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The Effect of Mr. Bilbul Teaching Aids on Fourth-Grade Students' Mathematics Learning Outcomes in Integer Topics

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Abstract

This study aimed to examine the effect of using Mr. Bilbul teaching aids on students' mathematics learning outcomes, particularly in integer material, among fourth-grade students at SD Muhammadiyah Jonggol. The research employed a quantitative approach with a pre-experimental design using a one-group pretest–posttest model. The participants consisted of 27 fourth-grade students selected through random sampling. Data were collected using an essay-based achievement test administered before and after the implementation of the teaching aids. The data were analysed using non-parametric statistical techniques, including the Mann–Whitney test and normalized gain (N-gain) analysis. The results showed a significant improvement in students' learning outcomes after the use of Mr. Bilbul teaching aids, with the average score increasing from 61.93 in the pretest to 87.30 in the posttest. The N-gain analysis indicated a high level of improvement. These findings suggest that the use of Mr. Bilbul teaching aids has a significant positive effect on students' understanding of integers and can be an effective learning medium to enhance mathematics learning outcomes at the elementary school level.

Kata Kunci:

Alat Peraga; Hasil Belajar Matematika; Bilangan Bulat; Siswa Sekolah Dasar.

Abstrak

Penelitian ini bertujuan untuk mengetahui pengaruh penggunaan alat peraga Mr. Bilbul terhadap hasil belajar matematika siswa pada materi bilangan bulat di kelas IV SD Muhammadiyah Jonggol. Penelitian ini menggunakan pendekatan kuantitatif dengan desain pra-eksperimen melalui model one-group pretest–posttest. Subjek penelitian terdiri atas 27 siswa kelas IV yang dipilih secara acak. Pengumpulan data dilakukan menggunakan tes hasil belajar berbentuk uraian yang diberikan sebelum dan sesudah penerapan alat peraga. Data dianalisis menggunakan teknik statistik nonparametrik, yaitu uji Mann–Whitney dan analisis normalized gain (N-gain). Hasil penelitian menunjukkan adanya peningkatan hasil belajar siswa secara signifikan setelah penggunaan alat peraga Mr. Bilbul, dengan nilai rata-rata meningkat dari 61,93 pada pretest menjadi 87,30 pada posttest. Hasil analisis N-gain menunjukkan peningkatan dalam kategori tinggi. Dengan demikian, dapat disimpulkan bahwa penggunaan alat peraga Mr. Bilbul berpengaruh

positif terhadap hasil belajar matematika siswa, khususnya pada materi bilangan bulat di sekolah dasar.

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INTRODUCTION

Education is a conscious and systematic effort to create a learning environment and process that enable students to actively develop their potential, including spiritual and moral values, self-regulation, personality, intelligence, noble character, and the skills required by individuals, society, and the nation (Makkawaru, 2019).

One of the key efforts to achieve optimal learning outcomes in education is through an effective learning process (Luqman, 2017). Achieving such outcomes requires the application of appropriate instructional strategies. One strategy that teachers can employ is the use of supportive learning media, particularly teaching aids. The use of visual teaching aids in mathematics instruction can help transform abstract concepts into more concrete representations, thereby facilitating students' conceptual understanding and encouraging concrete thinking aligned with the learning material (S. Lestari, 2021).

In mathematics learning, students are expected to play an active role in developing their reasoning abilities. To support this process, teachers are required to design engaging and meaningful instruction. Elementary school students possess distinct characteristics; they tend to enjoy play, movement, collaborative activities, and direct hands-on experiences (Aprilia & Fitriana, 2021). Therefore, mathematics instruction at the elementary level should incorporate elements of play, group work, and experiential learning to provide students with opportunities for active involvement in the learning process (Nuzulaeni & Susanto, 2022).

Based on observations conducted during the Field Experience Practice (PPL) with fourth-grade students at SD Muhammadiyah Jonggol, as well as interviews with the fourth-grade homeroom teacher, it was found that students' numeracy skills, particularly in integer operations, still require improvement. Many students experience difficulties in performing addition and subtraction operations involving integers. These difficulties are partly attributed to the limited use of instructional media in mathematics teaching. According to Mr. Dede Rukmana, the primary teaching aid used in delivering integer material is a number line drawn on the whiteboard using a marker, and the instructional methods applied at the school remain largely conventional.

Teaching and learning activities are predominantly teacher-centred, with students mainly listening to explanations, observing examples provided by the teacher, and completing practice exercises. Such instructional practices provide limited opportunities for students to construct their own understanding, resulting in learning that is largely procedural rather than conceptual. Given the importance of mathematics in everyday life, these conditions highlight the need for more effective instructional support. In practice, particularly among fourth-grade students at SD Muhammadiyah Jonggol, many students require the use of teaching aids to facilitate their understanding of difficult mathematical concepts. This challenge is further compounded by the limited availability of instructional media to support the mathematics learning process.

METHOD

This study employed a quantitative research approach to examine the effect of a specific instructional treatment on students' learning outcomes. Quantitative methods are appropriate when the research aims to measure the impact of an intervention and requires objective and accurate data. The research design used was a pre-experimental design with a one-group pretest-post-test model (Creswell, 2002; Creswell, 2007; Sugiyono, 2011).

The population of the study consisted of all students at SD Muhammadiyah Jonggol in the 2023/2024 academic year. The sample was selected randomly from one fourth-grade class, which served as the experimental group and consisted of 27 students. The research instrument was an essay-based achievement test designed to measure students' learning outcomes after the implementation of the Mr. Bilbul teaching aid. The test comprised seven items related to addition and subtraction of integers. Prior to data collection, the test instrument was piloted on students outside the research sample to ensure its suitability.

Data analysis was conducted to test the research hypothesis by comparing students' pretest and post-test scores. Statistical analysis was performed using a paired-samples t-test with the assistance of SPSS version 17 to determine whether there was a significant difference in students' learning outcomes before and after the intervention.

RESULT AND DISCUSSION

Result

To determine whether or not there is an effect of the use of Mr. Bilbul teaching aids on student learning outcomes, a test was administered before the application of Mr. Bilbul teaching aids (pretest) and after the application of Mr. Bilbul teaching aids (posttest) to the same class. Table 1 below shows the descriptive statistics of students' mathematics learning outcomes, both pretest and posttest, in the same class.

Table 1. Description of Results Statistics PreTest-PostTest.

Ket.	PreTest	PostTest
Min	21	21
Max	93	100
Mean	61,93	87,30
Std. Dev	14,035	16,167
Varians	196,994	261,370

Based on Table 1 above, the average pretest score is lower than the average posttest score. This result shows that there is a difference in students' mathematics learning outcomes before and after the application of Mr. Bilbul teaching aids. Then from the calculation of variance and standard deviation it is known that the pretest results are lower than the posttest, so it can be interpreted that the distribution of pretest data is not better than the posttest. Furthermore, from Table 1, it shows that the average pretest score is 61.93 and the average posttest score is 87.30. In this case, there is an increase in the average mathematics learning outcomes of students after the application of Mr. Bilbul teaching aids by 25.37. Meanwhile, to find out the level of classical completeness obtained by students before and after the application of Mr. Bilbul teaching aids, Table 2 can be observed below.

Table 2. Description of Student Learning Completion.

Value	Category	Pre-Test		Post-Test	
		Frequency	Persentage	Frequency	Persentage
$0 \leq X < 75$	Incomplete	22	81%	3	11%
$75 \leq X \leq 100$	Complete	5	19%	24	89%

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Based on Table 2 above, during the pretest, 22 students (81%) were classified as incomplete. Meanwhile, during the posttest, only 3 students (11%) were classified as incomplete, while 24 students (89%) were classified as complete.

To determine whether the data obtained from the study population was normally distributed, a normality test was conducted. Data testing was performed using IBM SPSS 22.0 for Windows software with a significance level of 0.05 based on the Shapiro-Wilk test. The results of the pretest-posttest normality test are presented below.

Table 3. Normality Test Results on PreTest-PostTest.

Test	Shapiro-Wilk		
	Statistic	**df**	**Sig.**
PreTest	.922	27	.043
PostTest	.674	27	,001

The Shapiro-Wilk test results in Table 3 above yielded a significance value of 0.043 for the pretest data and a significance value of 0.001 for the posttest data. Based on these results, it is concluded that the pretest and posttest data are not normally distributed because the significance value is less than 0.05. Therefore, in testing the research hypothesis, non-parametric statistical methods will be used, in this case the Man-Withney test.

After analyzing the pretest and posttest normality data using the Shapiro-Wilk test, it was determined that the data distribution was not normal at the 0.05 significance level. The Man-Withney test was then performed using IBM SPSS 22.0 for Windows software at a significance level of 5% or 0.05. Detailed SPSS output for processing the Man-Withney test data can be seen in Figure 1 below.

Test Statistics[a]

	NILAI
Mann-Whitney U	62.500
Wilcoxon W	440.500
Z	-5.285
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: KELAS

Figure 1. Test Result of Man Withney.

Table 4 above shows that the significance value obtained is <0.001. Because the Sig. value is lower than 0.05, the $H0$ is rejected and the $H1$ is accepted. Therefore, it can be concluded that there is an effect between the use of Mr Bilbul's teaching aids on the learning outcomes of fourth-grade students at Muhammadiyah Elementary School Jongol regarding integers.

Furthermore, to determine whether there is a difference in students' mathematics learning outcomes before and after the implementation of the Mr Bilbul teaching aids, a normalised gain (N-gain) test was conducted. Table 4 displays the results of the N-Gain test on the pretest-posttest data.

Table 4. Normalized Gain Test Results.

	N	**Min.**	**Max.**	**Mean**	**Interp.**
N-Gain	27	.00	1.00	.7033	High

In Table 4, the minimum value for the N-Gain test is 0.00 while the maximum value is 1.00. The average obtained in the N-Gain test is 0.70. Based on the average N-Gain test, it can be concluded that there is an increase in students' mathematics learning outcomes after the application of Mr. Bilbul teaching aids with the interpretation of a high increase ($0.30 \leq \text{gain} < 0.70$).

Discussion

Education is an endeavour aimed at achieving superior learning outcomes through the learning process. This achievement requires the use of appropriate strategies. As defined, a learning strategy is a method used by teachers to conduct teaching and learning activities with the goal of continuously transforming students' cognitive, affective, and psychomotor domains (Lestari, 2021). One strategy teachers can employ in the learning process is the provision of supporting learning media, namely teaching aids. With abstract mathematical concepts, the use of teaching aids can explain and concretely translate previously abstract mathematical concepts and can stimulate students to think concretely in accordance with the learning material (Saifani, 2019; Wibowo et al., 2025).

In mathematics learning, students are required to play an active role in the process of developing reasoning skills. To support this, teachers are also required to provide engaging instruction. Elementary school-age children have distinct characteristics. He enjoys playing, moving, working in groups, and experiencing or doing things directly (Fitriana, D.N., & Aprilia, A., 2021).

According to Sumanto (2011), learning media is anything that can be used to convey messages (learning materials) so that it can stimulate students' attention, interest, thoughts, and feelings in learning activities to achieve specific learning objectives. Media allows for direct interaction between students and students, students and teachers, and students and their environment. Teachers are not only required to have knowledge of media; they must also possess the ability to select and use media effectively. One form of media is teaching aids (Dwijayanti & Wiarta, 2024).

The learning media developed is an educational tool specifically designed for fourth-grade elementary school students in mathematics, specifically for integers. Based on field observations, students tend to prefer additional media such as the Mr Bilbul teaching aid. Its function is to optimise the learning process in fourth-grade elementary school mathematics. Furthermore, the Mr Bilbul teaching aid is also useful for students who are interested in learning. Mr Bilbul also serves as a way to instil basic, concrete, and realistic concepts, and of course, to motivate and stimulate students' learning. The function of Mr Bilbul's educational props aligns with the function of visual aids in facilitating student understanding (R. Lestari, 2021; S. Lestari, 2021).

The development of this educational teaching aid is expected to support student learning, particularly for fourth-grade elementary school students. It can be used individually or collaboratively within the classroom. The relationship between learning media and learning objectives, materials, methods, and student conditions must be a key consideration when selecting and using media in the classroom, ensuring that the media used is more effective and efficient in achieving learning objectives. This media development aligns with the standard competencies, core competencies, and indicators for fourth-grade elementary school students. The goal of this educational teaching aid is to produce a learning aid suitable for fourth-grade elementary school students, facilitating the transfer of information between teachers and students with the support of the media. The purpose of learning media is to simplify the learning process, increase learning efficiency, maintain the relevance of learning materials to learning objectives, and enhance student concentration.

In the initial stage before the treatment with the use of Mr Bilbul's teaching aids, the mean ($\bar{X}$) of students' pretest scores was 61.93, with a classical completion percentage of 19% (5 students) and a classical incompleteness percentage of 81% (22 students). Thus, the classification of students before the application of Mr Bilbul's teaching aids was included in the very low level and did not meet the minimum completion criteria in student learning outcomes, which was 75. Meanwhile, after the application of Mr Bilbul's teaching aids, the mean ($\bar{X}$) or average student score in the posttest increased to 87.30, with a classical completion percentage of 89% (21 students) and a classical incompleteness percentage of 11% (3 students). Based on the results obtained by the fourth-grade students of SD Muhammadiyah Jonggol, it can be said that there was an increase after the application of Mr Bilbul's teaching aids compared to before the application of Mr Bilbul's teaching aids.

In line with the results of the average comparison above, the results of the Normalised Gain (N-Gain) test of fourth-grade students of SD Muhammadiyah Jonggol also obtained an average score of 0.70, which can be interpreted as there being an increase in learning outcomes with a high category. The results of the hypothesis test also indicate that there is an influence of the use of Mr. Bilbul's teaching aids on the learning outcomes of integers of fourth-grade students of SD Muhammadiyah Jonggol because a significance value of 0.001 (<0.05) is obtained.

CONCLUSION

The implementation of the Mr Bilbul teaching aids significantly impacted students' mathematics learning outcomes. The average pretest score was 61.93, with a classical completion rate of 19% (5 students) and a classical incomplete rate of 81% (22 students). After the intervention, the average posttest score increased to 87.30. Of the 27 students taught using the Mr Bilbul teaching aids, 24 (89%) achieved scores above the Minimum Completion Minimum (KKM) (≥75), and 3 (25%) achieved scores below the Minimum Completion Minimum (<75). The Mr. Bilbul teaching aids significantly improved students' mathematics learning outcomes, particularly in integers, compared to conventional methods.

The Mr Bilbul teaching aids can be used as a learning medium to enhance student learning outcomes in mathematics. The Mr. Bilbul teaching aids are expected to facilitate a less teacher-centered learning process, enhancing student engagement and making classroom learning more engaging.

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