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Canva-based E-comic on the Dangers of Plastic Waste Environment as Learning Media for IPAS Effectively Improve Learning Outcomes

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Abstract: The decline in IPAS learning outcomes and focus on the material on the dangers of plastic waste is indicated by the unawareness of disposing of waste in its place. The purpose of this study was to develop Canva-based E-comics on the material of the Dangers of Plastic Waste for the Environment as an Effective IPAS Learning Media to Improve Learning Outcomes. The subjects used were fifth grade students of SDN Ngijo 01 Semarang. The method used is development research with the ADDIE model. Data collection used interviews, observations, tests, and questionnaires. Data analysis used descriptive and inferential statistical techniques. Development through five stages namely analysis, design, development, implementation, and evaluation. The results of media feasibility included a feasible category based on the assessment of material experts, media experts, linguists, and teacher and student response questionnaires. The effectiveness of e-comic is in the effective category to be used based on the increase in student learning outcomes after using this media. The conclusion is that the Canva-based e-comic media developed is valid, feasible, and effective in the teaching and learning process of the material on the dangers of plastic waste in IPAS subjects.

Keywords: Canva; E-comic; IPAS; Learning media; Plastic waste

Introduction

According to the minderoo philanthropic foundation in the plastic waste maker index shows that the world produced 139 million metric tons of single-use plastic waste in 2021 or 6 million metric tons more than in 2019 (Whiteman, 2023). The same thing is also seen from the Nusantara River Affairs Research Agency Census data in 2023, the input results from 64 points in 28 districts / cities in Indonesia there were 25,733 plastic waste found (Riski, 2024). From these data, it is known that Indonesia still produces a lot of plastic waste which results in various new problems such as flooding and disruption of human health. Plastic waste management by the Indonesian government is still lacking. Most Indonesians believe that they live in a "throwaway" "culture" and their food and beverage packaging is made of plastic (Jing, 2020). Waste is a major problem in Indonesian society, because large amounts of waste have a negative impact on both the environment and public health according to Apriyani in (Islamiyah et al., 2022).

The data obtained from observations conducted in the fifth grade of Ngijo 01 Semarang State Elementary School indicate a significant correlation between the lack of awareness regarding the disposal of plastic waste and the low academic performance of students on the subject of the dangers of plastic waste as outlined in the IPAS map. It is recommended that researchers conduct preliminary research through interviews with students and teachers. The results of the interviews with the students and teachers revealed that the students were disengaged from the learning process and that the

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conventional approach to teaching, with its limited use of flexible learning materials, contributed to a lack of interest and focus among the students, ultimately leading to a decline in their academic performance.

The most effective method for addressing environmental issues is to educate individuals who possess an awareness and sensitivity to the environment and the requisite knowledge to cultivate a constructive attitude towards these concerns (Avan et al., 2011). The act of learning is not merely the memorization of facts and figures; rather, it is the construction of knowledge. Moreover, educators must identify and reflect on instances of effective science learning, both from their own practice and that of their students (Wardani et al., 2023). It is therefore recommended that teachers employ a variety of materials, activities, and methods to teach scientific process skills to students from an early age (İsiker & Emre, 2020). Education represents the most valuable investment in terms of enhancing knowledge, abilities, attitudes, and values in order to adapt to the environment (Widiansyah, 2018). Environmental education materials are incorporated into the IPAS curriculum. The IPAS curriculum is a synthesis of natural and social sciences, reflecting the view that elementary school students perceive the world as a unified and integrated entity (Purnawanto, 2022). The IPAS subjects are particularly well-suited to the teaching of environmental hygiene and the dangers of plastic waste to the natural environment and human behavior.

The subject of environmental material is inherently complex, given its intrinsic relationship with the surrounding environment. To fully comprehend this material, it is necessary to develop electronic teaching materials that not only encompass learning material but also facilitate a comprehensive understanding of the subject matter (Maria & Paidi, 2024). Educators may utilize media to enhance the efficacy of the learning process. The advancement of media in the pedagogical context is of great importance for the effective conveyance of messages during the learning process (Aulia et al., 2022). Learning media serves five distinct functions: as a tool, as a learning resource, to capture students' attention, to accelerate the teaching and learning process, and to enhance the quality of learning (Syah, 2007). In essence, the use of media has the potential to enhance the efficacy of learning activities while reducing the consumption of energy, time, and resources (Junaidi, 2019).

The media plays an instrumental role in the dissemination of information, which can be utilized to educate the public about the detrimental effects of plastic waste and the necessity of implementing more efficacious waste disposal practices. Furthermore, the utilization of multimedia in an educational context must take into account the developmental characteristics of the learners. The utilization of effective multimedia in an elementary school setting is contingent upon alignment with the specific stage of student development. In general, the behavior of elementary school children is still characterized by high levels of activity, positive affect, and a desire to engage in novel experiences. It is therefore crucial to incorporate multimedia innovations with a plethora of images and colors into science learning at the basic education level (Amali et al., 2023). This is because elementary school students are the generation that will bring about change in the future. Therefore, it is of paramount importance to foster their character development in accordance with government guidelines (Sulfadli & Supartinah, 2023). One of the most effective digital learning media currently in use is e-comic learning media. Comic media may be employed as an alternative learning medium when educators encounter challenges in providing direct learning experiences to their students (Handayani et al., 2024).

A comic is generally defined Electronic comics are digital publications comprising text and digital images, which can be accessed via electronic devices such as mobile phones, laptops, and computers. This format facilitates convenient access to the content for both students and educators. E-comics are digital publications that do not require paper, thus representing a more environmentally friendly option. E-comics possess a number of advantages, including the capacity to incorporate audio, which facilitates understanding through audio-visual techniques that simultaneously stimulate the senses of sight and hearing (Gunawan, 2022).

The implementation of digital learning media has been demonstrated to positively influence student learning outcomes (Afifa & Astuti, 2024). Similarly, e-comic media is a form of digital media that has been demonstrated to enhance student learning outcomes. Student attention can be captured through the use of educational practices that address environmental issues that are relevant to the students themselves or to their local communities. Additionally, practices that address other pertinent issues can also be employed (Simsekli, 2015). In other words, learning media materials are tailored to align with the daily activities of students. The utilization of digital comic media by educators at Ngijo 01 Semarang Elementary School has yet to be implemented. The advancement of digital comics is in accordance with the prevailing trends in the field of education (Eva et al., 2020). The combination of the advantages of comics with technological developments in the 21st century, adapted to the characteristics of elementary school students, results in an innovative and

creative learning medium that is well received by students.

Canva platform is one of the applications that emerged in the context of the rapid developments in the field of technology (Irsan et al., 2021). Canva can be utilized as a tool for developing electronic comics due to its innovative features in creating educational material about the environmental impact of plastic waste.

Previous research indicates that digital comics have a positive impact on student learning outcomes, are a viable educational tool, and foster positive character development (Indriyani et al., 2024; Ramadhayani et al., 2022; Rizqi & Zumrotun, 2023; Maghfiroh et al., 2023; Pinatih, 2021; Rosidah, 2022).

The objective of the research study was to develop an e-comic on the dangers of plastic waste to the environment as an effective IPAS learning medium to enhance learning outcomes. This research represents a novel contribution to the field of study, offering a fresh perspective on the subject matter. The objective of this research is to develop e-comic media, evaluate its feasibility, and assess its efficacy as a learning medium. This research is distinguished from previous studies by the products developed, the tools utilized for product development, the research samples, and the learning media materials.

Method

Research Methods, Model, Time, and Subject

The method used was development research with a sample of fifth grade students of Ngijo 01 Semarang State Elementary School. The research was conducted from January 2024 to May 2024. ADDIE is a model that generally has five stages analysis, design, development, implementation, and evaluation (Hidayat & Nizar, 2021).

Field Research and Data Collection Techniques

In the analysis stage, the activities carried out are identifying problems in the field, determining initial product planning as an answer to the problems that have been identified, and determining the product to be developed. Data was collected through observations, interviews, tests, and questionnaires. The analysis stage is carried out to understand the curriculum, needs, student characteristics, and existing technology at school (Dewi & Setyasto, 2024).

The second stage of the design process involves the creation of media designs in accordance with the material, as well as the development of research instruments, including research grids, learning devices, validator instruments, pretest and posttest questions, and teacher and student response instruments.

ADDIE requires expert input, so the material is revised based on expert opinions, suggestions, and input before field testing (Yulia et al., 2023). The third stage of this process is the realization of the product design which is then validated by a panel of experts consisting of material experts, media experts, and language experts. After that, a small group trial was conducted. The results of the assessment conducted by the validators were then analyzed and revised in accordance with the recommendations given.

The fourth stage, implementation, entails the administration of large-group trials in accordance with the actual conditions that would be encountered in a classroom setting. The learning media is employed in accordance with its function in the teaching and learning activities.

The fifth stage of the process is the evaluation of the activities that have been carried out. This stage is concerned with measuring the extent to which the objectives of the development research have been achieved. The evaluation was conducted by the research team through questionnaires to teachers and students after the use of e-comic media. Evaluation is actually not seen as the last stage, but is applied to all stages of the teaching process. Deficiencies and errors are replaced, updated and renewed (Palabiyik & Oral, 2023).

Data Analysis

Data analysis consists of three tests conducted on pretest and posttest scores. The three tests are normality test, t-test, and N-Gain test. The data in the analysis results are presented in Microsoft Excel 2021.

Result and Discussion

Result

Analysis

Canva-based e-comic media in its development is designed according to student needs. The media used in learning IPAS material on the dangers of plastic waste tends to be less innovative and flexible in its use. The impact is minimal student enthusiasm for teaching and learning activities. In this case, researchers see that Canva-based e-comic media can be an innovative, flexible and able to attract student interest in the teaching and learning process in the classroom. Comics can be entertainment as well as a medium for teaching science (Purwanto & Yuliani, 2013). Through Canva-based e-comic media, students can also add new insights for students.

The educational material developed contains information regarding the detrimental impact of plastic waste on the environment, as outlined in IPAS Chapter 8 Topic B for grade V SD. The development of e-comic media is also guided by the identified needs of both

teachers and students, as ascertained through the administration of a questionnaire. The results of the teacher need questionnaire indicated that there were still difficulties in teaching the material on the dangers of plastic waste to the environment. Teachers have indicated a need for innovation in the learning media employed, with the objective of facilitating student comprehension of the material.

The teacher agreed to the existence of Canva-based E-comic media which contains supporting images, colors, and animations that attract students. The teacher suggested that the e-comic media be equipped with character voices to make it easier for students to feel the emotions of the characters. In line with that, the results of the student needs questionnaire also show that students are interested in IPAS learning but have difficulty with the material on the dangers of plastic waste. Students need efficient and interesting learning media to support the learning process of IPAS material on the dangers of plastic waste.

Design

In the media design stage, the first activity carried out is to select media that is tailored to the results of the analysis of teacher needs, student needs, material, learning objectives, and problems in the field. The second activity is designing media drafts. The third activity is to develop a prototype by combining media designs into one complete e-comic product. The last activity at the design stage is the preparation of research instruments in the form of grids.

At this stage, the preparation of learning tools is also undertaken. These include teaching modules and student worksheets that are tailored to the material on the dangers of plastic waste to the environment. The content of these learning tools explains the types of waste, as well as the impact of plastic waste on the habitat of living things in the natural environment. Moreover, the validation process involves the input of three experts, namely linguists, material experts, and media experts, who provide their insights and assessments.

The pretest and posttest question instruments, comprising 25 multiple-choice questions, were also developed following the review of a number of test items. The final instrument is a questionnaire designed to elicit responses from teachers and students regarding their perceptions of e-comic media products. The e-comic design incorporates a narrative that is closely aligned with the lived experiences of students, featuring a cast of characters who facilitate comprehension through discourse. This e-comic is entitled Kopeling, an acronym that denotes "environmental care comics."

Development

The objective of this stage is to validate and demonstrate the efficacy of Canva-based e-comic media as a pedagogical tool in the teaching and learning process. The researchers proceeded to divide the process into three discrete activities. The initial activity entails the development of media through the creation of e-comic designs within the Canva application, leveraging the available elements within the application. The presentation comprises 29 slides, including one for the home page, one for the cover page, two for the information page, one for the developer's profile, one for the bibliography, one for the glossary, and 22 for character conversations containing material on the dangers of plastic waste.

Figure 1. Home page

Figure 2. Comic material page

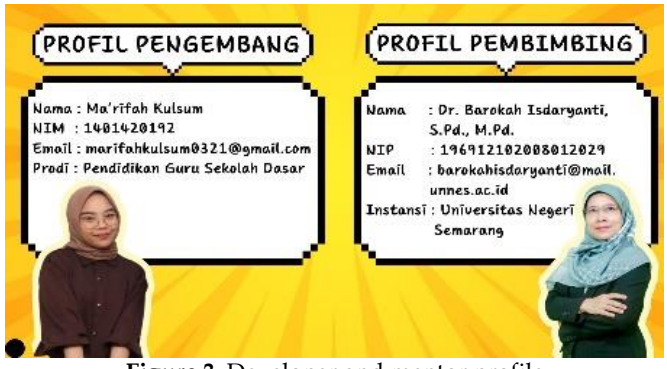

Figure 3. Developer and mentor profile

In their research, scholars utilize the public display link menu on Canva to facilitate convenient access for educators and students, whether via cellular device or laptop computer. It may also be accessed via the following link: https://www.canva.com/design/DAGHu_YS-F8/jLgJ9fLbVbY0wY4ac9ZUyA/view?utm_content=DAGHu_YS-F8&utm_campaign=designshare&utm_medium=link&utm_source=editor

The second activity, product validation by experts to determine the feasibility of the product, is carried out by linguists, material experts, and media experts. The assessment of e-comic media based on Canva is conducted in accordance with a number of criteria.

Table 1. Recapitulation of Expert Assessment

Parameters	Material Expert	Media Expert	Linguists
Score Obtained	56	75	17
Maximum Score	60	80	20
Percentage	93.3%	93.7%	85%
Criteria	Very Feasible	Very Feasible	Very Feasible

The assessment conducted by material experts, media experts, and linguists indicates that the Canva-based e-comic media, which has been developed, exhibits highly feasible criteria, with a percentage of 93.3%, 93.7%, and 85%, respectively.

The third activity was a small group trial. A total of six fifth-grade students were selected through the use of a purposive sampling technique to participate in small group trials. The purposive sampling technique is a method used to select a sample that meets specific criteria (Sugiyono, 2013). The study considers students with the two highest ranks, the two lowest, and two students with intermediate ranks. The objective of the preliminary trial is to ascertain the viability of the product prior to its formal evaluation. The students commence with the pretest, after which they engage in the learning process with the assistance of Canva-based e-comic media that presents material on the adverse effects of plastic waste on the environment. Subsequently, the students are presented with the posttest questions. The results of the small group trial indicated a 66.67% increase in learning outcomes.

Following the completion of a series in lessons, students were invited to complete a response questionnaire, the aim of which was to ascertain their views on the product in question. The feasibility of the Canva-based e-comic media was determined to be 85%. In addition to the students, a response questionnaire regarding Canva-based e-comic media was also completed by the educator in the context of small group trials. The results indicated that Canva-based e-comic media is highly feasible, with a percentage of 90%.

Implementation

The fourth stage is implementation. Here, the efficacy of Canva-based e-comic media is evaluated in large-scale trials. The implementation was conducted on May 15-16, 2024. The Canva-based e-comic media was implemented on 22 grade V students through a pre-experimental design, employing the one-group pretest-posttest design model.

The initial trial of e-comic media with a large group of students commenced with the completion of a pretest by the students, followed by the implementation of two e-comic-based Canva learning sessions. Each student accessed the media via their personal mobile device, with the e-comic also displayed on an LCD projector. Upon completion of the learning series, students were tasked with completing a posttest and providing feedback via an evaluation questionnaire.

The One-Group Pretest-Posttest Design model enables the effect of treatment to be determined by comparing the posttest value with the pretest. The pretest value is derived from student learning outcomes in the absence of e-comic media products, whereas the posttest value is obtained from student learning outcomes involving the use of e-comic media products.

Table 2. Student Work Results

Description	Pretest	Posttest
Student Count	22	22
Average	47.81	71.81
Criteria for Achieving Learning Goals	70	70
Highest Score	64	88
Lowest Score	28	56
Completed Students	0	17
Incomplete Students	22	5
Average Completeness	0%	77.27%
Average Increase		77.27%

The mean increase in student learning outcomes in the large group trial was 77.27%. This increase provides evidence that Canva-based e-comic media has an impact on learning outcomes. The responses of students in the large group to the Canva-based e-comic media were markedly positive, with a high proportion of favourable qualifications (86.81%). Furthermore, the instructor's response to the Canva-based e-comic media in the large group trial was also included in the very feasible qualification, with a percentage of 95%.

Evaluation

The evaluation stage is conducted with the objective of assessing each phase of the aforementioned four stages in order to reduce errors and enhance the

quality of Canva-based e-comic media. The objective is to assess the success of Canva-based e-comic media and ascertain its efficacy. It is essential to conduct a comprehensive analysis of the data in order to ascertain the efficacy of the media in question. The data analyzed are the results of pretest scores obtained prior to the use of the media and posttest scores obtained subsequent to the use of the media.

The data analysis encompasses two stages: an initial data analysis in the form of a normality test, and a final data test using a t-test and an n-gain test. The initial data analysis, comprising pretest and posttest normality tests, was calculated using the Liliefors formula with the aid of Microsoft Excel 2021 software. The purpose of the normality test is to determine whether the learning outcomes of fifth grade students at Ngijo 01 State Elementary School are normally distributed or not.

Table 3. Normality Test Results

Action	Lo	Lt	(α)	n	Criteria
Pretest	0.167745	0.1888958	0.05	22	Normal
Posttest	0.1155064	0.1888958	0.05	22	Normal

In the large group learning outcomes, the largest absolute price value (Lo) is 0.167745 in the pretest and 0.1155064 in the posttest. It is known that the critical value of L for sample (n) = 22 and the significance level (α) which is 0.05 is 0.1888958, so that the pretest value Lo (0.167745) < Lt (0.1888958) and the posttest value Lo (0.1155064) < Lt (0.1888958). Lo is smaller than Lt, so the data is normally distributed, so then use parametric statistical calculations (t test).

The t test was conducted with the following hypotheses: (1) Ho = There is no effect of E-comic media on the material of the dangers of plastic waste in IPAS subject on the learning outcomes of fifth grade students of Ngijo 01 Semarang State Elementary School; (2) Ha = There is an effect of E-comic media on the material of the dangers of plastic waste in IPAS subject on the learning outcomes of fifth grade students of Ngijo 01 Semarang State Elementary School. The criteria for testing the average difference is if *t* count < *t tab*le then Ho is accepted, and if *t* count > *t tab*le then H0 is rejected. And if calculated based on significance, if *Sig*. count > 0.05 then Ho is accepted and if *Sig*count < 0.05 then Ha is accepted.

Table 4. t Test Results

Data	Pretest & Posttest
(α)	0,05
Sig. count	0,00000004
t table	2,07961384
t count	8,31639304
Explanation	Ha is accepted (there is an influence)

The t test results in the large group obtained t count (8,31639304) > t table (2,07961384). And if calculated based on significance, Sig. count (0.00000004) < 0.05, then Ha is accepted, so there is a significant effect.

The second final data analysis is the average increase test or N-Gain Test. The N-Gain test was conducted to determine the average increase in learning outcomes after using Canva-based e-comic learning media. The high category is obtained if the n-gain value obtained is more than 0.7; medium if more than 0.3 and less than 0.7; and low if less than 0.3.

Table 5. N-Gain Test Results

Pretest Average	Posttest Average	Score Max	Average Difference	N-Gain Value
47.818	72.545	100	24.727	0.45070734 (Medium)

The results of the N-gain test of pretest and posttest scores in the large group trial showed that the average increase in pretest and posttest was 0.45070734 with medium criteria.

The second final data analysis is the average improvement test, also known as the N-Gain test. The N-Gain test is a widely utilized method for assessing the efficacy of an educational intervention in enhancing learner outcomes. This method provides a robust basis for assessing the extent to which a learning program has contributed to students' comprehension. An n-gain value exceeding 0.7 is indicative of a high category, while a value between 0.3 and 0.7 denotes a medium category, and a value below 0.3 signifies a low category (Sukarelawan et al., 2024).

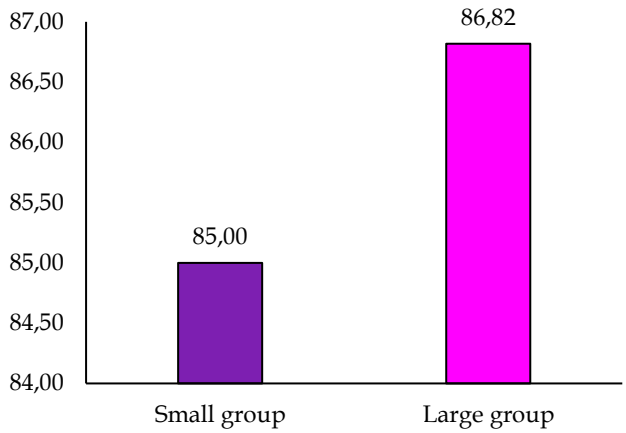

Figure 4. Student response diagram

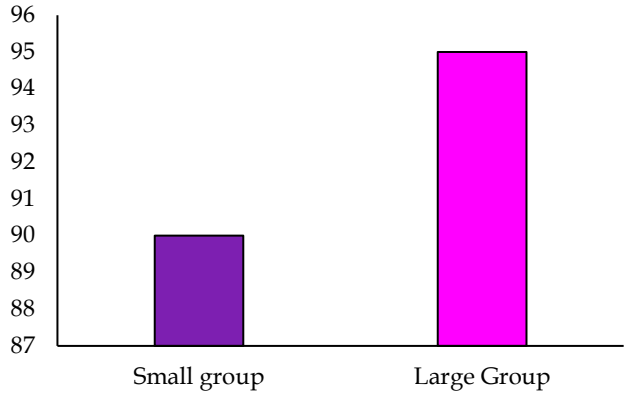

Figure 5. Teacher Response Diagram

Discussion

The results indicated that the use of Canva-based e-comic media in the teaching and learning process was effective in improving student learning outcomes. This is undoubtedly linked to the content of the Canva-based e-comic media, which is closely aligned with students' daily lives, particularly in relation to plastic waste. The Canva-based e-comic was developed based on an analysis of the needs of teachers and students, which were refined with existing situations and conditions. The feasibility and effectiveness of the media are determined through assessments from various parties, including material experts, media experts, linguists, teachers, and students.

The feasibility of the media can be determined through the assessment of the media by experts. The assessment of the media was conducted by three experts: material experts, media experts, and linguists. They employed an instrument in the form of a rating scale. The material validation assessment yielded a score of 56, with a maximum score of 60. The percentage obtained was 93.33%, indicating that the project is highly feasible. In contrast, the media validation assessment yielded a score of 75, with a maximum score of 80. The percentage obtained was 93.75%, indicating a very feasible category. The final score for the language validation assessment was 17, with a maximum score of 20. The resulting percentage was 85%, indicating a very feasible category.

The feasibility of the media is also supported by the results of student and teacher responses after testing the product in the field. In the small group trial, the number of student response scores obtained was 51 out of a maximum score of 60, representing a percentage of 85% with very feasible criteria. Subsequently, the results of the teacher response questionnaire in the small group trial yielded a score of 36 out of a maximum score of 40, corresponding to a percentage of 90% with very feasible criteria. The results of the questionnaire administered to students in the large group trial yielded a total of 191 student response scores, with a maximum possible score of 220. This represents a percentage of 86.81%, which is within the range of scores that can be considered to be very feasible. In the large group trial, the results of the teacher response questionnaire achieved a score of 57 out of a maximum score of 60, with a percentage of 95% and highly feasible criteria. The assessment of the three experts, as well as the teacher and student response questionnaires in both large and small group trials, indicate that the Canva-based e-comic media is suitable for use.

The effectiveness of e-comic learning media based on the Canva platform is contingent upon the achievement of student learning outcomes. The Canva-based e-comic media was employed in the context of two meetings. Student learning outcomes in the cognitive domain are obtained from the results of the pretest and posttest scores. The results of the pretest indicated that none of the students (0%) had completed the task, while 22 students (100%) had not. Of the students who completed the posttest, 17 (77.27%) did so, while 5 (22.72%) did not. The mean score increased by 77.2% between the pre- and post-test periods. The value is calculated in accordance with the KKTP (Criteria for Achieving Learning Objectives) of the IPAS lesson content. These results indicate a positive change in students and a successful outcome of the learning process.

To ascertain the effectiveness of Canva-based e-comic media, researchers employed the t-test to calculate pretest and posttest scores. The normality test was conducted using the Liliefors formula in Microsoft Excel 2021 software. The pretest values were found to be less than the lower limit (Lo) of 0.1775 and greater than the upper limit (Lt) of 0.319. Similarly, the posttest values were less than the lower limit (Lo) of 0.20678 and greater than the upper limit (Lt) of 0.319. This indicates that the hypothesis is accepted, or that the data is normally distributed. The data indicates that the pretest and posttest scores on the trial were normally distributed. Therefore, the calculation of learning outcomes in this study was conducted using parametric statistical techniques (t-test). The results of the t test calculation obtained $t$count > $ttab$le. With the results (8.31639304 > 2.07961384) or (0.00000004 < 0.05). Indicates that Ho is rejected and Ha is accepted So there is a significant difference in student learning outcomes between before and after the teaching and learning process with e-comic media.

The mean increase in student learning outcomes was calculated using the N-gain formula. The mean difference between the pretest and posttest scores in the trial was 0.45070734, which falls within the moderate category, as it is greater than 0.3 but less than 0.7. The results of the data analysis indicate that the Canva-based

e-comic on the dangers of plastic waste to the environment of the IPAS map is a feasible and effective tool for use in the learning process to improve the learning outcomes of fifth grade students at Sekolah Dasar Negeri Ngijo 01 Semarang.

Conclusion

The Canva-based e-comic media developed proved to be feasible to use in the teaching and learning process and effective in improving student learning outcomes in the fifth grade of Ngijo 01 Semarang State Elementary School through the ADDIE stages of analysis, design, development, implementation, and evaluation. The feasibility of Canva-based e-comic media is supported by the assessment results of material experts 93.33%; media experts 93.75%; and linguists 85% which are included in the very feasible category. The responses of students and teachers after using the media were also very positive with a percentage of 86.81% by students and 95% by teachers with very feasible criteria. The effectiveness of Canva-based e-comic media on student learning outcomes is evidenced by the results of students' pretests and posttests which increased the average score by 77.2%. The normality test shows that the data of students' pretest and posttest scores are normally distributed. The results of the t-test also showed a significant difference in student learning outcomes. The N-Gain test states that the average increase in student learning outcomes is in the moderate category. From this data, it can be concluded that the Canva-based e-comic media developed is valid, feasible, and effective in the teaching and learning process of the material on the dangers of plastic waste in the IPAS subject.

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All authors have made a significant contribution to the development of this scientific work. The first author was responsible for conducting the research and preparing the scientific work. The second author provided guidance, direction, and advice throughout the research and preparation of the scientific work. The authors collaborated with one another at each stage of the research process in accordance with the established procedures.

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