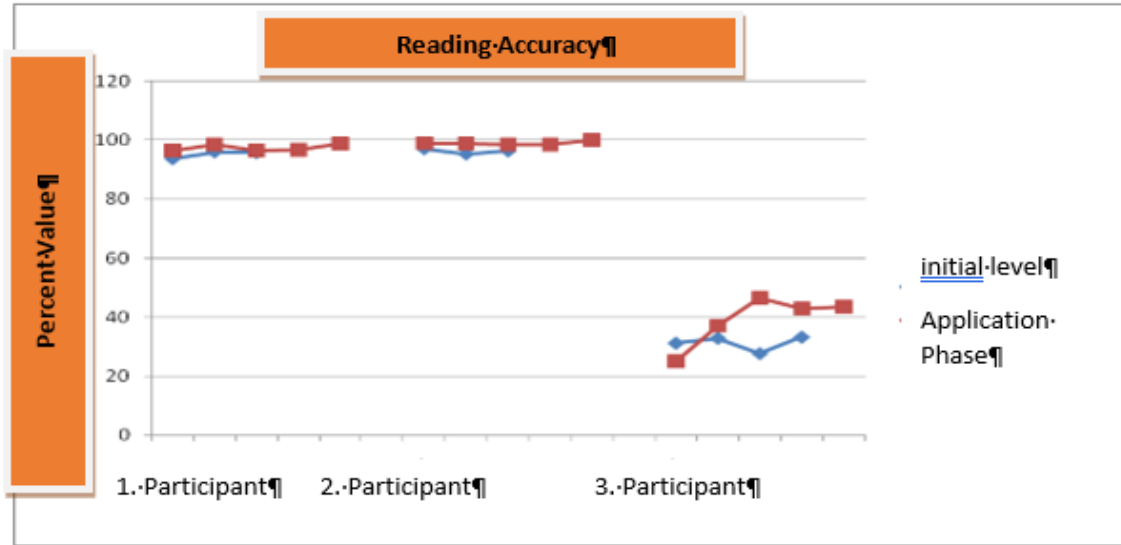
Figure 4. Percentages of participants' reading accuracy

The Effect of OpenDyslexic Font on Prosodic Reading

In the research, a total of 8 data were collected for prosodic reading, 3 at the beginning level and 5 at the implementationphase. For prosodic reading, 3 text reading data were taken in the font used in the fourth grade textbook at the beginner level. During the implementation phase, 5 texts in the fourth grade textbook were translated into OpenDyslexic font and read and prosodic reading data were obtained.

Participant I

Baseline data was obtained from the first participant in three sessions. According to these data, prosodic reading scores were calculated as 32, 34, 34, respectively. The average prosodic reading score of the first participant was 33. Since these data at the baseline level showed stability, the implementation phase was started with the first participant.

Five session probe data were obtained from the first participant during the implementation phase. Considering these data, prosodic reading scores were calculated as 53, 52, 51, 54 and 55, respectively. The average prosodic reading score of the first participant in the application phase was 53. The prosodic reading skill of the first participant improved since the first text written in OpenDyslexic font. Considering the scores, although some minor fluctuations were observed in the data, there was an increase in the prosodic reading level of the participant in general. While the prosodic reading average of the first participant's baseline was 33 points, it increased to 53 points in the application phase.

Participant II

Three session baseline data were obtained from the second participant. According to these data, prosodic reading scores were calculated as 31, 31 and 34, respectively. The average prosodic reading score of the second participant was 32. Since these data at the baseline level showed stability, the application phase was started with the first participant.

Five session probe data were obtained from the second participant during the implementation phase. Considering these data, prosodic reading scores were calculated as 53, 52, 51, 53 and 56, respectively. The average prosodic reading score of the second participant in the application phase was

53. The participant's prosodic reading skill improved since the first text written in OpenDyslexic font. Considering the scores, although some minor fluctuations were observed in the data, there was an increase in the prosodic reading level of the participant in general. While the prosodic reading average of the second participant's baseline was 32 points, it increased to 53 points in the application phase.

Participant III

The prosodic reading scale was not kept because the third participant did not gain enough reading skills and made too many reading errors in the text.

Data on the effect of OpenDyslexic font on prosodic reading of students with reading difficulties are shown in Figure 5.
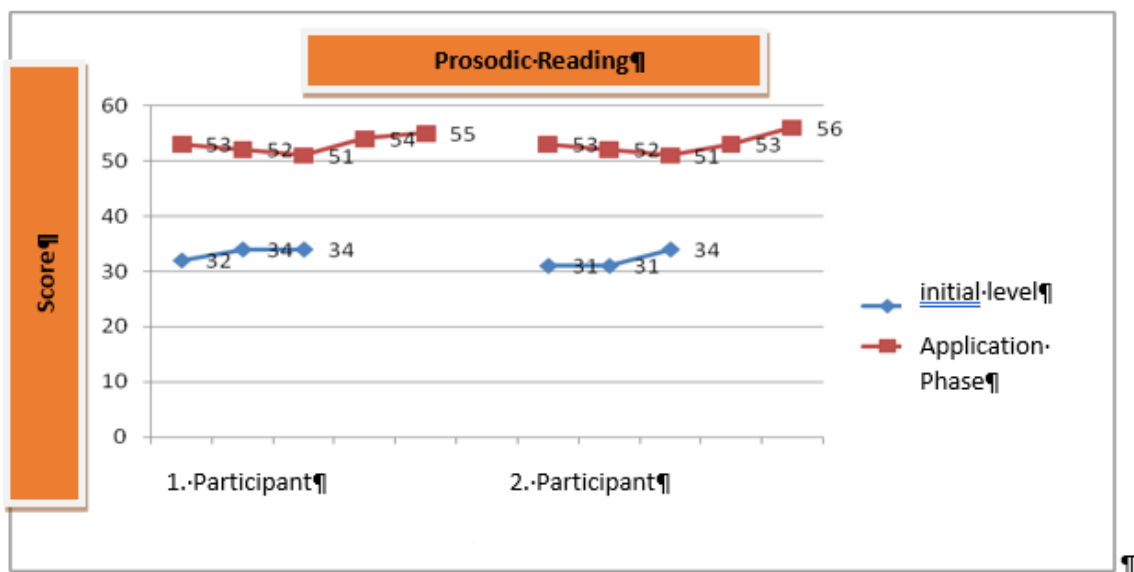

Figure 5. Participants' prosodic reading scores

Effect of OpenDyslexic Font on Reading Level

Participant I

Table 2. *Reading level of Participant I*

Error Types	Initiation Level First Text	Implementation Phase Final Text
Misreading	1	1
Replacing Another Word	0	0
Words Given by the Researcher	1	0
Skipping	0	0
Adding	1	0
Reversing	0	0
Total	3	1
Word Recognition Percentage	%94,11	%98,75
Words read right within 1 min.	48	79

There was a decrease in reading errors in the last text of the first participant compared to the first text. An increase of approximately 5% was observed in the percentage of word recognition. While the reading level of the first participant was at the teaching level in the first text, it was seen that he was at the teaching level in the last text. However, while the percentage of word recognition in the first text was close to the level of anxiety, it increased to a level very close to the level of free reading in the final text.

Participant II

Table 3. *Reading level of Participant II*

Error Types	Initiation Level First Text	Implementation Phase Final Text
Misreading	1	0
Replacing Another Word	0	0
Words Given by the Researcher	0	0
Skipping	1	0
Adding	0	0
Reversing	0	0
Total	2	0
Word Recognition Percentage	%96,15	%100
Words read right within 1 min.	52	77

While the second participant made 2 errors in the first text, he read the last text without any errors. While the participant's word recognition percentage was at the level of instruction in the first text, it increased to the level of free reading in the last text.

Participant III

Table 4. *Reading level of Participant III*

Error Types	Initiation Level First Text	Implementation Phase Final Text
Misreading	9	8
Replacing Another Word	5	5
Words Given by the Researcher	2	1
Skipping	3	2
Adding	1	1
Reversing	2	1
Total	22	18
Word Recognition Percentage	%31,25	%43,75
Words read right within 1 min.	10	14

Compared to the first text, the third participant's reading error rate decreased in the last text. While the participant's word recognition percentage was at the level of concern in the first text, it remained at the level of concern in the last text. On the other hand, there was a 12.5% increase in the percentage of word recognition in the last text compared to the first text.

The Effect of OpenDyslexic Font on Reading Comprehension

In the study, a total of 4 data were collected; one for the reading comprehension initiation level and three for the application phase. Beginner level text questions were applied in the font used in the fourth grade textbook. Implementation phase text questions were translated into OpenDyslexic font and applied. Reading comprehension questions were taken from the textbooks. The first part of the comprehension questions, which consists of three activities, consists of guessing the meanings of the words in the text, the second part consists of answering questions about the text, and the third part consists of finding the subject of the text and the main idea. Equally weighted scoring was given to all three events.

Participant I

The percentage of reading comprehension of the first participant was calculated as 59%, 82% and 82%, respectively. Although the participant's reading comprehension percentage fluctuated in the application phase data points, the reading comprehension percentage increased in general. There is a 23% increase between the first score and the last score.

Participant II

The reading comprehension percentage of the second participant was calculated as 54%, 78% and 78%, respectively. Although the participant's reading comprehension percentage fluctuated in the application phase data points, the reading comprehension percentage increased in general. There is a 24% increase between the first score and the last score.

Participant III

The reading comprehension percentage of the third participant was calculated as 31%, 48% and 49%, respectively. Although the participant's reading comprehension percentage fluctuated in the application phase data points, the reading comprehension percentage increased in general. There is an 18% increase between the first score and the last score. Data on the effect of OpenDyslexic font on reading comprehension of students with reading difficulties are shown in Figure 6.
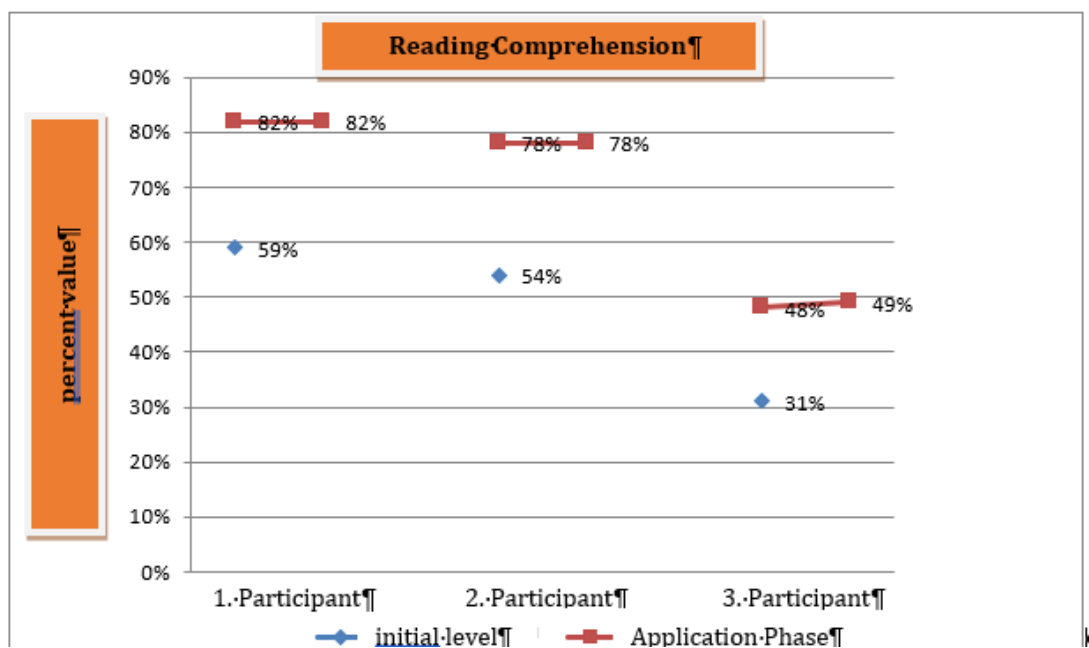

Figure 6. Reading comprehension percentages of the participants

Discussion and Conclusion

In this section, the effect of OpenDyslexic font applied in the research on reading fluency and reading comprehension level is discussed based on findings and comments.

Conclusion and Discussion on the Effect of OpenDyslexic Font on Reading Speed

In the first sub-objective of the research, the effect of OpenDyslexic font on the reading speed of students with dyslexia was investigated. Considering the reading speed of the participants included in the study, the average reading speed of the first participant at the initial level increased from 47 words to 64 words. There was a 48% increase in the first participant's reading speed compared to the initial level. The average reading speed of the second participant increased from 55 words to 70 words, and a 27% increase in reading speed was observed. The average reading speed of the third participant increased from 8 words to 12 words. There was a 50% increase in the reading speed of the third participant. When these results were evaluated, it was seen that the reading speed of all three of the participants increased, and it was found that OpenDyslexic font was effective.

No studies were found examining the effect of OpenDyslexic font on the reading speed of Turkish readers. There are very few studies on the effect of OpenDyslexic font on reading speed abroad. On the other hand, studies have focused more on word reading for the determination of reading speed.

Zikl et al. (2015) compared OpenDyslexic with the widely used Arial in their research to confirm whether the use of certain fonts in dyslexics affects the reading quality and whether the font is suitable for use to compensate for educational problems. Reading speed of students was measured when using OpenDyslexic font with standard fonts. In conclusion, it was found that the use of the OpenDyslexic font, specially designed for dyslexic students, did not lead to a significant improvement in reading speed or error rates compared to the commonly used font.

In another study investigating the effect of OpenDyslexic on the reading speed of students with dyslexia, Wery and Diliberto (2016) present a single-subject alternative to investigate the extent to which it affects reading speed or accuracy compared to two commonly used fonts, Arial and Times New Roman. treatment design was used. Results from this alternative therapy experiment showed no improvement in reading speed for students with dyslexia.

The study of Rello and Baeza-Yates (2013), in which they investigated the effect of font on reading speed on individuals with dyslexia, is known as the first study to measure the effect of 48 dyslexic individuals (between 11-50 years) on reading performance using eye tracking and asking them about their personal preferences. The study is an objective study of the 12 most commonly used fonts on the web (Arial, Arial Italic, Computer Modern Unicode (CMU), Courier, Garamond, Helvetica, Myriad, OpenDyslexic, OpenDyslexic Italic, Times, Times Italic, and Verdana). The results of the study on reading performance provide evidence that font types have an impact on readability. In this study, it was found that the reading time of italic fonts is always longer than that of latin fonts. This result confirmed the widely accepted fact that ligatures are more difficult to read for people with dyslexia. It did not find a significant difference in read time, although non-serif, monospaced, and latin fonts resulted in significantly shorter fix times. It is thought that keeping the age range of the participants included in the studies too wide has a negative effect on the results.

In Turkey, there was a study examining the effect of font on the reading speed of children with dyslexia. İleri (2020) used the electrooculography (EOG) method in his master's thesis, in which he aimed to determine the most suitable font to be used in the education of children with dyslexia. A total of 36 individuals, 23 of whom were diagnosed with dyslexia and 13 without dyslexia, were simultaneously recorded EOG signals while reading the texts containing different fonts and fonts. As a result of the research, while average reading times increased in texts prepared with Times New Roman in both groups, average reading times decreased in texts prepared with BonvecoCF font. This result supports the finding of our research with the inference that the font used has an effect on the reading speed of students with dyslexia.

The publication of the British Dyslexia Society also supports our research finding. The British Dyslexia Association reveals the importance of factors such as the selection of appropriate fonts and background colors and the use of non-transparent thick paper in order to prevent the visual stress experienced by some dyslexic people in written materials and make it easier to read (Dyslexia Style Guide, 2021). Hughes and Wilkins (2000) claim that children with reading difficulties are more susceptible to visual stress and that text size greatly affects students' reading speed. Visual stress is

manifested by unpleasant visual symptoms such as imaginary shapes, movement and colors of text, distorted or blurred printing, and general visual irritation during reading (Zikl et al., 2015). This finding prompted researchers to further examine the effect of visual features of text on reading in individuals with dyslexia. In our country, more and more comprehensive studies are needed to determine the effect of OpenDyslexic font on the reading speed of individuals with dyslexia.

Conclusion and Discussion on the Effect of OpenDyslexic Font on Reading Accuracy

The effect of the OpenDyslexic font applied in the second sub-objective of the study on the reading accuracy of students with reading difficulties was investigated. While the average reading accuracy percentage of the first participant at the baseline was 95.02%, the average reading accuracy percentage in the application phase increased to 97.32%. Considering these data, a 2.3% increase was observed in the average of the application data compared to the first participant's reading accuracy percentage baseline data average. While the average reading accuracy percentage of the second participant at the baseline was 96.11%, the average reading accuracy percentage in the application phase increased to 98.93%. The second participant's percentage of reading accuracy showed a 2.82% increase in the average of the practice data compared to the baseline data average. While the average reading accuracy percentage of the third participant at the baseline was 31.24%, the average reading accuracy percentage in the application phase increased to 38.97%. When these data were examined, a 7.73% increase was observed in the average of the application data compared to the third participant's percentage of reading accuracy compared to the baseline data average.

To sum up, the reading accuracy level of all three of the participants included in the study increased and OpenDyslexic font was found to be effective. While the correct reading rate of the first and second participants was high, the third participant made too many reading errors in the text. The third participant's reading errors caused by inversion are mostly composed of monosyllabic, short words such as "en, what". When the reading accuracy data of the participant were examined, it was observed that sometimes he made a reading error even in single syllable words, and sometimes he read 4-5 syllable words correctly in one go. This suggests that the participant's reading error is due to the fact that he tends to read backwards.

Zikl et al., (2015), who investigated the effect of OpenDyslexic on reading accuracy, found that error rates with OpenDyslexic font were slightly lower, especially in students who made frequent mistakes, suggesting that OpenDyslexic font might be more effective in students with severe reading difficulties. In their article, Wery and Diliberto (2016) revealed that studies with OpenDyslexic font did not show any improvement in reading accuracy. De Leeuw (2010), another study close to our research, found that reading with Dyslexie font reduces reading errors.

Conclusion and Discussion on the Effect of OpenDyslexic Font on Prosodic Reading

In the third sub-objective of the research, the effect of OpenDyslexic font on students' prosodic reading was investigated. While the average prosodic reading score of the first participant at the baseline was 33, the average prosodic reading score in the implementation phase increased to 53. While the average prosodic reading score of the second participant was 32, it was observed that the average prosodic reading score in the application phase increased to 53. Considering these data, it was evident that the prosodic reading levels of the first two participants increased and it was found that

OpenDyslexic font was effective on prosodic reading. The prosodic reading scale could not be kept since the third participant made too many reading errors in the text.

It was observed that the first and second participants' reading speed and accuracy increased, they read more fluently and confidently, and the participants who could recognize the word faster and more accurately began to use their voices better in text reading. As a result, the prosody reading scores of the participants increased.

Conclusions and Discussion on Reading Level of OpenDyslexic Font

In the fourth sub-objective of the research, the effect of OpenDyslexic font on students' reading comprehension level was investigated. The first participant read 48 words in 1 minute in the first text he read at the baseline level and made 3 reading errors. In the last text of the application phase, which was translated into OpenDyslexic font, it increased to 79 words in 1 minute and read 1 word incorrectly. It was seen that both of the participant's reading activities were at the teaching level. While the second participant read 52 words in 1 minute with a total of 2 incorrect readings at the beginning level, in the final reading study, he read 77 words in 1 minute without errors, and his reading level increased from the instructional level to the free reading level. The third participant read 10 words in 1 minute and made 22 reading errors in the first text at the beginner level. In the last text he read, it increased to 14 words in 1 minute, and his reading error decreased to 18 words. It was observed that the third participant remained at the level of anxiety in both reading studies.

In our study, the word recognition rate developed by Ekwall and Shanker (1988) and adapted by Akyol (2011) was used to determine reading levels. On the other hand, in determining the reading levels, the reading accuracy rates were divided into different ratio ranges according to the researchers. Farris, Fuhler, and Walther (2004), Rasinski and Hoffman (2003) read accuracy rates; 89% and below were anxiety (unsuccessful) levels, 90% to 94% were educational levels, and 95% to 100% independent levels (Sert, 2019). If these rates had beentaken as a basis in our study; we would have stated that the first and second participants were independent from the instructional level, while the third participant remained at the anxiety level.

Conclusions and Discussion on Reading Comprehension Level of OpenDyslexic Font

In the fifth sub-objective of the research, the effect of OpenDyslexic font on students' reading comprehension level was investigated. While the first participant's reading comprehension score at the initial level was 59, the final score in the implementation phase increased to 82. It was observed that the second participant increased from 54 points to 78, and the third participant increased from 31 points to 49.

Considering these data, it was seen that the reading comprehension levels of all three participants increased and OpenDyslexic font was found to be effective on reading comprehension. The positive effect of OpenDyslexic font on reading speed and reading accuracy also had positive effects on the secondary result, reading comprehension. Wery and Diliberto (2016) argued that dyslexia, which is characterized by fluent word recognition difficulties and poor decoding skills, may have secondary consequences such as reading comprehension problems, inhibiting the growth of vocabulary and cognitive schemas. Renske de Leeuw (2010) in his study, in which he measured the reading speed of the Dyslexie font with word studies, suggested measuring the reading comprehension skill on texts, as in

our study, and testing the hypothesis that a font that is thought to increase readability will increase reading comprehension as the effort and focus for reading will decrease. Our research findings are also consistent with these studies. As the reading speed and accuracy of our participants increased, their reading comprehension skills improved, and the participants gave more willing and accurate answers to the text questions.

Recommendations

Based on the research findings, recommendations for practice and future research are given below.

Recommendations for Practice

It was observed that all three students had difficulty in reading the informative texts containing foreign names while reading the narrative texts more fluently. In studies to determine the effectiveness of OpenDyslexic font, it may be more useful to monitor the progress of students if the texts are at the same difficulty level in terms of readability. Texts prepared with OpenDyslexic font can also be included in school textbooks.

Recommentations for Further Researches

It was observed that the third participant was more willing to screen reading and read more accurately in online classes due to the pandemic. With the OpenDyslexic font, text-to-speech studies can be conducted that investigate the effect on reading speed and accuracy through screen reading.

Studies can be conducted with larger sample groups to investigate the effect of OpenDyslexic font on fluent reading and reading comprehension on dyslexic Turkish readers.

Studies can be conducted to examine the eye movements of dyslexic students during reading with OpenDyslexic compared to other fonts.

Reading speed and accuracy of dyslexic students can be measured with OpenDyslexic fonts with texts prepared in different sizes, letter and word intervals.

With OpenDyslexic, studies can be made that compare more than one frequently used font with different features.

Studies can be done comparing different age groups on the effect of OpenDyslexic font on reading speed and accuracy.

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BIOGRAPHICAL NOTES

Contribution Rate of Researchers

Author 1: 50%

Author 2: 50%

Conflict Statement

There is no material or individual organic connection with the people or institutions involved in the research and there is no conflict of interest in the research

Genişletilmiş Türkçe Özet

OpenDyslexic Yazı Tipinin Disleksili Öğrencilerin Akıcı Okuma ve Okuduğunu Anlama Becerilerine Etkisi

Giriş

Okuma, bireylerin akademik, sosyal ve kişisel gelişiminde her geçen gün daha önemli hale gelmektedir. Bununla birlikte okullarda okuma sorunu yaşayan birçok öğrenci bulunmaktadır (Bingöl, 2003). Okuma sorunlarının en önemli sebeplerinden biri"disleksi" olarak bilinmektedir. Disleksi; sözcük düzeyinde okuma, çözümleme ve heceleme problemleri ile sesli okuma akıcılığında oluşan bozukluklarla karakterize olan genetik temelli nörogelişimsel bir okuma bozukluğudur ve genellikle fonolojik yeteneklerde yetersizlik olarak ortaya çıkmaktadır (Rello ve Baeza-Yates, 2013; Hoien ve Lundberg, 2000). Dünya Nöroloji Federasyonu'nun 1968'de yapmış olduğu tanımına göre disleksi, geleneksel öğretime, yeterli zekaya ve sosyokültürel fırsatlara rağmen okumayı öğrenmede zorluk olarak kendisini göstermektedir (Hoien ve Lundberg, 2000).

Disleksili bireylerin okuma güçlüğünün giderilmesi amacıyla tanı ve tedavisinde kullanmak üzere birçok hipotez ortaya atılmıştır. Bu hipotezlerden birisi olan "Magnoselüler Eksiklik Hipotezi", disleksiklerin magnoselüler sistemlerinin farklı yapıda olmasını, yaşadıkları okuma güçlüklerinin sorumlusu olarak göstermektedir. Bu hipotez, magnoselüler sistemin okuma sırasında gözlerin sakkadik (gözün okuma sırasında sıçramalı hareketi) hareketinde oldukça etkin olarak yer almasını temel almaktadır (Vellutino, Fletcher, Snowling, ve Scanlon, 2004; Vender, 2017). Magnoselüler Eksiklik Hipotezi savunucuları, disleksiklerin yaşadıkları okuma güçlüğüne ilişkin olarak magnoselüler sistemin işleyişinin normal düzeninde faaliyette olmamasını iddia etmekte, dayanak olarak disleksiklerdeki görsel dikkat odağı, göz hareketlerinin zamanlanması ve izlenmesinde yaşadıkları sorunları göstermektedirler. Magnoselüler sistemin, görsel hareketi algılama, hareket yönünü algılama, göz hareketinin kontrolü, göz hareketlerinin zamanlanması ve izlenmesi, görsel dikkat odağındaki ve göz hareketlerindeki değişimlerden sorumlu olması onları bu kanıya ulaştırmıştır (De Leeuw, 2010; Stein,

2018; Wilsenach, 2006). Magnoselüler sistemin eksikliği, göz hareketleri üzerindeki kontrolü zorlaştırdığından okuyucunun harflerin yerlerini konumlandıramamasına ve harflerin birbirinin üzerinden kayar şekilde hareketli görmesine sebep olmaktadır (De Leeuw, 2010; Wilsenach, 2006). Harflerin yerlerini değiştirmek disleksiklerde en sık rastlanan durumlardan birisidir. Bu durum, göz hareketlerinin kontrol edilememesi sebebiyle her iki gözü de aynı noktaya yönlendirememekten kaynaklanmaktadır ve bu da 'ters' harf etkilerine yol açmaktadır (Goswami, 2014). Harflerin, sırasının görsel olarak karıştırılması ya da tersinden sıralanması, kelimelerin görsel biçiminin, okumada üzerinde durulan, görsel sözlüğe ya da hafızaya aktarılmamasına dolayısıyla imla becerilerinin kazanılamamasına neden olmaktadır (Wilsenach, 2006).

Bu zorluklara maruz kalan disleksili bireyler, geleneksel öğretim yöntemleri ile olumlu ilerleme kaydedememektedirler. British Disleksi Derneği (2021) ve Bender (2012), disleksili bireylerin standart müdahale yöntemlerine karşı direnç gösterirken, uygun şekilde özel müdahale yöntemleri ile yaşadıkları güçlüklerin hafifletilebileceğini belirtmiştir. Disleksili bireylere özel müdahale yöntemlerinden birisi de uyarlanmış tipografi gibi özel araçların kullanılmasıdır. Zelinkova'ya göre (2003), disleksili öğrencilerin okuma performansı, yazı tipi ve boyutu, satır aralığı veya harf aralığı gibi metnin grafik niteliklerinden önemli ölçüde etkilenmektedir. Disleksik okuyucular, diğer okuyuculara kıyasla kelime tanımada daha fazla efor sarf etmek ve metne daha çok odaklanmak zorunda kalırlar, bu da onları metnin tüm görsel yönlerine karşı daha duyarlı hale getirmektedir (Zikl ve diğerleri, 2015). Bu bulgu, yazarları disleksili bireylerin, metnin görsel özelliklerinin okuma üzerindeki etkisini daha fazla incelemeye yöneltmiştir.

Son dönemde disleksi hakkında yapılan çalışmalar, disleksiklerin daha iyi şartlarda okuma yapabilmelerini sağlamak üzere okudukları metinlerin normal okuyuculara sunulandan farklı nitelikte hazırlanmasının faydalı olabileceği üzerinde durmuşlardır. Bu amaçla, disleksili bireylerin okumalarını kolaylaştırdığı iddia edilen farklı yazı tipleri tasarlanmıştır. Bunlardan birisi de araştırmamıza konu olan OpenDyslexic yazı tipidir.

OpenDyslexic, disleksik bireyler için metinlerin okunabilirliğini artırmak üzere oluşturulmuş açık kaynaklı bir yazı tipidir (Laddusaw ve Brett, 2019). OpenDyslexic yazı tipi, disleksiklerde en çok görülen okuma güçlüklerine yardımcı olmak üzere tasarlanmıştır. Bunların başında 'b' ve 'd' örneğinde olduğu gibi birbirine benzeyen harflerin karıştırılması gelmektedir. OpenDyslexic yazı tipinde bu sorun, harfleri birbirinden ayırt edilebilir kılmak için farklı yönlerde dolgunluk verilerek çözülmeye çalışılmıştır. Laddusaw ve Brett'e (2019) göre harflerin farklı yönlerde dolgunluk kazandırılmış tasarımı ve benzersiz şekilleri, disleksik okuyucunun zihninin harfleri hareket ettirip çevirmesini önlemeye yardımcı olmaktadır.

Bu araştırmada, disleksi tanılı öğrencilerin okuma akıcılığının ve okuduğunu anlama becerilerinin arttırılmasında OpenDyslexic yazı tipinin etkisi incelenmiştir. Bu amaçla OpenDyslexic yazı tipinin okuma güçlüğü olan öğrencilerin; a) sesli okuma hızının artırılmasındaki etkisine, b) okuma doğruluğunun artırılmasındaki etkisine, c) prozodik okuma düzeylerinin artırılmasındaki etkisine, d) okuma düzeylerinin artırılmasındaki etkisine, e) okuduğunu anlama düzeylerinin artırılmasındaki etkisine bakılmıştır.

Yöntem

Bu bölüm altı alt başlıkta açıklanmıştır: (a) araştırmanın deseni, (b) bağımlı ve bağımsız değişken, (c) katılımcılar ve seçimi, (d) veri toplama araçları, (e) verilerin toplanması, (f) verilerin analizi.

Araştırmanın Deseni

Bu araştırmada, okuma güçlüğü olan öğrencilerin akıcı okuma (okuma hızı, okuma doğruluğu, prozodik okuma) ve okuduğunu anlama becerilerinin artırılmasında OpenDyslexic fontun etkisini belirlemek amacıyla deneysel araştırma yöntemlerinden yarı deneysel araştırma yöntemi kullanılmıştır. Disleksi tanısı almış üç öğrencinin katılımıyla gerçekleştirilmiş olan çalışmamızda tek denekli deneysel araştırma desenlerinden denekler arası çoklu yoklama modeli kullanılmıştır. Deneysel araştırmalar başlığı altında, katılımcıların seçilme biçimine göre gerçek/tam deneysel araştırmalar ve yarı deneysel araştırmalar olmak üzere iki grup araştırmadan söz edilmektedir. Tam deneysel ve yarı deneysel araştırmalar arasındaki farkı belirleyen temel unsurlardan birisi katılımcıların yansız atama ile seçilip seçilmediğidir. Tek-denekli deneysel araştırmaların katılımcıları hâlihazırda sorunlu davranışları olan ya da yeni davranışların kazandırılmasına gereksinim duyan katılımcılar arasından seçilmesi nedeniyle araştırma katılımcıları yansız atama yoluyla belirlenememektedir (Aydın, Tekin-İftar, ve Rakap, 2019). Çalışmamızda da okuma güçlüğü olan öğrenciler belirlenip, bu öğrenciler arasından önkoşullara uygun olanlar çalışmaya dahil edilmiştir.

Çoklu yoklama modelleri, bir öğretim ya da davranış değiştirme programının etkililiğini birden fazla durumda değerlendirmeyi amaçlar (Aydın, Tekin-İftar, ve Rakap, 2019). Çoklu yoklama modelleri; (a) davranışlar arası çoklu yoklama modeli, (b) katılımcılar arası çoklu yoklama modeli, (c) ortamlar arası çoklu yoklama modeli olmak üzere üç grupta incelenmektedir. Katılımcılar arası çoklu yoklama modeli, bir bağımsız değişkenin etkililiğinin en az üç farklı katılımcı üzerinde incelendiği bir araştırma modelidir (Tekin-İftar, 2018). Modelin etkili bir uygulamayı, geri çekmeyi ve sürekli başlama düzeyi verisi toplamayı gerektirmemesi uygulama kolaylığı sağlamaktadır (Tekin-İftar, 2018).

Bağımlı ve Bağımsız Değişken

Çalışmanın bağımsız değişkenini OpenDyslexic font oluştururken bağımlı değişkenini ise katılımcıların okuma hızı, okuma doğruluğu, okuma prozodisi ve okuduğunu anlama becerisi oluşturmaktadır.

Katılımcılar ve Seçimi

Bu araştırma 2020-2021 öğretim yılında Aksaray ilinde resmi okullara devam eden, dördüncü sınıfta okuma güçlüğü olan üç öğrenci ile yürütülmüştür. Araştırmaya katılacak öğrencileri belirleyebilmek üzere gerekli izinlerin alınmasının ardından Aksaray Rehberlik ve Araştırma Merkezi'nde özel öğrenme güçlüğü tanılı (ÖÖG) ve skolastik becerilerde karma tip bozukluk alt tanılı dördüncü sınıf öğrenciler tespit edilmiştir. Tespit edilen öğrencilerin okulları ile irtibata geçilerek öğretmen ve velilerinden öğrenci hakkında ön bilgi alınmıştır. Çalışmaya istekli öğrencilerin belirlenmesiyle 10 yaşında iki erkek ve biri kız olmak üzere üç öğrenci çalışmaya alınmıştır.

Veri Toplama Araçları

OpenDyslexic fontun etkililiğinin belirleyebilmek amacıyla veri toplama aracı olarak Milli Eğitim Bakanlığınca 4. sınıf Türkçe ders kitaplarında okutulan metinler kullanılmıştır. Öğrencinin okuma hızını

belirleyebilmek için bir dakikada doğru okuduğu sözcük sayısı kaydedilmiştir. Okuma doğruluğunun belirlenebilmesi için metin içinde okuduğu doğru sözcük sayısı ve yanlış seslettiği sözcükler kaydedilmiştir. Prozodik okuma düzeyinin belirlenebilmesi için Keskin, Baştuğ ve Akyol (2013) tarafından geliştirilen "Prozodik Okuma Ölçeği" kullanılmıştır. Katılımcıların okuma düzeylerinin tespit edilmesi için "Yanlış Analiz Envanteri" kullanılmıştır.

Verilerin Toplanması

Okuma hızı ve prozodi için başlama düzeyi verileri en az üç oturumda kararlılık elde edilinceye kadar birer gün aralıklarla toplanmıştır. Başlama düzeyi verileri için okul ders kitaplarında yazılmış fontta metinler kullanılırken uygulama evresi verileri için metinler OpenDyslexic fonta çevrilmiştir. Uygulama sürecinde OpenDyslexic fonta çevrilmiş beş metin ile çalışma yapılmıştır. Başlama düzeyi verileri için Milli Eğitim Bakanlığı'nın Türkçe ders kitaplarında dördüncü sınıflar için hazırlanmış "Eskiciyle Para Babası", "Pinti", "Güler Yüze ve Gülmeye Dair" adlı metinler kullanılmıştır. Uygulama sürecinde ise "Ah Heidi Neredesin?", "Öğrenme ve Marie Curıe", "İpek Böceği", "Beyin Ne İşe Yarar", "Şakacı Fil" adlı metinler ile çalışma yapılmıştır. Çalışmaların ilk iki haftasında yüz yüze eğitim yapılmıştır. Ancak 2020-2021 eğitim-öğretim yılının bahar döneminde uygulanmaya başlanmış olan araştırma sürecinde tüm dünyayı saran Covid-19 salgını nedeniyle Türkiye'de sokağa çıkma yasağı ilan edilmiştir. Bu nedenle araştırmanın iki haftalık sürecinde uzaktan eğitim yapılmıştır. Yasakların hafifletilmesi ile birlikte uygulama sürecinin son iki haftası da yüz yüze eğitim uygulaması ile tamamlanmıştır. Okuduğunu anlama için başlama düzeyi verisi "Eskiciyle Para Babası" adlı metnin soruları ile toplanmıştır. Uygulama evresi verileri için "Ah Heidi Neredesin?", "Beyin Ne İşe Yarar" adlı metinler kullanılmıştır. "Öğrenme ve Marie Curıe" ve "İpekkelebeği" adlı metinler ile yapılan okuduğunu anlama çalışmaları pandemi nedeniyle canlı ders olarak işlenmiş olup okuduğunu anlama ölçekleri yazılı olarak cevaplandırılamamıştır. Bu nedenle bu metinlerin okuduğunu anlama ölçekleri puanlamaya dahil edilmemiştir. Çalışma, toplamda 23 ders saati olmak üzere 16 oturumda tamamlanmıştır.

Başlama Düzeyi ve Yoklama Oturumları

Çalışmaya başlamadan önce öğrencilere uygulama ve kullanılacak materyaller hakkında bilgi verilmiştir. Okuma metnin bir kopyası araştırmacı tarafından alınmış, diğeri ise öğrenciye sunulmuştur. Öğrenci okumaya motive edilerek hazır olduğunda başlaması söylenmiştir. Öğrenci okumaya başladığı andan itibaren video kayıt başlatılmıştır. Öğrenciye müdahale edilmeden tüm metni okuması sağlanmıştır. Öğrencinin okuyamadığı kelimeler üç saniye beklenildikten sonra araştırmacı tarafından okunmuştur. Öğrencinin satır atlama hataları anında düzeltilmiş, atlanan satır gösterilerek devam etmesi sağlanmıştır. Öğrencinin okuma videosu oturum sonrasında araştırmacı tarafından dikkatle dinlenerek bir dakikada doğru okuduğu kelime sayısı tespit edilmiş, okuma hataları çizelgeye kaydedilmiştir. Öğrencinin okuma videosu birkaç defa dinlendikten sonra prozodik okuma ölçeğine puanlama yapılmıştır. Okuduğunu anlama başlama düzeyi verisi için "Eskiciyle Para Babası" adlı metin ders kitabında yazılmış fontta çalışılmış, uygulama evresi verileri için ise "Ah Heidi Neredesin?", "Öğrenme ve Marie Curıe", "İpek Böceği", "Beyin Ne İşe Yapar" adlı metinler OpenDyslexic fonta çevrilerek sorular cevaplanmıştır. Sorular metinde geçen kelimeleri tahmin etme, metin ile ilgili sorular, metnin konusu ve metnin ana fikri olmak üzere üç etkinlik olarak hazırlanmıştır. Sorular gönüllü öğrenciye okutulmuş ve her öğrencinin kendi kağıdına cevaplaması istenmiştir. Yazma güçlüğü olan

öğrenciler için sorular sözlü olarak cevaplamaları istenmiş, sözel olarak verilen doğru cevaplar ayrıca not alınmıştır.

Verilerin Analizi

Başlama düzeyi için ders kitaplarında kullanılmış fontta metinler ile toplanmış verilerin analizi yapılmıştır. Uygulama evresi için OpenDyslexic fonta çevrilmiş metinler ile veri analizi yapılmıştır. Katılımcıların okuma hızı, okuma doğruluğu, prozodik okuma, okuma düzeyleri ve okuduğunu anlama puanları ile ilgili veriler toplanarak kaydedilmiş ve grafiğe işlenmiştir. Okuma hızı, katılımcının bir dakikada okuduğu kelime sayısından yapılan hata sayısının çıkarılması ile hesaplanmıştır (Deeney, 2010).

Doğruluk, her bir metin için doğru olarak tanımlanan kelime sayısıyla ölçülmüştür. Katılımcının ekleme, atlama, yanlış okuma, hiç okuyamama ya da yardımla okuduğu kelimeler okuma hatası olarak puanlanmıştır. Okuma doğruluğu yüzdesi, doğru okunan kelime sayısı toplam okunan kelime sayısına bölünmüş ve 100 ile çarpılarak hesaplanmıştır (Dowhower, 1987).

Prozodik okuma için Keskin, Baştuğ ve Akyol (2011) tarafından geliştirilen prozodik okuma ölçeğinden alınan puanlar kaydedilerek veriler grafiğe işlenmiştir. Keskin (2012), okuma becerisini yeterince kazanamamış, çok fazla okuma hatası yapan öğrenciler için ölçeğin kullanılmasını uygun görmemektedir. Birinci ve İkinci katılımcının prozodik okuma ölçeği verileri değerlendirmeye alınmıştır. Ancak çok fazla okuma hatası olması nedeniyle üçüncü katılımcının prozodik okuma ölçeği değerlendirilmeye alınmamıştır.

Okuma düzeylerini belirlemek amacıyla kullanılan Yanlış Analiz Envanteri ile kelime tanıma ve okuma düzeyleri tespit edilmiştir. Okuduğunu anlama düzeyini belirlemek için katılımcıların metin sorularına verdikleri cevaplar puanlandırılmıştır. Katılımcıların cevapları her etkinlik için yazılı ve sözlü olarak alınmıştır. Cevaplanmamış sorular ya da hatalı cevaplar puanlandırılmamış, eksik cevaplar her bir soru değerinin yarısı kadarıyla puanlandırılmıştır.

Bulgular

OpenDyslexic Fontun Okuma Hızına Olan Etkisine İlişkin Bulgular

Araştırmanın birinci alt amacında OpenDyslexic fontun disleksili öğrencilerin okuma hızına olan etkisi araştırılmıştır. Araştırmaya dahil edilen katılımcıların okuma hızlarına bakıldığında birinci katılımcının başlama düzeyinde ortalama okuma hızı 47 kelimeden 64 kelimeye yükselmiştir. Birinci katılımcının okuma hızında başlama düzeyine göre %48'lik bir artış görülmüştür. İkinci katılımcının ortalama okuma hızı 55 kelimeden 70 kelimeye çıkmış, okuma hızında %27'lik bir artış görülmüştür. Üçüncü katılımcının ise ortalama okuma hızı 8 kelimeden 12 kelimeye yükselmiştir. Üçüncü katılımcının okuma hızında %50'lik bir artış görülmüştür. Bu sonuçlar değerlendirildiğinde katılımcıların üçünün de okuma hızlarının arttığı görülerek OpenDyslexic font etkili bulunmuştur.

OpenDyslexic Fontun Okuma Doğruluğuna Olan Etkisine İlişkin Bulgular

Araştırmanın ikinci alt amacında OpenDyslexic fontun okuma güçlüğü olan öğrencilerin okuma doğruluğuna olan etkisi araştırılmıştır. Birinci katılımcının başlama düzeyindeki ortalama okuma doğruluğu yüzdesi %95,02 iken, uygulama evresi ortalama okuma doğruluğu yüzdesi %97,32'ye yükselmiştir. Bu verilere bakıldığında birinci katılımcının okuma doğruluğu yüzdesi başlama düzeyi veri ortalamasına kıyasla uygulama verileri ortalamasında %2,3'lük bir artış görülmüştür. İkinci katılımcının

başlama düzeyindeki ortalama okuma doğruluğu yüzdesi %96,11 iken, uygulama evresi ortalama okuma doğruluğu yüzdesi %98,93'e çıkmıştır. İkinci katılımcının okuma doğruluğu yüzdesi başlama düzeyi veri ortalamasına kıyasla uygulama verileri ortalamasında %2,82'lik bir artış görülmüştür. Üçüncü katılımcının başlama düzeyindeki ortalama okuma doğruluğu yüzdesi %31,24 iken, uygulama evresi ortalama okuma doğruluğu yüzdesi %38,97'ye yükselmiştir. Bu veriler incelendiğinde üçüncü katılımcının okuma doğruluğu yüzdesi başlama düzeyi veri ortalamasına kıyasla uygulama verileri ortalamasında %7,73'lük bir artış görülmüştür.

Özetle araştırmaya dahil edilen katılımcıların üçünün de okuma doğruluk düzeyi artmış ve OpenDyslexic font etkili bulunmuştur. Birinci ve ikinci katılımcının doğru okuma oranı yüksek iken üçüncü katılımcının metin içinde çok fazla okuma hatası yaptığı görülmüştür. Üçüncü katılımcının ters çevirmeden kaynaklanan okuma hatalarını en çok "en, ne" gibi tek heceli, kısa sözcükler oluşturmaktadır. Katılımcının okuma doğruluğu verileri incelendiğinde bazen tek heceli kelimelerde bile okuma hatası yaparken bazen de 4-5 heceli kelimeleri tek seferde doğru okuduğu gözlemlenmiştir.

OpenDyslexic Fontun Prozodik Okumaya Olan Etkisine İlişkin Bulgular

Araştırmanın üçüncü alt amacında OpenDyslexic fontun öğrencilerin prozodik okumalarına olan etkisi araştırılmıştır. Birinci katılımcının başlama düzeyindeki ortalama prozodik okuma puanı 33 iken uygulama evresindeki ortalama prozodik okuma puanı 53'e yükselmiştir. İkinci katılımcının ortalama prozodik okuma puanı 32 iken uygulama evresindeki ortalama prozodik okuma puanı 53'e yükseldiği görülmüştür. Bu verilere bakıldığında ilk iki katılımcının prozodik okuma düzeylerinin arttığı görülmüş ve OpenDyslexic fontun prozodik okuma üzerinde etkili olduğu bulunmuştur. Üçüncü katılımcının metin içinde çok fazla okuma hatası yapması nedeniyle prozodik okuma ölçeği tutulamamıştır.

Birinci ve ikinci katılımcının okuma hızının ve okuma doğruluğunun artmasıyla, metinleri daha akıcı, özgüvenli okudukları, seslerini daha iyi kullanmaya başladıkları gözlemlenmiştir. Bunun sonucunda da katılımcıların prozodi okuma puanları yükselmiştir.

OpenDyslexic Fontun Okuma Düzeyine İlişkin Bulgular

Araştırmanın dördüncü alt amacında OpenDyslexic fontun öğrencilerin okuduğunu anlama düzeyine etkisi araştırılmıştır. Birinci katılımcı başlama düzeyinde okuduğu ilk metinde 1 dakikada 48 kelime okumuş ve 3 okuma hatası yapmıştır. Uygulama evresinin OpenDyslexic fonta çevrilmiş olarak okuduğu son metninde 1 dakikada 79 kelime okumuş ve 1 kelime hatalı okuma yapmıştır. Katılımcının her iki okuma çalışmasında da öğretim düzeyinde olduğu görülmüştür. İkinci katılımcı başlama düzeyinde toplam 2 hatalı okuma ile 1 dakikada 52 kelime okumuş iken son okuma çalışmasında hatasız olarak 1 dakikada 77 kelime okumuş, okuma düzeyi öğretim düzeyinden serbest okuma düzeyine çıkmıştır. Üçüncü katılımcı başlama düzeyinde okuduğu ilk metinde 1 dakikada 10 kelime okumuş ve 22 okuma hatası yapmıştır. Okuduğu son metninde 1 dakikada 14 kelimeye çıkmış, okuma hatası ise 18 kelimeye düşmüştür. Üçüncü katılımcının her iki okuma çalışmasında da endişe düzeyinde kaldığı görülmüştür.

OpenDyslexic Fontun Okuduğunu Anlama Düzeyine İlişkin Bulgular

Araştırmanın beşinci alt amacında OpenDyslexic fontun öğrencilerin okuduğunu anlama düzeyine etkisi araştırılmıştır. Birinci katılımcının başlama düzeyindeki okuduğunu anlama puanı 59 iken uygulama evresindeki son puanı 82'ye yükselmiştir. İkinci katılımcının 54 puandan 78'e, üçüncü katılımcının ise 31 puandan 49'a yükseldiği görülmüştür. Bu verilere bakıldığında üç katılımcının da

okuduğunu anlama düzeylerinin arttığı görülmüş ve OpenDyslexic fontun okuduğunu anlama üzerinde etkili bulunmuştur.

Tartışma ve Sonuç

Türkiye'de yazı tipinin disleksi tanılı çocukların okuma hızları üzerine etkisini inceleyen bir çalışmaya rastlanmıştır. İleri (2020), disleksi tanılı çocukların eğitiminde kullanılmak üzere en uygun yazı tipinin tespit edilmesini amaçladığı yüksek lisans tez çalışmasında elektrookülografi (EOG) yöntemini kullanmıştır. 23 disleksi tanısı konmuş ve 13 disleksili olmayan toplam 36 bireyin, hazırlanan farklı punto ve yazı karakterlerini içeren metinleri okurken eş zamanlı olarak EOG sinyalleri kaydedilmiştir. Araştırma sonucunda, her iki grupta da Times New Roman ile hazırlanmış metinlerde ortalama okuma süreleri artarken, BonvecoCF yazı tipi ile hazırlanmış metinlerde ortalama okuma süreleri düşmüştür. Bu sonuç, kullanılan yazı tipinin disleksi tanılı öğrencilerin okuma hızına etkisi olduğu çıkarımıyla araştırmamızın bulgusunu destekler niteliktedir.

İngiliz Disleksi Derneği'nin yayını da araştırma bulgumuzu destekler niteliktedir. İngiliz Disleksi Derneği, yazılı materyallerde bazı disleksik kişilerin yaşadığı görsel stresi önlenmek ve okumayı kolaylaştırmak için uygun yazı tipi ve arka plan rengi seçimini, şeffaf olmayan kalın kağıt kullanımı gibi unsurların önemini ortaya koymaktadır (Dyslexia Style Guide, 2021). Hughes ve Wilkins (2000), okuma güçlüğü çeken çocukların görsel strese daha duyarlı olduklarını ve metin boyutunun öğrencilerin okuma hızlarını büyük ölçüde etkilediğini iddia etmektedir. Görsel stres, okuma sırasında hayali şekiller, metnin hareketi ve renkleri, bozuk veya bulanık baskı ve genel görsel tahriş gibi hoş olmayan görsel semptomlarla kendini gösterir (Zikl ve diğerleri, 2015). Bu bulgu, araştırmacıları metnin görsel özelliklerinin disleksili bireylerde okuma üzerindeki etkisini daha fazla incelemeye yöneltmiştir. Ülkemizde de OpenDyslexic fontun disleksili bireylerin okuma hızına etkisini belirleyebilmek adına daha fazla ve kapsamlı çalışmalara ihtiyaç vardır.

OpenDyslexic'in okuma doğruluğuna etkisini araştıran Zikl ve diğerleri, (2015), araştırma sonucunda OpenDyslexic font ile hata oranları özellikle çok sık hata yapan öğrencilerde biraz daha düşük çıkmış, bu sonuç OpenDyslexic fontun ciddi okuma güçlüğü çeken öğrencilerde daha etkili olabileceğini düşündürmüştür. Wery ve Diliberto (2016) makalesinde, OpenDyslexic font ile yapılan çalışmaların okuma doğruluğunda hiçbir gelişme göstermediğini ortaya koymuştur. Araştırmamıza yakın bir diğer çalışma olan De Leeuw (2010), Dyslexie yazı tipiyle okumanın okuma hatalarını azalttığını tespit etmiştir.

Araştırmamızda okuma düzeylerinin belirlenmesinde Ekwall ve Shanker (1988) tarafından geliştirilen, Akyol (2011) tarafından uyarlanan kelime tanıma oranı kullanılmıştır. Buna karşın okuma düzeylerinin belirlenmesinde okuma doğruluğu oranları araştırmacılara göre farklı oran aralıklarına ayrılmıştır. Farris, Fuhler, ve Walther (2004), Rasinski ve Hoffman (2003) okuma doğruluk oranlarını; %89 ve altını endişe (başarısız) düzeyi, %90 ile %94 arasını öğretimsel düzey, %95 ile %100 bağımsız düzey olarak belirlemiştir (Sert, 2019). Çalışmamızda bu oranlar baz alınmış olsaydı; birinci ve ikinci katılımcının öğretimsel düzeyden bağımsız düzeye çıktığını, üçüncü katılımcının endişe düzeyinde kaldığını ifade etmiş olurduk.

OpenDyslexic fontun okuma hızı, okuma doğruluğu üzerindeki olumlu etkisi ikincil sonuç olan okuduğunu anlama üzerinde de olumlu etkilere sebep olmuştur. Wery ve Diliberto (2016), akıcı kelime tanıma güçlükleri ve zayıf kod çözme becerileri ile karakterize edilen disleksinin okuduğunu anlama

sorunları, kelime dağarcığının ve bilişsel şemaların büyümesini engellemesi gibi ikincil sonuçlar doğurabileceğini savunmuştur. Renske de Leeuw (2010), Dyslexie yazı tipinin okuma hızını kelime çalışmaları ile ölçtüğü çalışmasında, çalışmamızda olduğu gibi metinler üzerinde okuduğunu anlama becerisinin ölçülmesini, okunabilirliği arttırdığı düşünülen bir yazı tipinin okuma için harcanan çabanın ve odağın azalacağı için okuduğunu anlamayı arttıracağı hipotezinin test edilmesini önermiştir. Araştırma bulgularımız da bu çalışmalarla örtüşmektedir. Katılımcılarımızın okuma hızı ve doğruluğu arttıkça okuduğunu anlama becerileri gelişmiş, katılımcılar metin sorularına daha istekli ve doğru cevaplar vermiştir.

Öneriler

Araştırma bulguları temel alınarak uygulamaya ve ilerideki araştırmalara yönelik öneriler aşağıda verilmiştir.

Uygulamaya Yönelik Öneriler

Üç öğrencinin de hikaye edici metinleri daha akıcı okurken özellikle içinde yabancı isimlerin bulunduğu bilgi verici metinleri okumakta zorlandıkları gözlemlenmiştir. OpenDyslexic fontun etkililiğini belirlemek amacıyla yapılacak çalışmalarda, metinlerin okunabilirlik açısından eş zorluk düzeyinde olması öğrencilerin gelişimini izlemek adına daha faydalı olabilir.

Okul ders kitaplarında OpenDyslexic yazı tipi ile hazırlanmış metinlere de yer verilebilir.

İlerideki Araştırmalara Yönelik Öneriler

Pandemi nedeniyle online olarak yapılan derslerde üçüncü katılımcının ekran okumasına karşı daha istekli olduğu ve daha doğru okuduğu gözlemlenmiştir. OpenDyslexic font ile ekran okuma üzerinden okuma hızı ve doğruluğuna etkisini araştıran metin okuma çalışmaları yapılabilir.

Disleksili Türkçe okuyucular üzerinde, OpenDyslexic fontun akıcı okuma ve okuduğunu anlamaya etkisini araştırmaya yönelik daha büyük örneklem gruplarıyla çalışmalar yapılabilir.

Disleksili öğrencilerin, okuma sırasında OpenDyslexic ile diğer fontlara göre göz hareketlerini inceleyen çalışmalar yapılabilir.

Disleksili öğrencilerin, OpenDyslexic font ile farklı punto, harf ve kelime aralıklarında hazırlanmış metinlerle okuma hızı ve doğruluğu ölçülebilir.

OpenDyslexic ile sık kullanılan ve farklı özelliklerdeki birden fazla yazı tipini karşılaştıran çalışmalar yapılabilir.

OpenDyslexic fontun okuma hızı ve doğruluğuna etkisi üzerine farklı yaş gruplarını karşılaştıran çalışmalar yapılabilir.