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Effect of the Fun Mathematics Educational Game on the Arithmetic Operation Skills of Children with Dyscalculia

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ABSTRACT

Students with dyscalculia often struggle to complete math tasks, particularly arithmetic operations involving whole numbers. Therefore, specialized learning methods are necessary, including using the educational game fun mathematics. This study aims to determine the impact of the educational game Fun Mathematics on the ability to perform arithmetic operations with whole numbers in children with dyscalculia. The research method used is experimental with a Group Pretest-Posttest Design. Data analysis was conducted using the Wilcoxon Signed-Rank Test, derived from the pretest and posttest results. The study results show that the average pretest score is 47.43, and the average posttest score is 72.57. This indicates a significant difference in the ability to perform arithmetic operations with whole numbers before and after being given the Fun Mathematics educational game. The T-test analysis results show a significance value of 0.016, indicating that the significance value is less than 0.05. Thus, Ho is rejected, and Ha is accepted. Therefore, it can be concluded that the Fun Mathematics educational game affects the ability to perform arithmetic operations with whole numbers in fourth-grade students with dyscalculia at Al Firdaus Elementary School, Surakarta

Keywords: Educational game, fun mathematics, dyscalculia, arithmetic operations

INTRODUCTION

The use and utilization of ICT has been carried out by all levels of society worldwide. ICT has been used in various fields in Indonesia, including education, as Supriyadi & Donni (2021) described. Lase (2019) explains that education will always change the advancement of science, technology, and societal cultural shifts. Education in Indonesia faces the era of society 5.0, which requires creative thinking and digital skills. The role of educators in facing the era of society 5.0 is crucial; educators must be able to utilize existing technology in their teaching processes so that students can experience the positive impacts of technological advancements. Elga et al. (2023) state that technological advancements impact teaching and teachers can use technology to create engaging teaching media.

One of teachers' evolving uses of technology is the creation or use of technology-based learning media, one of which is educational games. Wulandari et al. (2017) explain that interactive multimedia learning media, including educational games, can improve students' learning outcomes at school. Muhtarom (2022) defines educational games as designed to support the learning process by providing students with the tools to understand concepts, offering guidance in practicing numeracy skills and encouraging students to be actively involved in educational games. This game-based media can be applied to all subjects, including mathematics. Abdullah & Yunianta (2018) conducted research showing that

students' mathematics scores increased due to using educational games in learning. Mathematics is compulsory for all students, including those with special needs.

One inclusive elementary school in Surakarta, SD Al Firdaus, has students with dyscalculia with the same learning achievements as regular students. Abdurrahman (2018) defines dyscalculia based on the definition by the Association for Children and Adult Learning Disability (ACALD) as a specific learning difficulty involving impaired development of verbal or non-verbal integration abilities caused by neurological dysfunction. Saputra (2016) explains the impact faced by children, which includes challenges in addition, subtraction, division, and multiplication due to central nervous system disorders during their development. Interviews with homeroom teachers and the inclusion team revealed that there are dyscalculic students in the fourth grade who face barriers and difficulties in achieving learning objectives. One challenging learning material for these children is the arithmetic operation of whole numbers, where dyscalculic children struggle to achieve their learning goals and receive low academic scores, unable to reach the minimum passing grade in daily tests or semester exams.

Therefore, a solution is needed to address the problems faced by these students, one of which is using digital-based educational games. The researcher uses the fun mathematics game to overcome the difficulties faced by students. Cezarotto (2021), in his research on recommending good multimedia games for dyscalculic children to increase motivation and skills, suggests that games should have character figures, storylines, and rewards. This research aligns with the fun mathematics game, which includes character figures, game storylines, and rewards for completing levels. As Linhares et al. (2023) explained, Fun Mathematics is a game developed by SpeedyMind LLC to make learning mathematics more enjoyable and engaging. This application focuses on arithmetic exercises, including the four basic operations: addition, subtraction, multiplication, and division.

Moreover, according to João (2023, p. 5), fun mathematics is a game designed for children containing basic math teachings through challenges disguised as in-game battles. Previous research by Sadiqin et al. (2021) using the fun mathematics game concluded that this game could increase preschool children's motivation to learn arithmetic operations. Based on the above description, this study aims to determine the effect of the fun mathematics educational game on the arithmetic operation skills of whole numbers in fourth-grade dyscalculic students at SD Al Firdaus Surakarta.

METHOD

This study employs a quantitative research design with an experimental approach using a type of Pre-experimental Design in the form of a One-Group Pretest-Posttest Design. In the One-Group Pretest-Posttest Design, the effect of treatment is determined based on the difference between the pretest and posttest without comparison to a controlled group, meaning that the subjects who undergo the pretest and posttest in this study are from one group. The population in this study comprises fourth-grade students at SD Al Firdaus Surakarta, with a total of 60 fourth-grade students. The sample taken in this study consists of 7 students from classes IV, A, B, and C. The sampling technique used in this study is purposive sampling, based on the criteria determined by the researcher, namely students in the fourth grade identified as having dyscalculia.

Data collection was conducted using a test technique, specifically a written test in the form of multiple-choice questions to gather data on the impact of the fun mathematics educational game on the arithmetic operation skills of fourth-grade students with dyscalculia at SD Al Firdaus Surakarta. The test instrument was developed based on the theory from Rukiah (2018), which defines arithmetic operations as calculation processes consisting of four interrelated basic operations: addition, subtraction, multiplication, and division. Mastery of one operation influences the others. Andhin (2020) defines whole numbers as numbers used to express the cardinality of a set, for example, the set of whole numbers = {0,1,2,3}. Therefore, the aspects in the test instrument for arithmetic operations on whole numbers include addition, subtraction, multiplication, and division operations. The multiple-choice test format assigns a score of 1 for each correct answer and 0 for each incorrect answer.

The data analysis technique used in this study is inferential statistics. According to Sugiyono (2015), inferential statistics are divided into parametric and non-parametric. The researcher uses the non-parametric type with the Wilcoxon Signed Rank Test, assisted by the SPSS application, to process the data. The data from the pretest and post-test results reflect the student's learning outcomes.

RESULT AND DISCUSSION

The researcher collected students' scores before and after providing the treatment in the form of a fun mathematics educational game. The researcher then compared the pretest-posttest results obtained by the students. During the treatment, the students were enthusiastic because it was their first time experiencing learning mathematics as if they were playing a game. Additionally, a sense of competition emerged among the students based on the levels they achieved, with each student not wanting to be outdone by others. The increased motivation and the appeal of the given treatment influenced the students' scores before and after the treatment.

Here is a table comparing the scores of fourth-grade students with dyscalculia at SD Al Firdaus Surakarta:

Table 1. Comparison of scores pretest-posttest

No	Students' initials	*Pretest*	*Posttest*	Different
1	AB	44	68	24
2	AI	52	76	24
3	RO	56	76	20
4	DO	40	64	24
5	SS	64	92	28
6	AA	44	72	28
7	DA	32	60	28
Sum		332	508	176
Average Score *Pretest*		**47.43**		**25.14**
Average Score *Posttest*		**72.57**		

Based on Table 1 above, which presents the comparison between pretest and posttest scores, it is evident that there is an improvement in the results before and after the

treatment was given. The scores are improved in the pretest and posttest results obtained by the students, with the average pretest score being 47.43 and the average posttest score being 72.57. After identifying the comparative data of pretest and post-test results, the findings can be presented with descriptive statistics comparing the scores. The descriptive statistical data is presented in the table below

Table 2. Descriptive statistics comparing pretest-posttest scores

	N	Range	Minimum	Maximum	Sum	Mean	Std. Deviation
Pretest	7	32	32	64	332	47.43	10.690
Posttest	7	32	60	92	508	72.57	10.438
Valid N (listwise)	7						

Based on Table 2 above, the lowest and highest scores between the pretest and posttest can be observed. The lowest (minimum) score on the pretest was 32, which increased to 60 on the posttest. Similarly, the highest (maximum) score increased from 64 on the pretest to 92 on the posttest. The total score for the pretest was 332, while the total score for the posttest was 508, showing an increase of 176. There was also an increase in the average (mean) score from 47.43 on the pretest to 72.57 on the posttest, resulting in an improvement of 25.14.

Next, a normality test was conducted to determine whether the data was normally distributed. This study used the Shapiro-Wilk normality test technique. Susi (2022) explains that the Shapiro-Wilk technique is one method for testing normality to determine whether data is normally distributed with a small sample size of less than 50. The criteria for data being normally distributed using the Shapiro-Wilk test are as follows:

Table 3. Normality test

	Kolmogorov-Smirnov[a]			***Shapiro-Wilk***		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pretest	.197	7	.200*	.980	7	.957
Posttest	.228	7	.200*	.934	7	.582

Table 3 above shows the normality test results using Shapiro-Wilk, indicating a Sig value of 0.957 for the pretest and 0.582 for the posttest. Based on the presented data, it can be concluded that the research data is normally distributed since the values are greater than 0.05. Next, a hypothesis test was conducted using the Wilcoxon Signed Rank Test with the assistance of SPSS 29. The data from the pretest and posttest results reflected the students' learning outcomes. The aim was to determine whether the fun mathematics educational game influenced the arithmetic operation skills of whole numbers in fourth-grade dyscalculic students at SD Al Firdaus Surakarta. The decision to accept or reject the hypothesis was made by comparing the Asymp-Sig (2-tailed) result with the significance level (α). The results of the statistical test using the Wilcoxon Signed Rank Test with the help of the SPSS 29 program are presented in the following statistical test results table:

Table 4. Test statistic Wilcoxon sign rank test

Test Statistics

	Posttest - Pretest
Z	*-2.401[b]*
Asymp. Sig. (2-tailed)	.016

The established significance level is α = 0.05. If the significance level result is < 0.05, Ho is rejected, and Ha is accepted; if the significance level result is > 0.05, then Ho is accepted, and Ha is rejected. Based on the Wilcoxon Signed Rank Test calculation results, it is found that the calculated Z value for pretest and posttest scores is -2.401, and the Asymp-Sig (2-tailed) value is 0.016 at a significance level (α) of 0.05. The comparison of results shows that the Asymp-Sig (2-tailed) value is smaller than the significance level (α) of 0.05. Therefore, Ho is rejected, and Ha is accepted; thus, it can be concluded that in this study, "The fun mathematics educational game affects the arithmetic operation skills of whole numbers in fourth-grade dyscalculic students at SD Al Firdaus Surakarta" can be accepted.

CONCLUSION

The fun mathematics educational game enhances users' mathematical arithmetic skills, such as addition, subtraction, multiplication, and division. The fun mathematics educational game affects the arithmetic operation skills of fourth-grade dyscalculic students at SD Al Firdaus Surakarta. Using fun mathematics educational games has improved the students' scores before receiving treatment. Gaming media can enhance the attractiveness and motivation of students in capturing and understanding lesson materials. Educators can utilize this game as a teaching tool for arithmetic operation topics. Furthermore, considering the abundance of educational games available, educators should carefully select and filter which games are suitable for teaching aids in the learning process.

REFERENCES

Abdullah, F. S., & Yunianta, T. N. H. (2018). Pengembangan media pembelajaran matematika trigo fun berbasis game edukasi menggunakan adobe animate pada materi trigonometri. AKSIOMA: Jurnal Program Studi Pendidikan Matematika, 7(3). 434-443. http://dx.doi.org/10.24127/ajpm.v7i3.1586

Abdurrahman, M. (2018). Anak Berkesulitan Belajar: Teori, Diagnosis, dan Remediasinya. Jakarta: Rineka Cipta.

Andhin, D.F. (2021). Pembelajaran 1. Bilangan Asli, Cacah, dan Bulat (ACB). Jakarta: Kementerian Pendidikan dan Kebudayaan.

Cezarotto, M. (2021). Recommendations for designing games for players with dyscalculia Recomendações para o design de jogos para jogadores com dyscalculia. Estudos Em Design, 29(3). 34–51.

Elga, F., Riri, O., Supriadi, & Hari, A. (2023) Perancangan Media Pembelajaran Bebasis Game Edukasi Menggunakan MIT APP Inventor Pada Pelajaran PAI. Jurnal Mahasiswa Teknik Informatika, 7(1). 65 – 664. htpps://doi.org/10/36040/jati.v7i.6179

João Marques. (2023). Development of an Educational Game: Math-Masters, Hlm. 5. Universidade Beira Interior

Lase, D. (2019). Pendidikan di Era Revolusi Industri 4.0. SUNDERMANN: Jurnal Ilmiah Teologi, Pendidikan, Sains, Humaniora Dan Kebudayaan, 12(2), 28–43. https://doi.org/10.36588/sundermann.v1i1.18

Linhares, Arruda, & De Castro, S. (2023). TDAH E A Utilização das Tecnologias Digitais Como Recursos No Processo De Ensino E Aprendizagem Da Matemática. Tecnologias Na Educação, 116–123.

Muhtarom, Hendrisa, A., & Achmad, B. (2022). Pengembangan Game Edukasi Matematika Untuk Meningkatkan Kemampuan Numerasi Siswa Smp. Transformasi: Jurnal Pendidikan Matematika Dan Matematika, 6(2), 95–108. https://doi.org/10.36526/tr.v6i2.2176

Rukiah. (2018). Meningkatkan Kemampuan Operasi Hitung Siswa pada Pembelajaran Matematika dengan Menggunakan Permainan Kartu di Kelas II SDN Habau Tahun Pelajaran 2016/2017. Jurnal Penelitian Tindakan Dan Pendidikan, 4(2), 9–19. https://rumahjurnal.net/index.php/ptp/article/view/478

Sadiqin, H.A., Nurhasikin, Liyana, A., Madiawat, & Norlindamalia. (2021). Learning Mathematics using Fun-Math Mobile Application for Pre-School. International Jasin Multimedia & Computer Science Invention and Innovation Exhibition, 12–15. https://ir.uitm.edu.my/id/eprint/49330/

Saputra, D.Y. (2016). Menangani Kesulitan Belajar Pada Anak Diskalkulia. Malang: Familia.

Sugiyono. (2015). Penelitian Kuantitatif, Kualitatif, dan R & D (Ke-3). Bandung: Alfabeta.

Supriaydi, Prakosha, D. (2021). Evaluation of the Use of Information and Communication Technology Case Study at SLB N Boyolali. International Journal of Multicultural and Multireligious Understanding, 8(10), 73–79. http://dx.doi.org/10.18415/ijmmu.v8i10.3005

Susi, I. (2022). Pengaruh Penggunaan Model Pembelajaran Berbasis Proyek “Project Based Learning” Terhadap Hasil Belajar Fisika Peserta Didik Kelas X IPA SMA Negeri 35 Halmahera Selatan Pada Konsep Gerak Lurus”. Jurnal Ilmiah Wahana Pendidikan, 8(5). 256–269. https://doi.org/10.5281/zenodo.6466594

Wulandari, R., Susilo, H., & Kuswandi, D. (2017). Penggunaan Multimedia Interaktif Bermuatan Game Edukasi Untuk Siswa Sekolah Dasar. Jurnal Pendidikan, 2(8).1024–1029. http://dx.doi.org/10.17977/jptpp.v2i8.9759