The Effectiveness Of Interactive Comic Media In Science Courses

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Abstract: An innovative approach that has attracted attention in recent years is the use of interactive media, such as interactive comics, in the teaching of science. This study aims to analyze the effectiveness of interactive comic media for science subjects in fifth grade elementary school. This research belongs to the type of Research and Development (R&D) research with research and development procedures consisting of two stages: media development and media testing. The method used develop and test learning media uses the Borg and Gall model. The product trial design used a pretest posttest control group design on students at SDN 2 Jambu as the experimental class and students at SDN 11 Jambu as the control class. Data were collected by observation, questionnaires, tests, interviews and documentation. The statistical test of effectiveness was carried out with SPSS. Data on the effectiveness of interactive comics learning media were analyzed by gain test, t test at a significance level of 0.05. Learning media developed in the form of interactive comics. The interactive comic was developed based on a needs analysis conducted on fifth grade students and teachers in three elementary schools in the Mlonggo sub-district, Jepara Regency. The use of interactive comics is effective as evidenced by an increase in learning outcomes. The average percentage of prettest in the control and experimental classes is almost the same, namely 30.00 and 30.67. After being given the intervention, the average posttest of the control and experimental classes increased to 50.00 and 74.83. The results of the t test obtained that the value of t count = 8.803 with a significance level of 0.000 < = 0.05. The conclusion obtained is that the development of interactive comic media has proven to be effective for use in learning in the fifth grade of elementary school. It is recommended that teachers use interactive comics in learning because it can improve student learning outcomes.

Keywords: Interactive comics; Learning media; Science.

Introduction

The positive impact of the Covid-19 outbreak is the emergence of awareness from teachers, parents and students related to learning that can not only be done at school (Tondelli et al., 2023). However, learning can also be done anywhere and anytime by utilizing technological developments (Suryadi, 2015). The first positive impact is that teachers become more creative and innovative by using network-based media to develop learning media according to their needs (Sholikhah & Krisnawati, 2019). The second positive impact is that the parents are more concerned with their children by trying to provide android mobile devices to support distance learning (Khamal, 2020). While the third positive impact is that students become more independent by being able to learn independently and be responsible for completing tasks given by the teacher through their Android cellphone (Utari & Astiswijaya, 2022).

So that with the habit of using Android phones and other technology-based media, when the government allows for face-to-face learning activities, the use of technology-based learning media can continue (Nurkamilah & Muthmainnah, 2022). Because every school also has an adequate internet network (wifi) to be

used in network-based learning activities at school. The purpose of using this network-based media is that learning takes place more interesting, fun, and effective, because the media is interactive which can involve student activities according to current student interests (Astuti, 2020; Sayılgan, 2022). This student's interest in learning is expected to be able to become a stimulation or stimulation to increase students' cognitive intelligence. Stimulation is an effort to stimulate children to introduce new knowledge or skills, which very important in increasing children's intelligence Based on the results of observations made to teachers in three elementary schools in Mlonggo District, namely: (1) SD Negeri 2 Jambu, observations were made on Saturday, May 14, 2022, (2) SD Negeri 11 Jambu, observations were made on Monday, May 16 2022, (3) SD Negeri 4 Srobyong, observations were made on Monday, May 16, 2022. The results of observations from three observed elementary schools showed that in learning science in class V theme 1, namely "The Skeleton of Animal Movement Organs", the teacher did not use media learning so that students get bored and find it difficult to understand the subject matter. In addition, the teacher has not made interesting learning media. The media currently owned by schools is also not sufficient. While the material on the Skeleton of Animal Movement Organs contains some material that cannot be exemplified directly, so it requires media that is packaged in an attractive manner but contains several examples that can help students' understanding.

Based on the results of interviews, the teacher presents learning only by lecturing, taking notes and giving assignments. Students just sit listening to the teacher's explanation and the activities that take place in the classroom are monotonous so students feel bored and become passive. As happened in SD Negeri 2 Jambu, Mlonggo District, Jepara. In science learning, teachers still apply less innovative learning. This results in a decrease in student motivation to participate in learning. From the results of interviews with fifth grade teachers at SDN 2 Jambu, data on student learning outcomes from 22 students, only 23% scored above the Minimum Completion Criteria (known with KKM) of 70. Meanwhile, for SDN 11 Jambu with a total of 20 students, only 25% of students completed the KKM. Likewise, at SDN 4 Srobyong, out of a total of 21 students, only 28% of students reached the KKM. Observing the results of interviews with teachers, it is necessary to have learning innovations.

Here the researchers developed interactive comic media to help teach the material for the Skeleton of Animal Movement Organs (Filjinan et al., 2022). Comics are interesting media because they contain images and text in language that is easy for students to understand

(Aditama & Lesmana, 2020). Conversational images and texts can be adapted to the material being taught. Interactive comics can be accessed through Android phones, laptops, and computers (Mulyati et al., 2021).

Interactive comics can be defined as images or symbols that are lined up in a deliberate sequence, which are done entirely using computer assistance (as opposed to comics that are done conventionally, scanned with a scanner, and then colored with a computer) and published digitally (as other forms of the printed version) (Farahiba & Kayati, 2021; Habiddin et al., 2022).

Learning media has a fairly positive impact on learning. Learning media is a tool and must have values that can develop soft and hard skills (Islamiyah & Puapasari, 2021). This is in line with the opinion of (Syamsuri & Md, 2021) that the learning process in schools can be more effective when communication and interaction between teachers and students use a learning media in the form of tools that are physically used to convey information in learning. Media also serves as a tool to motivate students in learning because the use of varied media will encourage students to want to know things related to the media (Baranyi & Molontay, 2021; Satria et al., 2023) . Learning media that must and must be developed by educators in addition to being able to train the level of cognitive thinking and honing the character of students, hopes that they must also consider and involve information and communication technology that is increasingly rapidly and will certainly be a challenge for students. students in the future (Aliriad, Priadana, et al., 2023).

This is in accordance with research conducted by (Filjinan et al., 2022). The test results of interactive comic learning media for environmental preservation based on character values show the average feasibility of material and media experts, teachers, and students. The similarity of this research is the development of interactive comics, the difference is that there is no development of character values in the research that the researchers did. The results of the development (Jannah & Atmojo, 2022) obtained are forms of digital media innovation in empowering 21st century critical thinking skills in science learning in elementary schools, including: digital educational games, videos, youtube, power point, macromedia / adobe flash, interactive comics, ebooks, interactive comics, augmented reality (AR), virtual reality (VR), educational websites, educational TV, and educational applications (teacher room, quipper school, smart classroom). The equation is that they both use digital media in science learning. The difference is that the article is not development research.

The test results (Candrayani & Sujana, n.d.) of interactive comic learning media for environmental

preservation based on character values show the average feasibility of material and media experts, teachers, and students. The similarity is that they both develop interactive comics, the difference in this study is that there is no character development.

Based on this background, it is deemed necessary to use media in the form of interactive comics in learning. Therefore, the researcher conducted a research on the development of learning media with the title "Development of Interactive Comic Media for Science Subjects in Class V Elementary School Students in Mlonggo Jepara District"

Method

This research is a type of development research or R&D (Research and Development). This research produces a product in the form of interactive comic media. This development research uses the Borg and Gall development model which consists of 10 steps (Hamzah, 2021), namely: (1) potential and problem analysis, (2) data collection, (3) product design, (4) design validation, (5) design revisions, (6) initial trials, (7) product revisions, (8) usage trials, (9) product revisions, and (10) mass production. In this study, the research steps were carried out until the 7th step, namely product revision. The research method is carried out through 4 activities, namely: (1) analyzing the needs of learning media, (2) developing learning media, (3) testing the feasibility of learning media, and (4) testing the effectiveness of learning media.

The research design used in this research is research and development or R&D (Research and Development) which serves to validate and develop products. R&D is a method related to product development, through the process of planning, producing and evaluating the validity of the products that have been produced (Darwin et al., 2021). The development model used is the Borg and Gall development model which has been adapted with 10 stages. However, this research only reached Step 7.

Data on the effectiveness of learning media is obtained from improving learning outcomes which show more than 70% of students completed individually with a KKM of 70. After obtaining pretest data from the control and experimental groups, initial data was analyzed. The aim is to find out whether the two classes used in the trial are in the same initial conditions. The analysis includes the normality and similarity tests of two variances (homogeneity test).

According to Salahudin (2017) the normality test aims to determine whether the two groups' test results data are normally distributed. Test the normality of the test results using the Kolmogorov-Smirnov test assisted

by SPSS. The normality test results can be seen in the print out of the analysis results of the Asymp column. Sig. (2-tailed). If the value obtained > 0.05 then Ho is accepted. According to (Sugiyono, 2015), the homogeneity test aims to determine whether the control and experimental classes have the same level of variance. The hypothesis for the homogeneity test is as follows:

Ho : the variance of the control class and the experimental class is the same
Ha : the variance of the control class and the experimental class is not the same

The similarity test of the two variances used Levene's test with the help of SPSS. The homogeneity test results can be seen in the print out of the analysis results for the Sig column. With Levene Statistics. If the results obtained> 0.05 then Ho is accepted. Product development effectiveness test was conducted by experimental class students. Researchers tested the effectiveness of the product using the difference in the results of pretest-posttest. The preparation of pre-test or post-test questions takes into account the level of thinking and is adjusted to the learning objectives. The data analysis technique of the students' pre-test and post-test results used the following methods:
a. Score the answers to each test question according to the question scoring guidelines.
b. Counting the number of answer scores obtained by students.
c. Calculate student scores by using Formula 1:

$$Student\ Score = \frac{Score\ obtained}{(Maximum\ Score)} x\ 100\% \qquad (1)$$

The effectiveness of learning is obtained through data analysis of improving student learning outcomes. The experimental data analyzed were pre-test and post-test data. The pre-test and post-test data from the control group and the experimental group were analyzed using the Normalized Gain or N-gain Formula (Formula 2):

$$N-gain < g > = \frac{Skor\ posttest-Skor\ pretest}{Skor\ maksimum-Skor\ pretest} \qquad (2)$$

The increase in student learning outcomes calculated by the n-gain formula can be divided into the following categories:

Table 3.3 Average Normalized Gain and Classification

Average Normalized Gain	Classification	Effectiveness Level
$\langle g \rangle \geq 0,70$	Tall	Effective
$0,30 \leq \langle g \rangle < 0,70$	Currently	Effective enough
$\langle g \rangle < 0,30$	Low	Less effective

Source: Hake in Zulifah, (2020)

In this study, the analysis using the n-gain formula

was carried out with the help of the SPSS program. Interactive comic media is said to be effective in increasing student learning outcomes if the achievement of increasing student learning outcomes is in the medium category.

After it was known that there was an increase in student learning outcomes in the control and experimental classes. Then a hypothesis test was conducted to determine whether there were differences in the learning outcomes of the control and experimental groups. This is done to determine whether or not the increase in student learning outcomes is significant using the t test. The formula used is to use the t test formula.

According (Aliriad et al., 2023) that, "Hypothesis testing using parametric statistics can be done if the test results show that the required assumptions are met. Hypothesis testing involving two population groups then testing the hypothesis using the t-test (t-test)".

According (Endrawan & Aliriad, 2023) data analysis can also be done with the independent sample t test test assisted by the SPSS program to determine whether there are differences in the learning outcomes of the control and experimental groups following. Whether there is a difference in learning outcomes in the control and experimental groups is indicated by the

Sig value. (2 tails). If the value of Sig. (2-tailed)> = 0.05 then H0 is accepted. On the other hand, if Sig. (2-tailed) < = 0.05 then H1 is accepted. The t test criteria in the pretest data analysis is the value of Sig. (2-tailed)> = 0.05. In the posttest data analysis the criteria is the value of Sig. (2-tailed)< = 0.05. Thus, it can be said that interactive comic media is effective in improving student learning outcomes.

Result and Discussion

Normality test was conducted to determine the normality of the data. The aim is to test whether the two sample data come from a normally distributed population. Normality test was carried out using the Kolmogorov-Smirnov test with the help of SPSS.

The level of significance used is = 0.05. The hypotheses tested are:
H0 : the sample comes from a normally distributed population
H1: the sample does not come from a normally distributed population

The results of the normality test for the control class and the experimental class are presented in Table 1.

Table 1. Normality Test Results for Experiment Class and Control Class

	Classes	Statistic	Kolmogorov-Sirminov[a]			Shapiro-Wilk	
			df	Sig.	Statistic	df	Sig.
Learning Outcomes	Pre Test Eksperiment	.165	22	.123	.950	22	.321
	Post test Eksperiment	.140	22	.200*	.941	22	.205
	Pre test kontrol	.146	20	.200*	.927	20	.137
	Post test kontrol	.178	20	.099	.938	20	.216

The table shows the results of the normality test using the Kolmogorov-Smirnov and. In this test, the data is declared normally distributed if the significance value for both Kolmogorov-Smirnov and Saphiro-Wilk is greater than 0.05.

The results of the data normality test using Kolmogorov-Smirnov showed the significance values for each test for each group were 0.123, 0.200, 0.200, and 0.099. The value is greater than 0.05. The results of the

data normality test using Shapiro-Wilk showed that the significance values for each test for each group were 0.321, 0.205, 0.137, and 0.216, respectively. These values are greater than 0.05. From the two tests, all the results have met the prerequisites, meaning that the data obtained are normally distributed.

The homogeneity test was carried out using the SPSS-assisted Levene test. The results of the homogeneity test can be seen in Table 2.

Table 2. Homogeneity Test Results

		Levene Statistic	df1	df2	Sig.
Learning Outcomes	Based on Mean	.445	1	40	.509
	Based on Median	.569	1	40	.455
	Based on Median and with adjusted df	.569	1	39.904	.455
	Based on trimmed Mean	.499	1	40	.484

The results of the posttest data homogeneity test for the two groups, the control and experimental classes, showed a significance value based on the mean of 0.445

which was greater than 0.05. This shows that the posttest data of the two groups are homogeneous.

The increase in student learning outcomes was analyzed using the normalized Gain average. To determine the outline of the improvement in student learning outcomes, recapitulation of the results of the pretest and posttest experimental class and control class. The average value of the N-Gain of the control group is 0.39 with the N-Gain (%) of the control group is 39. The average value of the N-Gain of the experimental group is 0.74 with the N-Gain (%) 74. These results indicate that the experimental group has N-Gain value with high category.

Independent sample t-test was used to determine the difference in the posttest mean of each test group significantly. A model is said to have a significant average difference if the value of sig (2-tailed) is less than 0.05. The test results can be seen in the following table.

The results of the independent sample t-test were carried out by looking at the value of Equal variances assumed. This is done because the data is homogeneous. The significance value obtained or Sig (2-tailed) is 0.000 < 0.05. This means that there is an average difference between the experimental class posttest and the control class posttest which is significant. These findings are reinforced by the results of the description of the independent sample t-test in Table 3.

Table 3. Statistical Results of Posttest Values for Control Class and Experiment.

	Class	N	Mean	Std. Deviation	Std. Error Mean
Learning Outcomes	Pre Test Eksperiment	22	87.9545	8.26050	1.76115
	Post Test Kontrol	20	74.5000	7.23660	1.61815

The table shows the posttest average of the experimental class 87.95 with a standard deviation of 8,260, and the posttest average of the control class, 74.50, with a standard deviation of 7,236. This proves that there is a significant average difference. That is, learning using developed media is much better.

The criteria for the effectiveness of the media are if the results of the t test for the pretest score have a value of Sig. (2-tailed) > = 0.05; and the criteria for the posttest score were Sig. (2-tailed) < = 0.05. After testing for 2 meetings, a test was conducted to determine the students' posttest learning outcomes. The results of the t test for the posttest score obtained t value = 5.590 with a value of Sig.(2-tailed) 0.000 < = 0.05. This means that there are differences in posttest learning outcomes in the control and experimental classes, namely the posttest learning outcomes in the experimental class are higher than the control class. Thus interactive comics have met the effective criteria (Arifin, 2017:124). So it can be said that interactive comics are effective in improving elementary science learning outcomes.

The effectiveness of learning is measured by increasing student learning outcomes in learning. The increase in student learning outcomes was analyzed using pretest and posttest data in the trial. The mean of pretest learning outcomes for the control and experimental classes are almost the same, namely in the control class 57.95 while in the experimental class 58.25. After the trial was conducted for 2 offline meetings, the average posttest score in the control and experimental groups increased to 74.50 and 87.95.

The students' pretest and posttest learning outcomes were also analyzed using the N-gain test. The results of the N-gain test were obtained in the experimental class with an increase value of 0.74 in the high category, thus learning using interactive comics has met the effective criteria (Sugiyono, 2015).

The t-test was also carried out using the SPSS program to test the differences in learning outcomes in the control and experimental groups before and after the trial. The criteria for the effectiveness of the media are if the results of the t test for the pretest score have a value of Sig. (2-tailed) > = 0.05; and the criteria for the posttest score were Sig. (2-tailed) < = 0.05. After the trial for 2 meetings, a test was conducted to determine the students' posttest learning outcomes. The results of the t-test for the posttest score obtained t-count = 5.590 with a value of Sig.(2-tailed) 0.000 < = 0.05. This means that there are differences in posttest learning outcomes in the control and experimental groups, namely the posttest learning outcomes in the experimental group are higher than the control class. Thus learning using interactive comic media has met the effective criteria (Sugiyono, 2015).

The seventh stage is product revision. Based on the results of student and teacher responses obtained from field trials, they were analyzed to find out the weaknesses of the media developed based on facts in the field. The results of the analysis are then used as revision material to maximize the media, as well as to determine the effectiveness of the media, namely interactive comics. From the data analysis, it was found that the interactive comic product developed was included in the "very feasible" category to be used as a learning medium and to assist in the learning process, especially in science learning material for the Skeleton of Animal Movements. At this stage, there are no weaknesses in the interactive comic media.The development of media in the form of interactive comics that can be accessed using Android phones and PCs of

all types is expected to be able to meet the learning needs of students which can be accessed anywhere and anytime.

The developed media certainly has advantages and disadvantages. The advantages of the interactive comic media developed include learning materials that are made complete, light and easy to understand because the materials are based on facts and conditions in everyday life, equipped with animal skeleton pictures that are rarely found in the surrounding environment and there are learning videos, games and quizzes (Sholikhah & Krisnawati, 2019; Trabelsi et al., 2022). In addition, the operation is easy because it is packaged like an online game that is often played by children. This media can be shared easily because it is web-based, so it can be used by sharing links anywhere. Media can be accessed using all types of Android phones, laptops and PCs that are connected to the internet (Sayılgan, 2023) .Based on the discussion, it can be concluded that the development of interactive comics is proven as needed, feasible and effective in improving science learning outcomes in elementary schools.

Conclusion

The effectiveness of interactive comics media is obtained from the average pretest learning outcomes for the control and experimental classes, namely the pretest in the control class is 57.95 while the experimental class is 58.25. After testing for 2 meetings offline, the average posttest score in the control and experimental groups increased to 74.50 and 87.95. The increase in the average learning outcomes in the experimental group is greater so that it can be said that interactive comic media is effective in improving elementary science learning outcomes.

Conflicts of Interest
The authors declare that they have no competition.

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