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Marmaris, Turkey

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Any paper submitted for the conference is reviewed by at least two international reviewers with expertise in the relevant subject area. Based on the reviewers' comments, papers are accepted, rejected or accepted with revision. If the comments are not addressed well in the improved paper, then the paper is sent back to the authors to make further revisions. The accepted papers are formatted by the conference for publication in the proceedings.

Aims & Scope

In the current century, with the effect of technological developments, studies on the development and implementation of individual education programs are increasing day by day. Considering the learning difficulties, it can be said that almost every individual needs special education. However, when special education is mentioned, education to be given in disability situations such as Autism Spectrum Disorder, Down syndrome, Hearing-Impaired and Deaf Children, Mentally Handicapped and Intellectual Disability, Vision Impairment and Blindness, Physical Disability, Specific Learning Disability and Chronic Health Conditions comes to the fore. At the same time, gifted and talented students are considered within the scope of special education. The focus of this conference is individual programs, training given to gifted and talented students and the physically and mentally handicapped.

The aim of this conference is to bring together academicians, researchers, educators and administrators from different countries, and to discuss theoretical and practical issues in all fields of special education. At the same time, it is aimed to enable the conference participants to share the changes and developments in the field of special education with their colleagues.

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IConSED 2023: International Conference on Special Education and Diversity

Web Application for Screening Dyslexia in Greek Students

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Abstract: Dyslexia's diagnosis is made taking into account reading and writing skills and is carried out by qualified scientific staff. In addition, there are screening tests that are designed to give an indication of possible dyslexic difficulties. Their main advantage is that they create a pleasant environment for the user and reduce the stress that can lead to false results. An online application was created for the first time, as far as authors' knowledge, for screening Dyslexia in Greek high school students named «DyScreTe». Thus, a sample of 240 students between 16 and 18 years old in Greece was taken, of which 120 were diagnosed with dyslexia by an official authority in Greece, and 120 were typically developed. The main hypothesis that was examined is that students who were diagnosed with dyslexia by official authorities in Greece had significantly lower performance in the respective software tests. The results verified the hypothesis we made those children with dyslexia in each test had a lower performance compared to the type developed in successful responses, except for the intelligence test. After random sampling, it was shown that the new online application was a useful tool for screening dyslexia. However, computer evaluation cannot replace the diagnosis by a professional expert, but with the results of this application, the interdisciplinary team that deals with the differential diagnosis will create and evaluate, at a later time, the appropriate intervention program.

Keywords: Dyslexia, Internet application, Screening tests

Introduction

It has been shown experimentally that students with developmental dyslexia have deficits in reading skills such as omissions of letters, incorrect reading of sentences and words, but they are mainly characterized as slow readers. Nevertheless, the etiology of dyslexia should not be investigated only in the reading disabilities of individuals but also in other cognitive skills, such as spelling, working memory, mathematical ability, visual and auditory retrieval and discrimination (Fletcher, 2009).

An extensive list of skills related to visual and auditory stimulus processing, mathematical ability and working memory function has been suggested as causative factors of dyslexia. Nonetheless, it is now taken for granted that dyslexia cannot be linked to a single causal factor, as it is associated with a wide range of problems. The fact that dyslexics face a wide range of difficulties inevitably lead scientists to conclude that different forms of dyslexia are related to different weaknesses of the individual (Fletcher, 2009).

A screening test indicates a high probability of dyslexic difficulties. Screening of dyslexia is done by assessing mainly a child's reading skills, which should be significantly lower than expected for his age group. One of the biggest difficulties faced by dyslexics is the ability to match effectively written texts (graphs) with sounds (phonemes). This difficulty emerges from the attenuated audio processing, which ultimately affects the phonological processing.

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However, computer-based evaluation (screening) cannot replace diagnosis by a professional expert, but is a very useful tool in order to decide whether a child should visit an expert for official evaluation or not. Moreover, the interdisciplinary team that deals with the differential diagnosis of a child has the knowledge to create the appropriate intervention program, something that cannot be done by a computer (Watson & Willows, 1995).

Literature Review

According to Singleton (2001), computer-assisted dyslexia screening provides a simple, direct, and objective way for teachers to assess children who have learning difficulties, screen existing or potential learning problems and obtain basic diagnostic information and generally measure children's progress. Moreover, it evaluates individual responses to support children with special learning disabilities and obtain information that will be useful to psychologists at a later time, during an intervention program

The main advantages of computer-based screening are the objective and standard presentation besides the faster management of participants' results. In addition, greater evaluation accuracy is achieved, since less training of managers is required, as well as time and cost savings. Finally, the results are immediately available; the process is enjoyable for children and confidential for adults. On the other hand, the critical issues and risks involved in computer-based evaluation are that boys have an advantage over girls and usually creating computer-generated tests needs time and money. Furthermore, computer tests are limited in some aspects of evaluation and there are risks, since technology may not cover certain areas of neuropsychology (Singleton, 2001). Some widely used computer based applications for screening dyslexia are Lucid CoPS Cognitive Profiling System, Lucid Rapid, CoPS Baseline, LASS Secondary, Lass Junior, Lass 11-15 and Lucid Adult Development Screening (LADS).

Research Contribution

There was no on-line application for screening Dyslexia aimed at high school students in Greece according to the authors' knowledge. The main purpose of this research was to create a web application for screening dyslexia to Greek students from 16 to 18 years old. For that reason, the application «DyScreTe» was created. Its name comes from the words Dyslexia Screening Test.

Internet Interactive Application

The advantages of a web application are that users have access to their files in any space they wish as soon as they have an internet connection and it does not require manual updates. Desktop applications at regular time intervals require installation-level updates with many instructions that bother users. In contrast, web applications perform automatic updates by pressing a button and the user simply waits a few seconds (Karakos, 2007).

In addition, web applications do not require special features from the computers. Moreover, online applications can be accessed by all users with a simple internet connection even if it is not very fast. Finally, desktop applications are much more expensive than online applications. The first ones are linked to a one-time payment and users do not have the option to purchase them for a specific period of time. An online application gives the opportunity to the user to buy it for a limited time. In this case it is likely that a private school will need to screen special learning difficulties in September and October when students are enrolled. This feature is not provided by a desktop application where users are required to pay for the application for a full year (Karakos, 2007). On the other hand, the disadvantages of web applications are that application cannot run without internet access. Moreover, not all countries have the proper speed to run applications properly and this is one of the main reasons why desktop applications still exist. Moreover, desktop applications are more secured than web applications since they are vulnerable to malware attacks (Karakos, 2007).

Objectives and Hypotheses

The originality of the research is the creation of an online application for screening dyslexia in students in Greece between 16 to 18 years old. The user is given the opportunity to screen dyslexia in high school students with a simple internet connection and without the existence of computers with special requirements. Moreover the time needed to complete 8 out of 10 tests is measured. According to the literature review, the main

hypothesis of the research is that children with dyslexia will show significant differences both in the mean scores and in the time of completion of all tests, compared to their typically developed classmates.

Then, according to the basic hypothesis analyzed, three sub-hypotheses emerge, according to which it is scientifically proven that the test will have the correct results at acceptable levels of confidence. Specifically, according to previous research, such as Skues and Cunningham (2011) and Bonifacci and Snowling (2008) it is expected that children, who have already been diagnosed with dyslexia by an official authority, will achieve lower scores in all tests, with the exception of the intelligence assessment test (1st Hypothesis). In addition, the research of Van Viersen et al., (2015) suggests that children with developmental dyslexia are not expected to have significant differences compared to their typically developed classmates in the intelligence assessment test (2nd Hypothesis). Finally, based on the results of the research of Boets and De Smedt (2010) and Träff and Passolunghi (2015), children diagnosed with dyslexia will complete the tests slower, with the exception of the intelligence assessment test (3rd Hypothesis). Thus, a large enough sample has been tested from the Greek students who executed the internet application. In addition, probabilistic sampling was performed and the sample was checked for regularity. An equal dispersion test was then performed. The above tests make the sample capable of drawing conclusions through it for the whole population and ensure the validity and reliability of the results that are required in any experimental research.

More specific, the method of collecting the sample ensured small sampling errors, which makes it representative of its population. In addition, the estimators who interpret the sample data are sufficiently capable of using inferred statistics to draw safe conclusions through the sample in the population. It is worth mentioning that in this research comparisons have been made between the tests in order to ensure their validity and reliability. Predictions were then made between trials, which enhances the ability of «DyScreTe» software to screen dyslexia.

Methods

Participants

Since the population of students with dyslexia is scattered and quite large, the selection of a random sample is a time consuming and costly process. Specifically, it has been estimated that only 5,52% of the Greek student population are students with dyslexia (Vlachos et al., 2013). In addition, the sample collection took place during the school years 2018 - 2019 and 2019 - 2020, which does not allow simple random sampling, due to time and cost. (Creswell, 2011). For the needs of the research, inductive statistics were performed, ie conclusions will be drawn through the sample to the population. The sampling method chosen is stratified or layered sampling. Its main feature is the reduced standard errors of estimators. Safe conclusions can therefore be drawn from the examination of the sample in the whole population (Neyman, 1992). More specific, the students were selected as subsets according to their age group. The separation of the sample was carried out in independent layers and specifically the first consists of 16 years old students, the second of 17 years old students and the third of 18 years old students. In this way the independence between the layers is achieved (Imbens & Lancaster, 1996). In addition, with the above way of selecting the sample, the homogeneity between the layers is achieved, as all the students, depending on which layer they are placed in, have been taught the same part of the material. Then, after defining the mattresses, the selection of students in each mattress was done randomly (Trost, J. E., 1986).

In addition, the above procedure was performed independently for the two experimental research groups. Specifically, a sample of the same size was collected for both the experimental group and the control group. The students in the experimental group should have been officially diagnosed with dyslexia without co-morbidity of other disorders. The schools in which the sampling took place are in the suburbs (southern and northern) and in the center of Athens. It is worth noting that the process was conducted with the consent of the school principal, the parents and of course the students who participated in the process. In the next stage, sampling was performed for the control group, which consists of students of the same sex and the same age group as students who were diagnosed with dyslexia. The main goal was to have uniformity between the two teams.

The size of the sample for proper quantitative data analysis is a very difficult decision and depends on many factors. Initially the general rule, that applies to both quantitative and qualitative research, is that the larger the sample the more representative it is of the population. In details, the higher the sample, the smaller the sampling error and the sample is representative of its population. It is understood that selecting a larger sample takes more time and the process is costly. The goal of each researcher is to minimize the sampling error, which is the difference between the sample value and the actual value that corresponds to the population (Creswell, 2011).

In this research the number of participants is very specific and limited. Access to students with dyslexia is not a simple process and can only take place under certain conditions. The exact population of students with dyslexia in Greece is changing rapidly and it is not easy for the researcher to access the population. In the present study, mathematical formulas from Cohen's 1988 tables were used to calculate the sample. According to these tables, a sample of 240 students was selected so that generalizations could be made at a 95% confidence level. The selected students are aged from 16 to 18 years and attend the classes 1st, 2nd and 3rd Grade of High School (lyceum). The research sample consists of 240 students with an average age of 16,8 years and a standard deviation of 1,09.

The experimental group consists of students who have already been diagnosed with dyslexia by an official authority of the Greek Government and specifically the participants in the research were diagnosed by KESY, ie the Educational and Counseling Support Centers. The students who participated in the research had been diagnosed with developmental dyslexia and did not appear any other developmental disorder. Specifically, the experimental group of students that participated in the research consists of 120 students. The control group consists of students who according to the informal evaluations of their teachers do not present any special learning difficulty. In addition, they have not been diagnosed with learning disabilities in the past. The control group that participated in the research consists of 120 students. The basic software tests are ten and are divided into those that examine verbal and non-verbal skills. Following the literature the main criterion for the selection of the software tests was to have, as much as possible, the maximum reliability and validity in the evaluation of the parameters of dyslexia in students.

Instruments

The program «DyScreTe» consists of ten tests which will be described shortly. The first test involves pseudowords (nonreal words). Specifically, the pseudowords are displayed on the screen and the student must recognize whether or not the displayed word is a pseudoword or a real one. The reason for this test is that people with direct dyslexia have the ability to read familiar, simple and easy spelling words. However, they cannot read pseudowords correctly and words that they did not use in their speech before a brain injury. Direct dyslexia is the rarest type of dyslexia (Lytton & Brust 1989). Lyon (2003) states that in the case of direct dyslexia, words are read aloud but their meaning is not understood. It is also difficult for people with direct dyslexia to read low frequency words or pseudowords.

The second test involves reading texts. Specifically, two texts are displayed on the screen and after each text there are four questions. In this test, a student's ability to read as well as to understand a text, in relation to time, is tested. Therefore, after the children read the text, they are asked to answer some questions to prove its comprehension. This test is included in the software in the light of the fact that reading disorders usually deal with problems in the rapid and accurate decoding of written speech. These disorders can lead to reading comprehension problems that are described as a key feature of a specific reading disorder or dyslexia (Mouzaki & Sideridis, 2007).

The third and fourth tests concern the examination of spelling. The third test concerns historical spelling and the fourth is grammar spelling. In particular, in the third test a series of twenty words are displayed on the screen where the historical spelling is examined. Thus, in the fourth test twenty words are displayed where the grammar spelling is examined and the student must choose the correct spelling from three choices given. These tests are included because a student, in order to be able to learn to spell, must have acquired the knowledge of letters, the knowledge of the spelling system of his language and have such a memory ability that allows the retrieval of letters and their phonetic correspondences in words with historical spelling. At the stage of productive spelling students have the ability to use spelling rules correctly. Thus, they need to practice more systematically on these rules as well as on historical spelling. At this stage students make mistakes that mainly concern historical spelling. Finally, developmental dyslexia is a special learning disability which is presented as difficulty in acquiring reading skills and later as instability in spelling and as a lack of fluency in handling written words.

The fifth test concerns the comprehension of audio texts. Specifically, the student listens to two recorded texts and after each text he has to answer four questions with multiple answers. In dyslexic individuals, the large cell system of the brain malfunctions, displays cells smaller than normal. This abnormality seems to affect all the functions with which the large cell system is connected, with the most basic the visual and auditory functions which affect the skill of reading. Therefore, an attempt is made to explain on a neurological basis, the

phonological deficits of the case of developmental dyslexia, which no one can deny that is present in the entire dyslexic population. Large cell theory, therefore, links deficits in phonological awareness with problems of visual and auditory nature (Reed, 1989).

The sixth test examines the student's mathematical ability in three areas (known object, arithmetic and problem solving). Dyslexic student are unable to memorize basic arithmetic data, retain rules and techniques. Moreover, they have a deficit in recalling arithmetic operations from long-term memory and have difficulty in any task related to numbers (Geary & Hoard, 2001).

The seventh test is a test in which memory and specifically working memory is tested. In details, students are given a series of thirty-five different letter sequences, where the first sequence contains two numbers, the second three numbers, the third four numbers, the fourth five numbers, the fifth six numbers, the sixth seven numbers, etc. The students will be called to choose the correct sequence of letters from the three options given to them. If a child could not remember two sequences in a row or three sequences in general then the test stops. Plaza et al. (2002) report in their research that students with dyslexia and special learning disabilities perform lower than normal developed ones in memory skills. In addition, the short-term working memory in these students presents weaknesses, resulting in difficulty in the sequence and in carrying out activities that require automation.

The eighth test examines visual memory. This test has a number of image patterns that a part of them is missing. The missing part is appeared in the screen for 4 seconds and then it disappears. The children have to fill in the missing part of a series of pictures given to them. The reason why this trial is included in the program is that in a very recent case study of a 13-year-old boy from Greece diagnosed with dyslexia, Terzopoulos (2015), suggests that children with dyslexia have difficulties in visual memory.

The ninth test examines children's visual ability. This particular test has a series of picture patterns where a part of them is missing. The children had to complete the pattern from a series of pictures given to them. The difference between this and the previous test is that the missing part is appeared in the screen continuously together with the series of pictures given. The reason for this test is previous research that shows that dyslexic students experience short-term memory impairment more when the tests involve schematic representations (Mc Dougall, Hulme, Ellis & Monk, 1994). In addition, children with dyslexia often perform lower in tests that involve the presence of visual perception. Many researchers believe that dyslexic students have a visual impairment and therefore perform poorly on visual tests. (Hammond & Hercules, 2000).

Finally, with the tenth test the intelligence of the students is evaluated. The examinee is given an array of ten images that simulate the scale of standard Raven matrices for the examination of non-verbal intelligence. In this way the intelligence of the students is evaluated which is expected to be similar in both the experimental group and the control group, ie the typically developed students (Raven, 1976). In addition, with the creation of the test, an attempt is made to evaluate some skills of students in combination, such as the sense of symmetry and the perception of the individual in the connection of shapes with the symbols that is required for both children with dyslexia and typically developed their classmates (Williams & McCord, 2006).

Procedure

The great advantage of the «DyScreTe» web application is that one student can perform all the tests without supervision. The tests have a continuous flow so that the student has the feeling that he is playing. The ideal place to take the test is a quiet one and in case the program has to be performed more than once by the same student the conditions must be the same. A suitable place where the application can be run in a school is the library or the computer lab. In those areas there are available computers and internet connection that are necessary conditions for running «DyScreTe» software. The instructions for taking the tests are the following. First the application administrator has to check if there is an internet connection and if the computer responds to the mouse movements. In addition to the smooth operation of the mouse it should be checked whether the audio settings are activated, since the application contains acoustic tests.

It is worth noting that the mouse is the main external unit of the computer that is necessary for the use of the application and must work properly without getting stuck. The tests contain time measurements and any failures with the mouse may cause delays and irritation to the user. Moreover, the user of the program, ie the student must sit directly in front of the computer screen because the tests contain text reading and the correct height of the screen is very important so that the process is comfortable and relaxing.

Data Analysis

Upon completion of the sample collection process, the Statistical analysis of the data was carried out with the help of the IBM SPSS Statistics Version 23.0.0.0 statistical software. The sample selected in the research is 240 students and specifically 120 students were the experimental group and 120 the control group. In order to perform data analysis, the normality of the sample of the two groups above was checked. After the normality test performed, it was found that the sample follows the normal distribution (Shapiro & Francia, 1972). The normality of the sample ensures that it is representative of the population. After that the main hypothesis and the three sub-hypotheses were checked An ANOVA (Analysis of Variance) table was used to compare the results of children with dyslexia with those of the control group, ie the typical developed children.

Results

«DyScreTe» is based on a main hypothesis to prove the accuracy of its results. The main hypothesis that was examined is that students who were diagnosed with dyslexia by official authorities in Greece had significantly lower performance in the respective software tests. For that purpose, a sample of 240 students aged between 16 and 18 years old was taken, of which 120 were diagnosed with dyslexia by an official authority in Greece and 120 were typically developed. The results verified the hypothesis we made that students with dyslexia in each test had a lower performance compared to the typical developed in successful responses, but also the three sub hypotheses that were mentioned earlier were verified. An ANOVA (Analysis of Variance) table was used to compare the results of students with dyslexia with those of the control group, ie the typical developed students. The ANOVA table showed that students with dyslexia had a statistically significant ($p < 0.01$) lower average of correct answers compared to the typical developed students in all tests, except the Raven test (as it was expected) as shown in Table 1.

Table 1. ANOVA table presenting the results of dyslexic students and the typical developed

Tests	Dyslectic Children		Typical developed	
	Average	Standard Deviation	Average	Standard Deviation
Pseudowords	14,33	1,57	18,19	1,02
Reading	4,2	0,80	7,1	0,82
Historical spelling	14,57	0,68	18,02	0,72
Grammar spelling	12,43	0,87	17,43	0,84
Listening	5,13	0,57	8,02	0,74
Mathematic ability	14,03	1,40	25,75	1,52
Working Memory	13,03	0,69	28,10	0,75
Visual distinction	8,02	0,77	14,30	0,86
Visual memory	7,03	0,94	14,12	0,90
Raven test	14,85	0,77	14,90	0,70

Moreover in Table 2 it is shown the time that a student needed to complete each test, for the eight tests where time was measured. The results verified the hypothesis we made that students with dyslexia needed more time to complete each test compared to the typical developed. An ANOVA (Analysis of Variance) table was used to compare the results of students with dyslexia with those of the control group, ie the typical developed students. The ANOVA table showed that students with dyslexia needed a statistically significant ($p < 0.05$) higher average of time compared to the typical developed ones in all tests where time was counted, expect Raven test which measures students' intelligence.

Table 2. ANOVA table presenting the results of dyslexic students and the typical developed concerning time needed to complete the test

Tests	Dyslectic Children		Typical developed	
	Average	Standard Deviation	Average	Standard Deviation
Pseudowords	1,32	0,42	0,54	0,25
Reading	6,77	0,84	4,60	0,87
Historical spelling	2,84	0,55	1,23	0,33
Grammar spelling	3,47	0,57	1,42	0,44
Listening	4,02	0,68	2,05	0,34
Mathematic ability	14,20	0,98	8,12	0,75
Visual distinction	6,24	0,52	3,87	0,40
Raven test	13,78	0,96	13,79	0,96

Table 3. ANOVA table presenting the statistical difference between the scores of dyslexic students and typical developed ($p<0.05$)

Tests		Sum of squares	Mean Square	F
Pseudowords	Between Groups	244,367	244,367	130,221
	Within Groups	773,911	1.67	
Reading	Between Groups	598,578	598,578	1198,077
	Within Groups	202,035	0,620	
Historical spelling	Between Groups	511,325	511,325	1102,011
	Within Groups	179,22	0,650	
Grammar spelling	Between Groups	422,444	422,444	599,477
	Within Groups	299,424	0,824	
Listening	Between Groups	812,784	812,784	2027,344
	Within Groups	138,789	0,302	
Mathematic ability	Between Groups	7984,984	7984,984	3785,977
	Within Groups	812,433	3,744	
Working Memory	Between Groups	14870,984	14870,984	25444,088
	Within Groups	233,785	0,722	
Visual distinction	Between Groups	2768,233	2768,233	3444,022
	Within Groups	247,248	0,796	
Visual memory	Between Groups	4347,874	4347,874	6785,244
	Within Groups	320,244	0,724	
Raven test	Between Groups	1,974	1,947	2,876
	Within Groups	174,470	0,432	

Table 4. ANOVA table presenting the statistical difference between time needed to complete the tests between the dyslexic students and the typical developed ($p<0.05$)

Tests		Sum of squares	Mean Square	F
Pseudowords	Between Groups	49,748	49,748	1035,587
	Within Groups	16,187	0,0057	
Reading	Between Groups	374,658	374,658	574,578
	Within Groups	244,784	0,812	
Historical spelling	Between Groups	233,444	233,444	1788,684
	Within Groups	74,435	0,457	
Grammar spelling	Between Groups	382,477	382,477	1487,537
	Within Groups	92,772	0,355	
Listening	Between Groups	115,478	115,478	661,498
	Within Groups	62,222	0,247	
Mathematic ability	Between Groups	2896,589	2896,589	5471,412
	Within Groups	184,365	0,578	
Visual distinction	Between Groups	786,022	786,022	2774,369
	Within Groups	85,178	0,347	
Raven test	Between Groups	0,007	0,007	0,008
	Within Groups	342,336		

In Table 3 it is shown that statistically significant differences were observed between the two groups in the control of the mean values of the students' scores in all tests, expect the Raven tests. In more detail, the p-value<0.05, therefore at a level of statistical significance of 5%, it appears that the average between the students of the experimental group (dyslectic students) and the control group (typical developed) differ. Moreover, statistically differences were observed between time needed to complete all the tests between the experimental group and the control group at a level of statistical significance of 5%, expect the Raven test as it is shown in Table 4.

Discussion

As it has already mentioned there were no on-line application for screening dyslexia in Greek school students aged from 16 to 18 years old. For that reason, the program «DyScreTe» was created. The «DyScreTe» consists of ten basic assessment tests which were derived from an extensive study of the literature in combination with specialized pro-gramming knowledge. It is a simple and discreet yet effective and pleasant tool for screening dyslexia for students in Greek high schools. «DyScreTe» is based on a main hypothesis to prove the accuracy of

its results. The main hypothesis that was examined is that the students who were diagnosed with dyslexia by official authorities in Greece had significantly lower performance in the respective software tests. Thus, a sample of 240 students from high school in Greece was taken, of which 120 were diagnosed with dyslexia by an official authority in Greece and 120 were typically developed. The results verified the hypothesis we made that students with dyslexia in each test had a lower performance compared to the typical developed in successful responses, except the intelligence test.

Conclusion

Detailed screening of dyslexia is essential for students who experience difficulties in their daily school life to create appropriate intervention strategy which strengthens their school performance and raises their self-confidence. With the «DyScreTe» program, different types of errors in the tests and response times could be analyzed in order to understand in depth the functions of the brain and to intervene more effectively in the student's everyday school life.The «DyScreTe» software assesses students on tests that examine reading ability, spelling, auditory processing, visual recall and discrimination, students' ability to solve mathematical problems, and tests that assess short- and long-term memory and also intelligence. By evaluating the above tests, the screening of dyslexia in high school students is carried out with a fairly high probability. Thus, it is a useful tool to evaluate in great detail the above tests so that specific deficits emerge and more information could be acquired about the above cognitive deficits. It is worth mentioning that dyslexic students have been observed to use their brains differently than their typically developed ones.

Research on dyslexia has shown that some of the most effective dyslexia interventions are based on the Orton – Gillingham method. One of the component of this method is that intervention is personalized to meet the needs of the student and to move at their pace. «DyScreTe»'s results could give to the intervention team specific data concerning the difficulties that student under consideration faces. In this way the intervention team could plan a detailed program. Moreover «DyScreTe» application could be used during the intervention to show student's progress and it can be changed according to them. To sum up the results of the program could be crucial for the construction of intervention program both in order to identify as detailed as possible the difficulties of the student and to monitor and evaluate an intervention program if it is needed.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Acknowledgements or Notes

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Examination of the Perceptions of Students Diagnosed with Special Talent regarding the Application of Kahoot-Assisted Astronomy

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Abstract: The aim of this study is to examine the experiences of the students regarding the "Kahoot assisted astronomy application". Phenomenological design was used in the research. The study group of the research consists of 40 students with special talents who are studying in a science and art center in Van in the first semester of the 2022-2023 academic year. Twenty-four of the participants were girls and 16 were boys. Easily accessible case sampling method was used in the formation of the study group of the research. In the research, first of all, 35 questions related to the subject of astronomy were prepared and these questions were uploaded to the Kahoot application, which is a Web 2.0 tool. Students used the sub-applications of "classic mode", "color siege", "team mode", "treasure chest" and "submarine team" in Kahoot application for eight weeks in groups. A semi-structured interview form was used as data collection tools within the scope of the research. Descriptive and content editing approaches were used in the analysis of the data. Codes and themes were created from the obtained data. As a result of the research, it was determined that the students' "Kahoot assisted astronomy application" had positive effects on students' motivation and perception towards astronomy. In addition, with this application, it was concluded that the students learned new concepts about astronomy, repeated the concepts they learned and eliminated their misconceptions about astronomy. In addition, it was observed that the students enjoyed the applications throughout the whole process.

Keywords: Astronomy, Kahoot, Gifted student

Introduction

Mankind has been curious about space since prehistoric times. Space has become one of the areas that humanity is most interested in. Throughout history, human beings have observed space, studied the positions and movements of celestial bodies, and as a result, they have planned their daily, monthly, seasonal and annual studies. People recorded their space observations throughout the process and organized their daily lives based on the data they obtained. Astronomy is accepted as a gateway science by everyone, regardless of age, culture or tendency towards science (Salimpour et al., 2020). Such sciences have a critical importance for people to understand the events they encounter in daily life such as the change of day and night, the phases of the moon, and the seasons (Almeqbaali et al., 2022).

In fact, astronomy is one of the oldest known sciences. (Bailey & Slater, 2003).Astronomy is a natural science based on observation (Li et al., 2019). This field of science has been influential in people's understanding of their environment and themselves for years (Trumper, 2006). For this, studies on astronomy education have been carried out in schools for a long time. Many countries have included activities for astronomy education in

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their new programs. Of course, the purpose of science taught in school is not to create astronauts, but to inspire students to appreciate science in general (Slater, 2018). Students studying at all levels from pre-school to university have a high level of interest and curiosity towards astronomy.

Many methods and techniques are used to increase students' interest, attitude and motivation towards astronomy, to learn astronomy concepts and to eliminate misconceptions about this field. Some tools scuh as animation, cartoon, video can be used in teaching concepts related to this field in schools. Many different studies are carried out. For this, researchers or teachers benefit from Web 2.0 tools. As it is known, students and teachers can actively use Web 2.0 tools in the lesson (Çetgin, 2021). The "Kahoot" application, a Web 2.0 tool, can be used to help students learn concepts about astronomy and to eliminate their misconceptions. Kahoot is a Web 2.0 tool that can be used for educational purposes.

The Aim of the Study

The aim of this study is to develop a Kahoot assisted astronomy application, which is a Web 2.0 tool, and to examine the views of the students towards the developed application. For this purpose, an answer was sought to the following question;

“What are the perceptions of students diagnosed with special abilities towards kahoot assisted astronomy?”

Method

Research Design

In the research, phenomenology design, which is one of the qualitative research methods, was used in order to determine the opinions of gifted students about Kahoot assisted astronomy. In the phenomenological design, participants' experiences, perceptions and comments about a phenomenon are examined (Creswell, 2007). This research model is used to illuminate the cases that we are aware of but do not have an in-depth and detailed understanding (Yıldırım & Şimşek, 2013). In this study, as a phenomenon, "Kahoot assisted astronomy application" was discussed and the perceptions of the participants towards this application were examined.

Research Group

The study group of the research consists of 40 students with special talents who are studying at a Science and Art Center (BİLSEM) located in a city center in the Eastern Anatolia Region of Turkey in the first semester of the 2022-2023 academic year. The study group of the research was determined by the easily accessible case sampling method. With this method, the researcher gives speed and practicality to the research as he chooses a situation that is close to him and easy to access (Yıldırım & Şimşek, 2013). The participants continue their education at the school where the researcher-teacher works. Eighteen of the participants study in support (3rd and 4th grade) and 22 in BYF (Being Aware of Individual Talents) (5th and 6th grade) groups. Twenty-four of the participants were girls and 16 were boys.

Implementation of the Study

For the studies, first of all, an astronomy question pool consisting of 50 true-false questions, which should fill in the blanks, was created. While creating the questions, the support of BİLSEM and the characteristics of the BYF group special talented students were taken into account. The pool of questions created was subjected to the necessary expert examination and after the examination, a quiz of 35 questions was created. The questions created were put into the Kahoot application, which is a Web 2.0 application. Depending on the difficulty level of the questions, they were scored as "standard score" or "double score" and were time-limited as 5 seconds, 10 seconds, 30 seconds and 60 seconds. As a result of the studies, Kahoot Assisted Astronomy Application has been finalized. After the application was prepared, the participants were informed about the application for 1 lesson hour and then a sample study was made and the application was introduced. After the development and promotion of the application was completed, the actual application was started. The working group carried out its work in groups of 4-5 people. The application lasted for a total of 8 hours, two hours a week for 4 weeks. During the application, each student was given a tablet. The teacher starts the application from the smart board

and each student first answers the questions that are reflected on their tablets individually. After the answers given, the success ranking is reflected on the main screen. The name of this mod is «classic mode». First of all, all the studies were done with the classical mode in kahot, and in the later lessons, the sub-applications of "color siege", "team mode", "treasure chest" and "submarine team" in the kahoot application were used.

Data Collection

In this study, in-depth interviews were conducted with gifted students who shared common experience, and thus their reactions and views on the developed kahoot assisted astronomy application were made sense of. As a data collection tool, a semi-structured interview form was prepared. For the semi-structured form, first of all, a draft form consisting of 14 questions was prepared and presented to the opinion of two field experts in order to ensure the content validity of the form and one Turkish teacher to examine it in terms of grammar. In addition, a pilot interview was conducted with a student for the clarity of the questions. As a result of the feedback received from the experts and the pilot application, some questions in the form were removed from the form, some were corrected and some questions were added to the form. As a result of all these studies, a semi-structured interview form with 7 questions was obtained.

Ethics

Before the application, the purpose of the research was explained to the participants and explanations were made about where and for what purpose the collected data would be used. In this process, all students in the study group gave their consent to the study and were told that they could withdraw from the study whenever they wanted. In addition, the confidentiality of the participants was taken as a basis in the research and within this framework, the participants were given codes as Student-1, Student-2……Student-40.

Data Analysis

In the analysis of the data obtained by using a semi-structured interview form, descriptive and content analysis methods, which are among the qualitative analysis methods, were used. First of all, the answers given by the students to the interview questions were transferred to the computer environment. The interview, which was transferred to the computer, was deciphered by making various readings on the raw data. In the analysis of the data obtained, the stages of coding the data, finding the themes, organizing and defining the data according to the codes and themes, defining and interpreting the findings were followed (Yıldırım and Şimsek, 2013). As a result of reading the data, codes were created from student opinions, and the codes were examined in terms of similar relationships and brought together under certain themes. Then, the codes and themes were interpreted and presented in a way that the reader could understand. In the study, two independent researchers created a code list simultaneously and these codes were compared. Miles and Huberman's (1994) reliability calculation formula was used to determine the reliability of the encodings made by the researchers, and as a result, the agreement between the coders was found to be 90%. During the interpretation of the data, codes and categories were tabulated and given as frequency (f) and percentage (%).

Results

In this section, the findings regarding the data obtained with the semi-structured interview form are given. After the readings on the answers given by the students to the interview questions, codes and themes were formed by combining similar codes. As a result of the analyzes, the themes of "Cognitive Characteristics", "Concept Learning", "Affective Features" and "Removal of Misconceptions" were formed.

The Cognitive Features theme and the codes included in this theme are given in Table 1. When Table 1 is examined, 25 of the students in the study group learned new information with the Kahoot assisted astronomy application, 24 learned with fun with this application, 20 found the application useful/useful, 15 repeated and reinforced their knowledge with the application. Among them, the application was effective in remembering information, 10 of them were that the application cleared some misconceptions about space, 8 of them were that the application was instructive / educational, 5 of them were that the practice improved attention and quick decision-making skills, and 4 of them were the permanence of their knowledge about space with the application.

reported an increase. Some students' opinions were given to give more detail regarding the code which were created under Cognitive Features.

Table 1. Cognitive features theme and the codes that make up this theme

Theme	Code	f	%
Cognitive Features	Learning new information	25	62.5
	Learning with fun	24	60
	Useful	20	50
	Repetition and reinforcement of knowledge	15	37.5
	Remembering information	12	30
	Clearing the misconception	10	25
	Tutorial/tutorial	8	20
	Being alert and making quick decisions	5	12.5
	Persistence of knowledge	4	10

Some student opinions that created these codes are given below;

S1. Very good. Great. I like it a lot. I am very pleased. Useful for learning new information.
S3. It was beautiful. That was so fun. Even if I made a few mistakes, I was not upset at all. Because it was so much fun.
S5. It was a very nice and easy application. I liked that it was easy the most. I both learned new information and reinforced what I already knew.
P8. It was a very instructive and educational application.
S9. I swear it's a legendary app. I have never heard of such an application before. I loved this app. I learned a lot because I love it.
S10. It was a very good application. I learned a lot of new information. This app is very helpful as it teaches me new information and concepts.
P11. This app is both educational and beautiful and fun.
S12. It's a very nice application. I like it a lot. We played and learned at the same time. In fact, we learned by having fun. It is a very logical and beautiful application.
S13. I think it's a very good app. I really liked that it contributes to the education of children by combining play and education.
S26. Actually, I did not learn new information, I already knew all of them, but I refreshed the information I had forgotten. Besides helping me refresh my knowledge, it also improved my reflexes.
S29. Through this study, I learned a great deal about space.
S32. It improved my ability to be careful and act quickly.
S33. I learned new information about astronomy that I did not know.
S36. It made the knowledge I had learned more permanent. There was no mistake I knew about this, but I reinforced what I learned.

It is seen that students state that they have gained necessary information within the given topic and they liked the application that they used.Another theme created as a result of the analysis of students' answers is the "Concept Learning" theme. The Concept Learning theme and the codes included in this theme are given in Table 2.

Table 2. Concept Learning theme and the codes that make up this theme

Thema	Code	f	%
Concept Learning	All astronomy concepts	20	50
	The phases of the moon	18	45
	Age of the universe	15	37.5
	Galaxy	14	35
	Nebula (nebula)	13	32.5
	Supernova	12	30
	Earth's twin planet	8	20
	Evening star	8	20
	Asteroid belt	8	20
	Earth's natural satellite	6	15
	Meteor	6	15
	The planet with the most moons	6	15
	The invisible phase of the moon	5	12.5

When Table 2 is examined, 20 of the students in the study group learned all the astronomy concepts with the application, 18 of them learned the phases of the Moon, 15 of them the age of the universe, 14 of them the concept of galaxy, 13 of them the concept of nebula, and 12 of them the concept of supernova. 8 are Earth's twin planet, 8 are which planet the evening star is, 8 are what the asteroid belt is and where it is located, 6 are Earth's only natural satellite, 6 are the concept of meteorites, 6' Two of them stated that they learned about the planet with the most satellites and 5 of them stated that they learned about the unseen side of the Moon. It is not easy to remember some concepts in astronomy which are being taught in schools. So students' reflections are being paid attention, in this scope. As we authors of the study believe in that some students in our country have some difficulties while they are being educated within astronomy and astronomy based topics.

Some student opinions that created these codes are given below;

S1. I found out how old the universe is.
S3. I learned that the sun is not a planet but a star. I also learned how old the universe is.
S8. I did not know the phases of the Moon before, thanks to this application, now I know all of them. I learned the concepts of full moon, new moon, bulging moon, crescent moon, first quarter and last quarter.
S9. I learned that the only natural satellite of the Earth is the Moon.
S10. I learned new information. For example, I learned what a meteor is.
P11. I learned everything about astronomy.
S12. I learned good information about space.
S16. I learned that the age of the universe is 13-14 billion years.
S29. I learned how many moons the nebula, galaxy, Saturn planet has, how old the universe is, and so on.
S35. I learned what Nebula and Supernova are.
S38. I learned the phases of the Moon, the name of the star explosion is supernova, the other name of Venus is the evening star, the planet with the most moons is Saturn.

Another theme created as a result of the analysis of the students' answers is the "Affective Characteristics" theme. The Affective Characteristics theme and the codes included in this theme are given in Table 3:

Table 3. Affective Characteristics theme and the codes that make up this theme

Theme	Code	f	%
Affective features	Beautiful	35	87.5
	Fun	34	85
	Enjoyable/Enjoyable	30	75
	Interest and motivation towards astronomy	20	50
	Perfect	20	50
	curiosity about space	16	40
	Excitement	14	35

When Table 3 is examined, 35 of the students in the study group found the practice enjoyable, 34 found it fun and 30 enjoyable/pleasant, 20 students found the practice to increase their motivation and interest in astronomy, 20 said the practice was excellent, and 16 students found it enjoyable. 14 of them stated that the application was exciting. For giving more detailed information with the students' views, some statements created by those, were given.

Some students opinions that created these codes are given below;

S1. My interest in space has increased. I had a lot of fun in this process and it was very enjoyable for me.
S3. I was already very curious about space. I will deal with this matter further from now on.
S5. It increased my curiosity about space and I was eager to learn new information about space. I had a great time. We laughed a lot with our friends during this process.
S6. I was already interested in space, this application has increased my interest even more. It was very nice work. It was a very enjoyable and exciting application.
S9. This application has greatly increased my interest in space. I had a lot of fun in this process. It was fun playing with friends.
S10. It further fueled my existing good interest in astronomy.
S11. We had a lot of fun with our friends, we laughed a lot.
S12. I already had an interest in space. After this study, I will investigate the things I wonder about space.
S16. It was a very enjoyable application. Also, my motivation towards space has increased more.

S24. That was so fun. I enjoyed playing color siege, treasure chest, submarine team, classic mode that we played in this application.
S26. I was already an astronomy enthusiast. With this application, my curiosity towards space increased even more.
S29. It was so much fun and so beautiful. I came first in all competitions.
S33. I had so much fun playing. I especially liked the diving game that we all played together.
S39. It was beautiful. That was so fun. It was perfect.

It is clearly seen that the students have very positive views regarding application. We are able to understand this by focusing on their views as given above. Another theme created as a result of the analysis of the students' answers is the theme of "Removal of Misconceptions".

The theme of Eliminating Misconceptions and the codes included in this theme are given in Table 4. When Table 4 is examined, 26 of the students learned the age of the universe they had previously misunderstood, 24 of them the phases of the Moon, 22 of them about artificial satellite-natural satellite, 20 of them about meteor, 15 of them about stars and planets, 15 of them about big stars. They stated that they correctly learned the concepts of bang and nebula, 12 of them learned the asteroid belt and wormholes, 10 of them learned the location of the asteroid belt, and 10 of them correctly learned the nebula and supernova. Having misconceptions and trying to remove them from students' minds is not easy. To be able to understand this, it is clear that Ministry of National Education should carry out more efforts within this topic.

Table 4. The theme of eliminating misconceptions and the codes that make up this theme

Theme	Code	f	%
Elimination of Misconceptions	Age of the universe	26	65
	The phases of the moon	24	60
	Atificial satellite and natural satellite	22	55
	Meteor	20	50
	Mixing the concepts of Star and Planet	15	37.5
	Confusing Big Bang and Nebula	15	37.5
	Confusing Wormholes with the Asteroid Belt	12	30
	Location of the asteroid belt	10	25
	Confusing the concepts of Nebula and Supernova	10	25

Some student opinions that created these codes are given below;

S3. I thought the sun was a planet. I thought space was much older, it wasn't.
S5. I did not know the age of the universe, I learned it thanks to this study.
P8. I was mixing up the first four and the last four of the phases of the Moon and it helped me learn them.
S9. With this application, I corrected many of my mistakes about space.
S10. I didn't know the age of the universe, now I do.
P11. For example, I misunderstood the concepts of artificial satellite, natural satellite, last quarter and first quarter. Thanks to this application, I corrected these mistakes.
S12. Did I misunderstand the age of the universe? Turns out he was 13-14 billion years old.
Ö26. I learned that the age of the universe is not 13-14 quadrillion years.
Ö29. I always confused the first four and the last four of the phases of the moon. Thanks to this study, I learned how to distinguish the two with the letter "D".
P33. I was confusing the concepts of nebula and supernova, now I learned the two.

Here, it is seen that all students' views show us they had difficulties in learning those concepts but now they have solved the problem through this application.

Discussion and Recommendations

It is known that some smilar studuies by using Kahoot platform can be found from the literatüre. For instance, Zucker and Fischer (2019) stated that with the use of KAHOOT! students who they studied and teachers were able to play their way into substantive and student-centered discussions. Siouli et al. (2018), stated that Technology Enhanced Learning (TEL) in STEM Education is a well-established method for engaging students with challenging concepts such those in space and astronomy. In their study, they studied with 14 children from year 5 to year 6 aged between 11 and 12 years old, every Friday from 1:45 p.m. to 3:15 p.m. They concluded

that by using technology from the constructivist perspective students can do some things such as they can access, select and interpret information. So, they cane review and adjust their work to promote the quality. Asa'd and Gunn (2018) used Kahoot in the formal teaching to motivate students within Pyysics to solve problems they face during the course. So they found their students liked the game and the game motivated them to practise more problems. There is a study that have smilar results with the content of the current study. Holbrey (2020), found that the integration of synchronous online learning in lecture theatres gave no technical difficulties and that gaming was successful in enabling active participation and interactive learning. This research was carried out with students who study at Science and Art centers in the province of Van. It is recommended that this study can be applied to a different region with more students. Besides, Kahoot based digital games can be used in any other science and technology based topics placed in science courses.

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Diversity Management is the Core Area to Improve Learning Outcomes for All Children in Nepal

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World Education Inc

Abstract: Nepal is a country of diversity in terms of ideological, cultural, religious, caste, geographical and sexual orientation, ethnicity, class, and language. Diversity is not merely a problem, it is an opportunity for exploring the creativity of individuals who have cultural, racial, physical, and ethnic differences. In this context, this abstract aims to share the role of teachers in diversity management in the classroom to address the individual's learning needs. I have selected the practices being used in the early-grade classrooms to address diversity in the Nepalese context. Headteacher, the teacher, the parents, and the students are the beneficiary and key respondents of this study. School is an extremely important place for students to feel safe and comfortable. In order to learn, students need an environment that makes them feel welcome. If a student feels unsafe and insecure, they will not be able to focus on learning. Students with a diverse cultural background may feel that they stand out alone in the classroom, they may feel underrepresented in the teaching materials, etc. Children with diverse backgrounds may then feel unsafe and uncomfortable in a classroom when they don't feel that their diversity is seen or valued. Racial, cultural, and gender differences are important factors in a person's identity, and it's extremely valuable for teaching to help students understand differences better. Efforts that teachers make to improve diversity in the classroom can benefit all learners in a variety of ways. From pre-primary students to high school students, it is always a good time for teaching to focus on racial and culturally unique differences in the past, present, and future. It can benefit diverse students who need to be represented and accepted and can help all students learn from unique perspectives and increase their understanding.

Keywords: Diversity, Individual differences, Individual learning needs, Teaching learning materials, Opportunity

Introduction

Nepal has taken a number of steps and introduced several initiatives over the past few decades to improve issues of educational access and inclusion for diverse groups, including children with disabilities. Many development partners and civil society organizations are contributing to improving the learning outcomes of all children in Nepal. This paper provides key highlights on the best practices and achievements of World Education Inc. in improving the reading competency of children with disability in Nepal. World Education is considered a civil society organization in Nepal. This organization has been implementing several projects that address diversity and ensure quality education in Nepal (DoE, 2016; 2017; World Education Nepal, 2017).

Teaching to engage diversity, to include all children, and to seek equity is essential for preparing civically engaged children and for creating a school and society that recognizes the contributions of all people. Teaching for diversity refers to acknowledging a range of differences in the classroom. Teaching for inclusion signifies embracing difference. Teaching for equity allows the differences to transform the way we think, teach, learn and act such that all experiences and ways of being are handled with fairness and justice. These ideas complement each other and enhance educational opportunities for all students when simultaneously engaged. Three imperatives make it an essential component for us to actively practice teaching for diversity, inclusion, and equity (CEHRD, 2006 ; 2008; 2018).

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Teacher

Every child needs trained and competent teachers, whether at home or school. Teachers have to deal with students with different characteristics in the classroom. Some students are noisy, whereas some are quiet; some learn quickly, while others need more time, and some are often absent and struggle to keep up. A teacher should know the attributes and learning styles of every student but should not differentiate between them. Teachers should also be able to support children with special needs in school, and they should be willing to accept the challenge. Children may have disabilities or behavioral issues, but in most schools in Nepal, teachers are not aware of such students. Teachers should be made aware of the issues these children face and have the skills to address these challenges in the classroom.

Mentoring (Effective Coaches and Mentors)

It is often found that one-shot training does not bring major changes in the quality of delivery and transfer of knowledge and skills into the classroom. In Nepal, Resource Persons used to provide some mentoring, but with federalism, new systems are being developed. For many years the Resource Class teachers have been deprived of support through mentoring and coaching. Where available, support to the teachers inside their classroom by trained mentors with good knowledge and skill in reading and literacy instruction has proven to be an effective measure for improving the children's reading skills. In early-grade learning programs in remote locations and disadvantaged communities in Nepal, highly skilled and knowledgeable mentors have not been available. World Education, in a number of programs, has used a blended mentoring approach with young, highly mobile learning mobilizers (8-10 schools being supported) coupled with access to more senior professional program staff and mobilization of Education Focal Persons and Roster Trainers when needed. This has been relatively effective, and World Education sought to adapt this approach in early grades to address the needs of children with disabilities.

High-Quality Text and Materials

High-quality text and materials play an important role in facilitating the learning and reading of children and need to be carefully designed and developed when it comes to children with disabilities and learning difficulties. Best practices include using Universal Design for Learning (UDL) principles, and special adjustments are needed for some students. Text and materials supported by various projects and organizations are not always appropriate, disability friendly, or accessible.

Strategies and Method

Capacity Building of Teachers in 3 Different Models.

The following paragraph provides an overview of the three types of intervention to enhance the capacity of teachers that have been conducted under the Resource Class, Intensive, and Lite models.

Resource Class Model

All Resource Classes (46) of 10 districts - Types of Resource Class: 14 for visually impaired students, 17 for deaf and hard of hearing students, and 15 for students with intellectual disabilities.

Intensive Support Model

All community schools (257) in four Municipalities in Banke and Surkhet provided additional training, materials, and technical support for screening and pedagogy. The project reached 771 classrooms, trained and mentored 682 teachers, 4,369 SMC/PTA (School Management Committee and Parent Teachers Association) members, and 257 Head Teachers.

Lite Support Model

All schools (3,185) with the training of Head Teachers through cascade approach to lead early screening and orient and support early grade teachers to improve efforts to address learning needs of children with disabilities and struggling learners using early grade reading materials and approaches and individualized education plans.

Capacity Building of Organization of People with Disabilities (OPDs)

Training of OPDs to Mentor in Schools

23 (17F, 6M) OPDs staff enhanced their skill in effective mentoring and coaching techniques for supporting the early grade teachers on reading-focused activities to improve the reading outcomes of the children with disabilities and learning difficulties. Seven days of reading-focused coaching/mentoring training imparted the knowledge, skills, and competencies on instructional strategies and use of instructional materials, classroom observation, assessment techniques, and individualized education plan (IEP) and the development of the teaching-learning aids from locally available materials. After the training, the OPD staff conducted materials development workshops at the school level, engaging the teachers, parents, and members of SMC.

OPD Staff and Member Capacity Development Training

Three-day training on reading-focused community mobilization was conducted where 66 (34F, 32 M) participants, including Inclusive Education Coordinators, Social Mobilizers, program officers, and representatives from the board of the partner organization, were trained. During the training, participants learned the basic concepts and approaches for community mobilization. Issues in the application of activities that contribute to the reading improvement of children with disabilities and functional limitations were identified, and mapping of stakeholders was done. District-wise community mobilization action plans were developed on the prioritized issues.

Providing Hi-Teach and Low-Tech Materials

Learning kits and Teaching-Learning Materials were provided to the 46 Resource Classes benefiting 441 students with disabilities in these Resource Classes in nine project districts. These sets contained 1,014 learning materials, including sets of leveled readers, sets of blocks, sets of flashcards, braille slates and stylus, sponge letters, shapes, and objects that were distributed to the students having disabilities studying in Resource Classes from the nine project districts.

Figure 1. Photographs of children for whom materials were provided in the project

Braille was embossed on the existing letter and word flash cards which was a new innovation by the project that enabled parents, teachers, and volunteers that are not visually impaired to support braille learners. Teachers are using the idea to create and adapt flashcards that are supported by various projects and organizations which are easily available in the classroom.

Figure 2. An example of typoscopes

World Education developed and promoted the use of typoscopes for facilitating the reading of children with visual disorders and children with intellectual and learning difficulties who have problems dealing with a lot of text on a page. These typoscopes were made of rigid plastic materials with appropriate size and thickness that can be easily held by children. Scopes of various sizes were appropriate for reading letters, words, and short sentences and were widely used by the students.

Comprehension dice have been adapted by World Education and produced in bright colors with rattling seeds which are very attractive to students and have been effective for teachers to conduct activities in groups to enhance the comprehension skill of the student. Early Grade Reading Assessment testing and experience have shown that for children with disabilities, many students able to decode words lack the vocabulary and skills to comprehend text. Teachers found the comprehension block an effective way to get much more focus on comprehension and understanding of the text. This was especially useful in Nepali Sign Language(NSL)classes where deaf students have been focused on finger spelling words in the past rather than understanding the meaning of sentences. In addition to the above materials, braille paper with slate and a stylus was provided to Resource Classes for children with visual impairments. All classes were provided with typoscopes, and all the Resource Classes were provided with general stationery items like exercise books, pencils, crayons, and chart papers. Teachers shared that they found identifying the most appropriate teaching-learning materials for specific reading skills or addressing the specific needs of disability groups challenging. More effort is needed to help teachers understand different ways materials can be used and to make use of them frequently.

Results and Discussion

World Education's intervention to improve the reading competency of a diverse group of children studying in the early grade of public school in Nepal has made remarkable achievements. The intervention has conducted two levels of assessment 1. Fidelity of the teacher's capacity building program and 2, assessment of children's progress in reading.

Teachers practicing inclusive and child-centric approach/techniques to improve the reading/learning outcome of children with disabilities in the Resource Class model and intensive support model:

"This training proved to be very effective and productive. Spending years in this profession never made me realize and think about the various learning-related difficulties being one of the major reasons for children not achieving competency. This training provided us with some basic guidance to identify children with possible symptoms regarding learning difficulties and skill to develop a plan for improving their learning". -Early grade teacher- Karnali Province, Nepal

Classroom observation with the purpose of measuring the percentage of teachers practicing inclusive and child-centric approach/techniques for improving the reading/learning outcome of children having disabilities was conducted through the fidelity of implementation (FOI) study. The first round of the study was conducted in the month of May, 2022, and the final round was conducted in September 2022. A total of 96 classes from 53 schools of the intensive model being run by trained early-grade teachers were observed by 10 enumerators. 24 observation questionnaires under five major areas of observation; 1. Accessible and Inclusive classroom, 2. Reading Instructional Strategy, 3. Use of TL and Supplementary Learning/Reading Materials, 4. Teaching Learning Process and Methodology and 5. Assessment and Evaluation were included in the observation. The results were analyzed by dividing the score into three thresholds; I. Below 40 percent, II. Between 40 percent and 59 percent, and III. 60 percent and above. It is assumed that children from those classes with teachers meeting the threshold of fidelity of implementation score "60 percent and above" are expected to have improved learning outcomes.The below graph shows the percentage of teachers practicing inclusive and child-centric teaching-learning approaches;

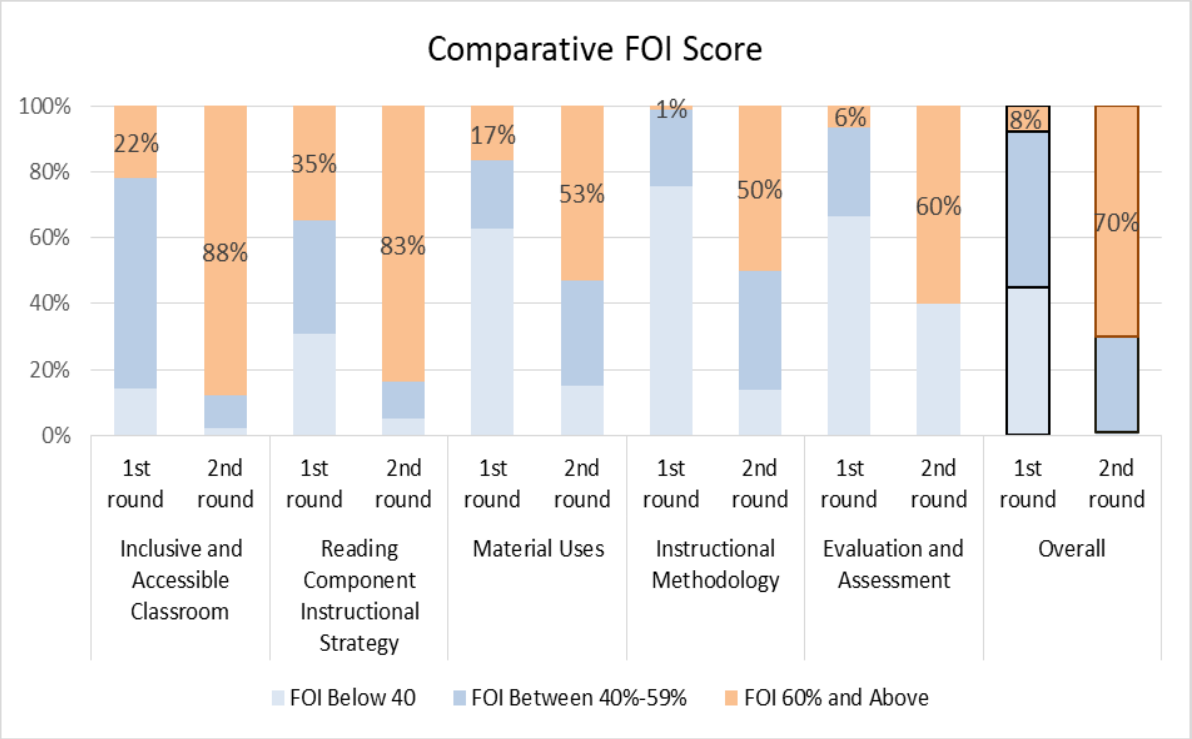

Figure 3. Percentage of teachers practicing ınclusive and child-centric approach

The comparative chart shows the improved result from the first round and the last round of fidelity of implementation classroom observation conducted in May 2022 and September 2022, respectively. The Social Mobilizers developed specific support plans based on classroom observation. They provided intensive support to the teachers for transferring reading instructional strategy, use of teaching-learning and supplementary materials, development and updating IEPs, regular assessment and evaluation of children's learning, and effective classroom management. As the project intervention reached the peak in the final quarter, the result from the second round of the fidelity of implementation study showed a huge improvement compared to the previous round. The study result shows 70 percent of teachers implement and practice inclusive and child-centric approaches with a fidelity of 60 percent or above. This is more by 62 percentage points, which was only 8 percent during the first round of the study.

Early Grade Reading Assessment (EGRA)

World Education supported the Nepal government in developing adapted EGRA tools for measuring the reading gains of children with disabilities and measured the progress through a baseline and an endline study using the tools. The adapted EGRAs measure children's ability to read and comprehend on the basis of various subtasks included in the adapted tools developed for children with different types of disabilities. Overall six major subtasks were included in the reading assessment. The EGRA testing of children with disabilities in Resource Classes resulted in data for almost one full academic year. The intensive and lite interventions through medical verification started to pick up in early 2022. The below result is the achievement made within one academic year. The below graph shows the samples that were administered the EGRA baseline at various times of the year (World Bank and the Global Partnership for Education, 2017).

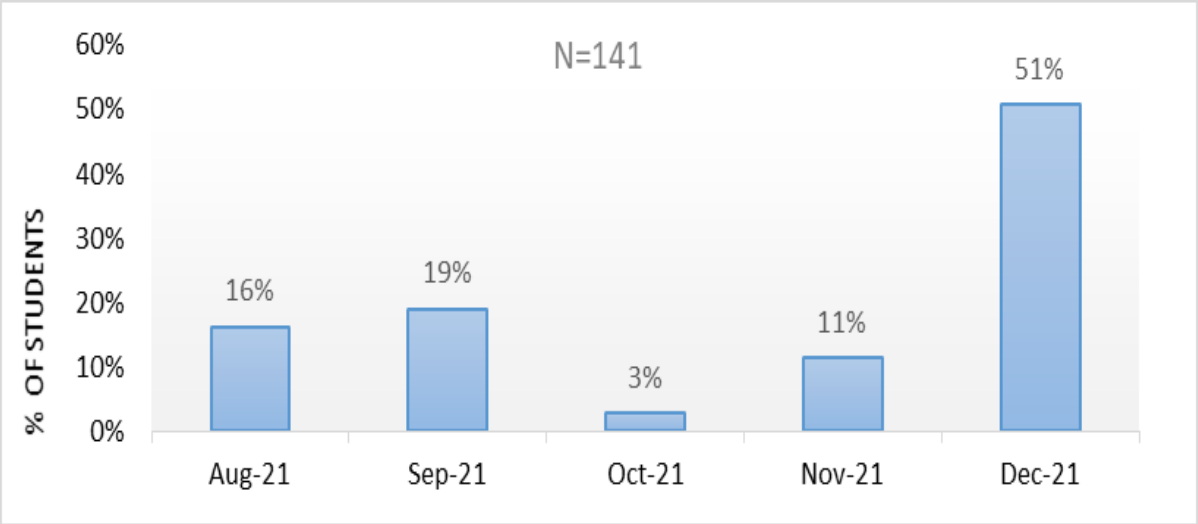

Figure 4. Timeline showing samples of students administered EGRA baseline in 2021

The above graph shows that more than half, i.e., 51 percent of the children who went through the baseline in December 2021, had an early endline in September 2022 after just nine months from the baseline.The below chart shows the actual change seen in the result at EGRA endline based on the goal level indicator set for the project evaluation purpose on the below-mentioned indicators:

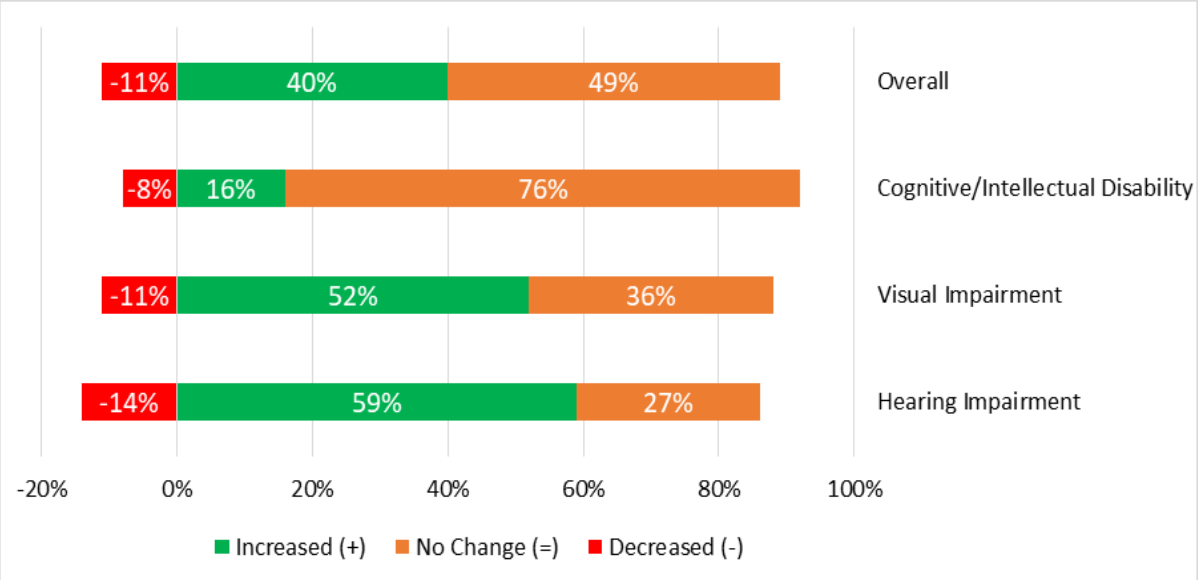

Figure 5. Percentage of children demonstrating ıncreased fluency by disability types in the endline

The above chart shows, overall, 40 percent of the early grade children having disabilities demonstrated increased reading fluency during the EGRA endline study.

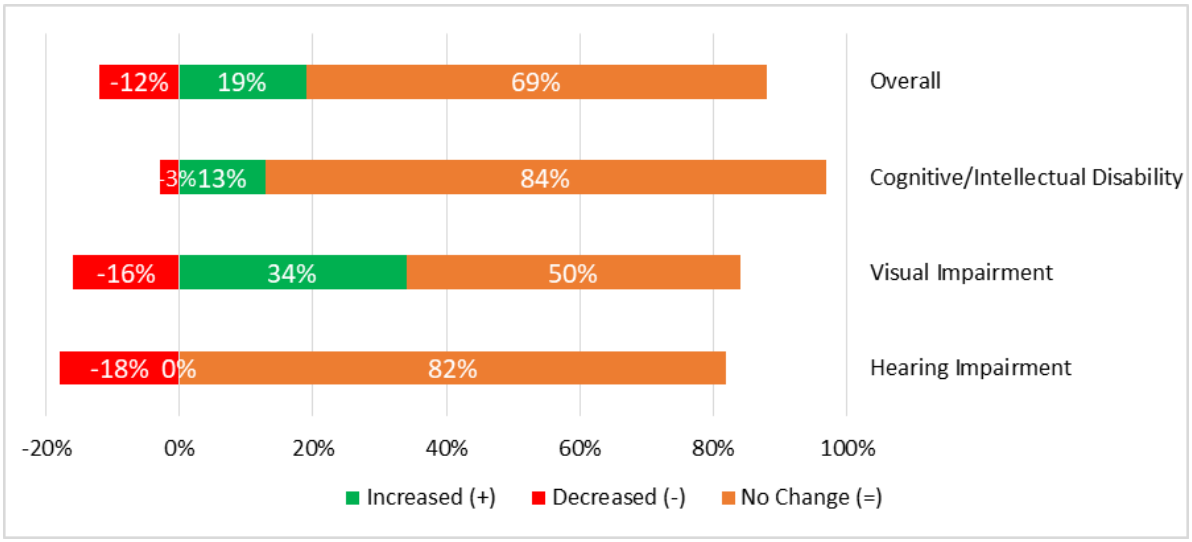

Figure 6. Percentage of children demonstrating ıncreased comprehension by disability types in the endline

The above chart shows, overall, 19 percent of the early grade children having disabilities demonstrated increased comprehension skills during the EGRA endline study. Overall no increase in the reading comprehension score for children with hearing impairments was found, while children with visual impairments showed more improvement. Three children with hearing impairments who answered three, four, and five reading comprehension questions correctly in the baseline answered less than three questions in the endline and 18 among the total 22 scored zero.

Percentage of Zero Scores

The number of children with zero scores are substantially decreased in all the subtasks during the endline. However, the result shows that a large percentage of children having disabilities from early grades haven't started to read. The percentage of children who haven't started to read in their early grades was analyzed through the zero scores, and the comparative result is presented below:

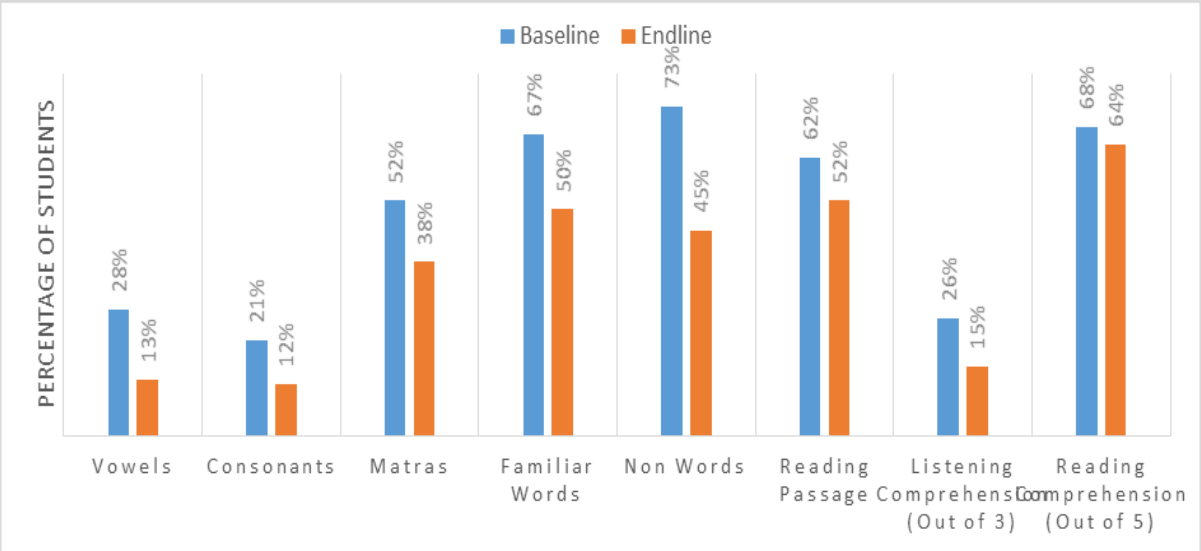

Figure 7. Change in percentage of students with zero scores from baseline to endline by subtasks

The comparative result shows the percentage of students with zero scores has significantly decreased for all subtasks in the end line, while for the reading comprehension subtask, the number of children with scores is still at the same point. In the above graph, 64 percent of children are not able to answer any of the comprehension questions correctly. This concludes that a large percentage of children are still facing difficulty in comprehending the text read.

Conclusion

Diversity expresses itself in so many different ways, so it can be daunting to try and start conversations around bringing it to the classroom. Start slowly and intentionally. Addressing diversity issues has to be slow and steady. The teachers are the key actors to manage the diverse group of students in the classroom. The government system should have a robust plan and strategy to improve teachers' capacity. Competent and motivated teachers can contribute to improving the learning outcomes of all children. Diversity in and out of the classroom will continue to grow. Only through competent teachers, it is possible to prepare students to adapt to an evolving world and embrace those different from themselves. High-quality materials and texts can help identify teaching materials that are already fully accessible as well, and in many cases, the judicious choice of such materials greatly alleviates accessibility issues. Using of use specific tools (captioning video recordings, providing alternate text for images, and more) to facilitate accessibility in an online learning environment. Accessibility ensures that all students can equally access, use, and understand learning content. New accommodation needs may arise in hybrid and online learning environments. Moreover, making course content accessible to all students in these scenarios requires some adjustments in relation to face-to-face settings.

Recommendations

- Many students learning sign language is essentially starting from scratch when they arrive in the classroom, as most have little prior exposure to the national sign language. In addition, Nepal Sign Language is rapidly evolving with many teachers struggling to keep up with the new formally recognized signs. It needs to incorporate an assessment of language development/vocabulary assessment for NSL students alongside EGRA tests. In this way, the acquisition of language can be assessed and enable a better understanding of what is affecting comprehension scores, as both poor language skills and poor reading skills can inhibit comprehension.

- The OPDs were found to play an important role in supporting teachers to focus on children with disabilities. Having a person more familiar with disability issues to interact with helps teachers and parents feel more supported and motivated to address the children's needs. As many of the mentors were persons with disabilities themselves they also provided good role models. Their engagement also motivated LGs to pay more attention to the learning needs of children with disabilities. Local governments and future projects should mobilize OPD staff to mentor teachers and support schools.

- Regular technical backstopping and discussion for local Government and schools are very critical to develop and implement inclusive education plans. The provision of sharing best practices on inclusive education through videos, literature, articles, and supporting materials can be a good source to refer to while developing an inclusive education plan at the local level.

- Children with disabilities have diverse characteristics. Using the national benchmark for early grade to measure children's reading competencies may not fully capture the learning paths of children with disabilities. Further research and discussions on assessment and benchmarking may help generate additional insights on how well children are learning, which interventions are effective, and how to set learning targets. with disabilities is recommended for the future projects.

Scientific Ethics Declaration

The author (Seema Acharya) declares the scientific ethical and legal responsibility of this article published in EPESS journal.

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* This article was presented as an oral presentation at the International Conference on Special Education and Diversity (www.iconsed.net) held in Marmaris/Turkey on April 27-30, 2023

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