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The development of computational skills of visually impaired children of primary classes

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Abstract

With this study, it is aimed to improve the calculation skills of visually impaired children in elementary grades. In this context, it is expected that mathematical calculation skills will gain meaning and target behaviours will be changed with the help of technology for visually impaired children. The study group of the study consists of 78 primary school students who continue to study in voluntary primary school classes. The research was conducted in the fall academic year of 2021–2022. In the study, elementary school students were given training on calculations in a 4-week classroom environment in order to gain calculation and mathematical skills. In the study, the 'calculation skills' measurement tool was used to collect data. The measurement tool used in the study was delivered to primary school students with the help of their families and collected. The analysis of the data was carried out using the SPSS programme; frequency analysis was carried out using the *t*-test; and the results obtained were added to the study accompanied by tables. As a result of the research, it was found that the calculation and mathematics skills of primary school students have a positive effect on education, as well as on motivation in their studies.

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1. Introduction

When the contents prepared for the orientation and independent movement skills of visually impaired students are examined, it is seen that an assessment tool is offered. However, it is not known whether norm studies were carried out while developing the evaluation tool on this resource (Huff Jr et al., 2021). When the literature was examined, there was no standard orientation and independent movement skills assessment tool. It was reported that guidance and research centres in our country specially trained students for schools, special classes, inclusion of students in orientation and their performance, and rehabilitation centres acted independently, expressing the need for a standardised assessment tool (Urea et al., 2020). One of the important elements in the preparation of individualised education plans is to determine the performance level of a visually impaired student. Taking into account the level of performance, long-term, short-term and educational goals are being created with the aim to be achieved (Baglama et al., 2018). Due to the lack of a standard assessment tool in the world, these assessments are being tried to be carried out with observations that vary from person to person. Therefore, this situation is an obstacle to determining rational goals and achieving independence for people with visual disabilities who have a wide age gap (Bilyalova et al., 2021). As a result of the implementation of a standard assessment tool, it will be possible to create an individualised education plan (BEP) for the student; conduct studies on orientation and independent movement skills; and test their progress.

It is known that vision plays an important role in the design and realisation of motor skills. In sighted children, vision becomes the main source of information around the age of 6 months. In sighted infants, psychomotor skills, such as attention, strength, balance, reaction speed, co-direction and flexibility, develop rapidly after birth (Bahari et al., 2021). Eyesight provides babies with opportunities to get to know their surroundings without moving. Babies can only perceive situations such as the placement of things and colours through vision. In sighted babies, a person or an interesting object can motivate them to move (Melaku, 2021). Each new skill gained for a baby who begins to move helps him expand his own world and conduct new experiments. It is known that motor development plays an extremely important role in the process of a child's recognition of his environment, adaptation, participation in social activities and independence (Rocha et al., 2021). The effective use of motor skills is directly related to social, language, daily life skills and emotional development. The child's movement allows him to communicate with people and objects around him, and therefore to interact with the environment (Okur et al., 2019). Visually impaired children are physically less active than sighted children. Among the factors that cause this situation is the fear of the transaction, less physical activity and spatial disorder; the parents of the child may also include situations such as fear. These factors significantly affect the development of the visually impaired child, who has limited interaction with the environment (Zhang et al., 2021).

The environmental factors that the visually impaired child is in and his/her gaining experience play an extremely important role in determining the speed and direction of psychomotor development. It is observed that families take an overprotective approach to their children from infancy. Not providing the child with enough stimuli around him negatively affects his psychomotor development (Hooshyar et al., 2021). Since sensory stimuli are insufficient to provide proper orientation to an

object during the elementary school period, it may also not be possible for elementary school students to orient themselves to an object and grasp/hold it by hand (Udokang et al., 2020). In this context, it is expected that technology will help the visually impaired child with constant sounds around the machine assistance, and when he is not provided with the opportunity to touch it, gradually these sounds will help or intend to learn for him.

1.1 *Related Research*

Mountapmbe and Ludi (2021) designed block-based programming environments to improve accessibility for visually impaired people and expressed that they had witnessed an increase in research. In this regard, they sought to create their work, ensuring that students have basic computer skills, curriculum improvement and accessible screens to block-based programming environments. Designing the learning experiences of visually impaired students has arrived at positive conclusions, such as how to improve the use of a computer environment that is useful and helpful for visually impaired students. It takes time for a student with visual impairment to adapt to both the environment and to learn the conceptual skills of an object that he does not see, but it is believed that this difficult experience will benefit them if all systems are well planned.

Yilmaz and Koc (2021) carried out a study on visual disability and arithmetic and reading achievements of both genders. In this research, it was intended to provide visually impaired children with meaningful learning experiences. Visually impaired students enrolled in programming were given the flexibility used on a mandatory basis, which acquired positive results. In this context, when discussing the programme's values and curriculum for visually impaired students, it was observed that technology is very important. However, it is known that each such study benefits visually impaired students; it is also known that enriching the field of writing with such studies creates an alternative and a short path to go.

Ukeli and Akem's (2013) study on the status of a problem revealed the parental role for visually impaired students (at both home and school) and aimed to investigate the relationship between mathematical achievement and the parental role in school. The math achievement for students in elementary school who started to work was positive and the role of the parent in the house, for students who do not have a cognitive disability associated with mathematics achievement, was negative. Therefore, they also concluded that there is a strong positive relationship between mathematics achievement and the role of parents at home for students with cognitive disabilities Dec

When the related research studies are examined, it is seen that information, communication and education are always supported by visually impaired students. It prepares them better for their lives and eliminates the obstacles even a little bit. Explaining mathematical operations such as calculation to elementary school students with such technology is the most indispensable condition of the research. The research will continue with the problem situation.

1.2 Purpose of the study

The aim of this study was to improve the calculation skills of visually impaired children in primary school classrooms. The answers to the following questions were sought for the general purpose of the study:

1. How are the computer usage times of visually impaired primary school students?
2. What is the usage time of calculation applications of visually impaired primary school students?
3. What is the usage time of computer and calculation applications of visually impaired primary school students during the day?
4. Is there a significant difference between the calculation trainings of visually impaired elementary school students according to the gender variable?
5. What are the opinions of visually impaired primary school students about technologies, computational applications and teaching after the study?

2. Method

In this section of the research study, information about which method was used in the study, which group of students participated in the study, the type and source of the data in the study, the data collection tool and the statistics used in the study are included.

2.1 Research model

It is seen that the research is continued within the study using one of the research methods – the quantitative research method. A quantitative research method is a research method that aims to describe an action from history to the present day with a model in which it exists, as well as to be used for a wide audience when it is considered (Uzunboylu et al., 2021). The quantitative research methods used in this research determine the development of calculation skills of visually impaired primary school students and how they learn using technology by determining the terms of use of the calculations using applications on the determination of the status of the investigation; gender, class, education and term are designed according to the variables.

1.2. Working group/participants

The participation group included in the study consisted of 78 voluntary primary school students who continue their education and training in various primary schools in Kazakhstan. In the research, the measurement tool was explained, applied and accepted by the students with the help of their families.

Gender

In this section, the differences of primary school students according to their gender are given in Table 1.

Table 1. Distribution of primary school students according to the gender variable

Gender	Male		Female	
	F	%	F	%
Variable	44	56.41	34	43.58

When Table 1 is considered, the distribution of the primary school students participating in the study according to the gender variable is determined and the information is examined and added. In this context, 56.41% (44 people) of the visually impaired primary school students were male, while 43.58% (34 people) of the visually impaired primary school students were female. In the gender section, the findings reflect the actual gender distribution.

Computer usage times of visually impaired elementary school students

In this section, the computer usage times for the reinforcement of calculation skills of visually impaired elementary school students are discussed and examined, and the studied values are digitised and presented in Table 2.

Table 2. The distribution of visually impaired elementary school students regarding their computer usage time

Computer Use	1–2 hours		3–4 hours		5 or more hours	
	F	%	F	%	F	%
Variable	4	5.13	24	30.77	50	64.10

When Table 2 is examined, visually impaired elementary school students' computer usage times were examined and detailed information has been provided. In this context, 5.13% (4 people) used the computer for 1–2 hours, 30.77% (24 people) used the computer for 3–4 hours and 63.10% (50 people) used the computer for over 5 hours. It is seen that computer usage time is mostly 5 hours and above and is preferred for the development of calculation skills of primary school students within the research.

Calculation applications of visually impaired primary school students' usage times

In this section, the calculation applications of visually impaired primary school students' usage times according to the daily usage time periods in the educational process are investigated and examined. Detailed information is presented in Table 3.

Table 3. Calculation applications of visually impaired primary school students' usage times

Calculation applications	1–2 hours		3–4 hours		5 or more hours	
	F	%	F	%	F	%
Variable	3	3.85	11	14.10	64	82.05

When Table 3 is examined, the calculator application for visually impaired elementary students' mathematical skills and technological applications, as selected with the audio in the formation of the button when it is tapped in the formation of the learning environment and conditions of use after the study, are given. In this context, 3.85% (or 3 people) used the computing application for 1–2 hours, 14.10% (11 people) used the calculator application for 3–4 hours and 82.05% (64 people) used it for more than 5 hours. In this context, the usage amount of using educational computing applications is observed to be more than 5 hours by visually impaired elementary students, which is preferred in this research.

Class status

In this section, the class information of visually impaired primary school students in the study group was examined and detailed information is presented in Table 4.

Table 4. The distribution of visually impaired elementary school students according to their class status

Department	Grade 2		Grade 3		Grade 4	
	F	%	F	%	F	%
Variable	12	15.38	17	21.79	49	62.83

When Table 4 was examined, the distribution of the primary school students with visual impairment in the study group according to their class status is considered and the relevant information according to the class scale is added. In this context, 15.38% (12 people) were in grade 2, 21.79% (17 people) were in the grade 3 and 62.83% (49 people) were in grade 4. In the class distributions section, the findings reflect the actual distribution.

2.3 Data collection tools

In this section, it can be seen that there is a measurement tool developed by the creators of the problem sentence in the research within the research. The data collection tool was examined by visually impaired elementary school students and experts in the field of technology related to computing applications, and inappropriate items were removed from the study and corrected. A personal information form called the 'calculation skills' measurement tool, which was applied to visually impaired elementary school students with the help of their families and developed by researchers, was used. The validity of the scope of the measurement tool developed was examined by three professors and three associate professors, who have worked on special education, computational applications, mathematical operations and technology. The unnecessary items were removed from the measurement tool and rearrangements were made.

1. Personal information form (demographic data): In the personal information form, information such as gender, computer usage times, calculation applications usage times and class are provided.

2. Calculation skills data collection tool: A 5-point Likert-type questionnaire was prepared to obtain information about the calculation skills and mathematical operations views of visually impaired elementary school students. 20 items of the measurement tool consisting of a total of 22 items were used and 2 items were removed from the measurement tool, thanks to experts' opinions. The opinion of visually impaired primary school students from two factorial dimensions, such as 'computational skills', 'technological dimensions' and 'mathematical operations', was applied. The Cronbach alpha reliability coefficient of the measurement tool as a whole was calculated as 0.95. The measurement tool is rated as 'I strongly disagree' (1), 'I disagree' (2), 'I am undecided' (3), 'I agree'

(4) and 'I definitely agree' (5). The measurement tool was collected from primary school students in the form of an online environment.

2.4 Application

In the application part of the study by volunteer researchers in Kazakhstan, who continue their education at various elementary schools in the area designated to visually impaired elementary students and their families with programmes, 78 applications were obtained. With the help of mathematical calculation, they could plan and prepare educational activities with their families after their education in the school environment, and remote learning was intended to be continued to be used in this situation and transferred to the families. This calculation was prepared with the application programme and the training event was organised by experts in the field of environment; the research part in the event was completed; a sound recording created for elementary school students and families of applications for computing and mathematical operations to be heard by visually impaired students by a 4-week computational and mathematical situation merge with technology in education for visually impaired students in the elementary activity was provided. Conditions of use, determination of how often they use various applications of learning techniques and how often they use computational applications with technology in math classes were provided to visually impaired elementary school students in the form of technology education. It was expected that visually impaired elementary school students would participate in the event held every week on this topic. After 4 weeks of training, a measurement tool and an information form were applied to visually impaired elementary school students with the help of their families, and the data are given in the form of tables in the findings section. It is explained how visually impaired students will respond to the measurement tool collected with the help of the families. Most of the schools of education used the distance education programme through the Adobe application for distributed and designated in Section 3 of 26 for the next week. Each section was limited to the maximum handed out to the visually impaired elementary students' set up; each 55-minute training programme of training was in the form of questions and answers, with a time frame 15 minutes, and in total 70 minutes of online education was processed if a student is in elementary school. Smartphone, tablet and laptop computers, with devices such as the microphone, were used in the training. The measurement tool applied to visually impaired elementary school students was coded in the environment of calculation programmes and transferred to the SPSS programme.

2.5 Analysis of data

Statistical data obtained from university students were analysed using the statistics programme using frequency (f), percentage (%), mean (M), standard deviation (SS) and *t*-test with irai. The data obtained from the programme are given in tables accompanied by numerical values, findings and comments.

3. Findings

In this section, the findings related to the learning status of sports lessons of primary school students with a blended teaching method are given. Each data of the study is given in tables and is presented in this section accompanied by comments.

3.1 .Computer and calculation applications of visually impaired primary school students during the day use time

The purposes of using computing applications for computer and mathematical operations by visually impaired primary school students during the day have been investigated and detailed information has been presented in Table 5.

Table 5. Computer and calculation applications' usage of visually impaired primary school students during the day

Department	Morning		Lunch		Afternoon	
	F	%	F	%	F	%
Variable	12	15.38	37	47.44	29	37.18

When examining Table 5, visually impaired elementary school students' computer and applications usage and computing time during the day was investigated according to the purpose of the research problem and the relevant information is provided. In this context, 15.38% (12 people) expressed that used it in the morning, 47.44% (37 people) used the computer and the calculator application during lunch time and 37.18% (29 people) chose to use it in the night time. In this context, it can be said that most of the students prefer to use computer and computing applications at noon, according to the problem situation of the research.

3.2 Educational status of visually impaired primary school students between decalculation trainings according to the gender variable

In this section, it was investigated whether there is a significant difference between the data obtained from the study and the calculation training of visually impaired primary school students according to the gender variable, and detailed information is presented in Table 6.

Table 6. Educational status of visually impaired primary school students between decalculation trainings according to the gender variable

	Gender	**N**	***M***	**SD**	**Df**	**t**	**p**
Calculation applications' education	Boy	44	4.40	0.47	78	-5.043	.000
	Girl	34	3.64	0.85			

When Table 6 is examined, the educational status of visually impaired primary school students according to the gender variable was investigated and it was determined that there was a significant difference between their computational education [t(78)) =0.000, p<.05]. When the educational status of visually impaired students in the elementary calculation is examined, visually impaired male students had an average score in this area (M=4.40), while female students had a lesser score (M=3.64). In this context, it can be said that there is a significant difference between the calculation

education scores of visually impaired male primary school students and visually impaired female students in this study and that the findings of this research are also high.

3.3 Post-study opinions of visually impaired primary school students on technologies, computational applications and teaching

In this section, the opinions of visually impaired primary school students about technologies, computational applications and teaching are investigated and examined after the study and are presented in Table 7.

Table 7. Post-study opinions of visually impaired primary school students on technologies, computational applications and teaching

No	Variable	Değerler	
		M	SS
1	I have enjoyed such applications as visually impaired	4.34	0.69
2	I have enjoyed using calculation applications as a visually impaired	4.41	0.54
3	Getting this kind of training with my parents for visually impaired people makes me closer to them	4.39	0.66
4	I have received enough help from my parents for education	4.43	0.59
5	I found calculation applications for visually impaired applications on the spot	4.39	0.66
6	I believe that voice applications for visually impaired people are always at the forefront	4.51	0.59
7	I find such applications meaningful and useful for visually impaired people	4.43	0.63
8	When I study computing applications, I am eager to share them with my friends	4.60	0.49
9	I find it useful for technology for visually impaired people	4.58	0.59
10	I recommend calculation applications for visually impaired people	4.53	0.50
11	I believe that the visually impaired have changed with such applications	4.48	0.55
12	I believe that my visual disability is not at the forefront of the education I receive	4.46	0.63
13	Although I have a visual disability, I understood the calculation training better with my family	4.43	0.59
14	I find such applications useful and useful for visually impaired people	4.41	0.63
15	I can communicate with visually impaired people with the help of technology	4.34	0.61
16	Communicating with my teacher through technology and learning something gives me pleasure.	4.46	0.63
17	I am happy to use technology and hear voices as a visually impaired person	4.41	0.63
18	I do not think that my visual impairment is an obstacle to	4.36	0.69

	learning computing applications		
19	I consider myself lucky and successful to have learned technology as a visually impaired person	4.41	0.60
20	As a visually impaired person, I would also like to see such applications in my other courses	4.39	0.73
	Overall Average	4.43	0,61

It can be seen from Table 7 that there are post-study opinions of visually impaired primary school students regarding technologies, computational applications and teaching. It was observed that the values between the post-study scores are high and there is a significant difference. Although there was a significant difference in all statements, according to the results of the study, 'I am eager to share it with my friends when I study computational applications', from the statements of visually impaired elementary school students, had a score of M=4.60 and 'always in the forefront of audio applications for visually impaired people believe that he is' had a score of M= 4.51, which shows that there was a significant difference between the values of each one. However, the mean value for 'for technology for visually impaired people find it useful' was M=4.58. Although the results for each item is positive in the survey, the visually impaired students' opinions, 'I believe that with these types of applications has changed my blind' (M=4.48), show that they are satisfied with the education in elementary school; with this vision disability, they are forced with the help of this technology, thanks to their families, despite their families forming a bond with all this situation and solved the problem by taking pleasure in seeing how even the barrier of the findings evolved mathematical values were reached.

In addition, finally, based on Table 7, it is considered that it is an inevitable to use technology in education and training to such an extent, as well as to support their families. It has also been found that families support the education of visually impaired students for this application, which is directly proportional to their development of calculation skills.

4. Discussion

It is known that innovations in technology and the adaptation of people have always made it easier for both students and educators. Even if it takes time to use innovative technology, it is inevitable that it will receive support at a time when there are difficulties when using it. It is both known and seen that technology is costly and time-consuming when research is handled. In this context, Chakraborty et al. (2013) conducted a study on visually impaired persons' increased ease of reading with low-cost wearable devices and they are healthy and intend to be used in the activities for students. As a result, wearable technology for the visually impaired students of economically less privileged is easy to use for the visually impaired and potentially low-cost solution that offers the results of research in the context of this research; they achieved this result when combined with vision; it is seen that the results of strengthening the calculation skills of students with disabilities have been achieved. It is known that while it is seen in this study that another obstacle has been removed with technology, it is also important to use this technology correctly with students.

Piazza et al. (2010) carried out a study on the development and learning about numbers and arithmetic learning difficulty that is also shared with other animals and people sayisallig birth place spontaneously, which is a basic ability to grasp the numeric variables 'number sense' that is based on NA that are being widely considered by knowing to explore the links between number sense and diskalkuli. After that, they aimed to investigate the multiplicity of point sets called number sharpness, and as a result, they concluded that this concept has improved over time and mathematical skills have strengthened. When this value of the research was combined with the result of the research, it

was concluded that the mathematical values of male students were better understood. It is proposed to combine this technology with another study, while achieving the results that men are better used.

Costa et al. (2021) conducted a study on special educational needs, and in this case, they intended to develop computational thinking skills in children who are blind, visually impaired students, based on QR code which results in an audio output when combined with technology; students are benefitted by this. When this value is combined with the results of the research, it has been found that technology has an impact on visually impaired primary school students, and their families are very important in their lives when using this technology.

5. Results

When the results are considered, it is seen that the number of participants comes first. In this experimental study, it was concluded that a total of 78 visually impaired students participated; the families of these students were also interviewed and it was expected that they would use the technology experimentally. The value of elementary school students was examined and detailed information on visually impaired as a result of computer usage times in light of the results showed more than 5 hours; these computers with voice commands for applications were designed with visually impaired elementary students; these technologies were used with the help of the families of each student and a habit was gained. In visually impaired elementary students' research skills in relation to another value, the calculator application for the formation of mathematical and technological applications as selected with the audio button when it is tapped in the learning environment by providing the conditions of use after the formation of study was investigated and, as a result, most research in educational computing applications showed up to 5 hours usage; it is observed that this amount is preferred by visually impaired elementary students.

Another outcome of the research discussed the computer usage time of when visually impaired elementary school students in the day, according to the research problem and the purpose of computing applications. The authors researched the problem and as a result, according to the state of business research, they concluded that the afternoon was preferred for calculating computer applications. When this value is taken into consideration, it is seen that visually impaired elementary school students take another step forward to learn the skills designed for them while being eager to use technology at lunch time. Another result of the study discussed the gender variable when the value of visually impaired elementary school students and educational status were investigated; according to the calculation, it was inferred that there is a significant difference in the education of visually impaired students. Male students had an average score, but female students had a higher mean score in this area. It is also known that there were more male students in the research than female students.

Finally, the values of the opinions of visually impaired students, which is the backbone of a survey of opinions, are obtained; the corrected mistakes when eliminating errors remains. It is known that, in this context, the final results of the study discussed when visually impaired students in the elementary technologies, applications and computing education in relation to post-trial opinion was high and it was inferred that there is a significant difference. Additionally, they were happy to share with their friends the received instruction in computing applications; audio applications are believed to be in the forefront for visually impaired people; visually impaired people have found use for these types of applications of technology, which has changed with their belief in education and training to have the support of their families, and also using this kind of technology brings inevitable wealth. Finally, it has been concluded that the support of families to the education of visually impaired students for this application is directly proportional to the development of their calculation skills.

References

Baglama, B., Haksiz, M., & Uzunboylu, H. (2018). Technologies Used in Education of Hearing Impaired Individuals. *International Journal of Emerging Technologies in Learning (iJET)*, *13*(09), pp. 53–63. https://doi.org/10.3991/ijet.v13i09.8303

Bahari, R., Shokravi, F. A., Anosheh, M., & Moridi, M. (2021). Effect of a health education program on puberty knowledge among visually impaired female adolescent students. *Medical Journal of the Islamic Republic of Iran*, *35*, 74. doi: 10.47176/mjiri.35.74

Bilyalova, A., Bazarova, L., Salimova, D., & Patenko, G. (2021). The Digital Educational Environment: The Problem of Its Accessibility for Visually Impaired Students. *International Journal of Emerging Technologies in Learning (iJET)*, *16*(16), pp. 221–230. https://doi.org/10.3991/ijet.v16i16.23453

Chakraborty, T., Khan, T. A., & Al Islam, A. A. (2017). Flight: a low-cost reading and writing system for economically less-privileged visually-impaired people exploiting ink-based braille system. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 531-540).https://doi.org/10.1145/3025453.3025646

Costa, R., Araújo, C., & Henriques, P. R. (2021). Melodic-Teaching computational thinking to visually impaired kids. In *Second International Computer Programming Education Conference (ICPEC 2021)*. Schloss Dagstuhl-Leibniz-Zentrum für Informatik. **https://drops.dagstuhl.de/opus/volltexte/2021/14220/**

Hooshyar, D., Pedaste, M., Yang, Y., Malva, L., Hwang, G. J., Wang, M., ... & Delev, D. (2021). From gaming to computational thinking: An adaptive educational computer game-based learning approach. *Journal of Educational Computing Research*, *59*(3), 383-409. https://doi.org/10.1177/0735633120965919

Huff Jr, E. W., Boateng, K., Moster, M., Rodeghero, P., & Brinkley, J. (2021). Exploring the perspectives of teachers of the visually impaired regarding accessible k12 computing education. In *Proceedings of the 52nd acm technical symposium on computer science education* (pp. 156-162). https://doi.org/10.1145/3408877.3432418

Melaku, S. M. (2021). The effects of tutorial class for female students on their academic achievement in Wachemo University, Ethiopia. *Global Journal of Guidance and Counseling in Schools: Current Perspectives*, *11*(2), 66–76. https://doi.org/10.18844/gjgc.v11i2.5276

Mountapmbeme, A., & Ludi, S. (2021). How Teachers of the Visually Impaired Compensate with the Absence of Accessible Block-Based Languages. In *The 23rd International ACM SIGACCESS Conference on Computers and Accessibility* (pp. 1-10). https://doi.org/10.1145/3441852.3471221

Okur, M. R., & Demir, M. (2019). Identifying the problems faced by visually impaired learners in their educational life and developing solutions for the field of open and distance learning. *Journal of Open Education Practices and Research*, *5*(2), 49-62. https://dergipark.org.tr/en/pub/auad/issue/45710/576569

Piazza, M., Facoetti, A., Trussardi, A. N., Berteletti, I., Conte, S., Lucangeli, D., ... & Zorzi, M. (2010). Developmental trajectory of number acuity reveals a severe impairment in developmental dyscalculia. *Cognition*, *116*(1), 33-41. https://doi.org/10.1016/j.cognition.2010.03.012

Rocha, F., Guimarães, G., Gonçalves, D., Pires, A. C., Abreu, L. V., & Guerreiro, T. (2021). Fostering collaboration with asymmetric roles in accessible programming environments for children with mixed-visual-abilities. In *The 23rd International ACM SIGACCESS Conference on Computers and Accessibility* (pp. 1-4). https://doi.org/10.1145/3441852.3476553

Udokang, A. E., & Odeyemi, J. B. (2020). Empirical study of the effect of type of family and extra lesson on students' academic performance: A case study of some selected schools in Kwara State, Nigeria. *New Trends and Issues Proceedings on Humanities and Social Sciences*, *7*(3), 94–103. https://doi.org/10.18844/prosoc.v7i3.5238

Ukeli, V. T., & Akem, I. A. (2013). Parental Role in Mathematics Achievement of Visually Impaired Students in Benue State. *Journal of Educational and Social Research*, *3*(5), 25. Retrieved from https://www.richtmann.org/journal/index.php/jesr/article/view/636

Urea, I. R., & Carmen , A. . (2020). Dimensions of relationships of students with intellectual disabilities. *International Journal of Special Education and Information Technologies*, *6*(1), 48–60. https://doi.org/10.18844/jeset.v6i1.5786

Yilmaz Ince, E., & Koc, M. (2021). The consequences of robotics programming education on computational thinking skills: an intervention of the young engineer's workshop (yew). *Computer Applications in Engineering Education*, *29*(1), 191-208. https://doi.org/10.1002/cae.22321

Zhang, Y., Luo, R., Zhu, Y., & Yin, Y. (2021). Educational Robots Improve K-12 Students' Computational Thinking and STEM Attitudes: Systematic Review. *Journal of Educational Computing Research*, *59*(7), 1450-1481. https://doi.org/10.1177/0735633121994070