Mimbar PGSD Undiksha
Volume 12, Number 1, Tahun 2024, pp. 163-174
P-ISSN : 2614-4727, E-ISSN : 2614-4735
Open Access: https://doi.org/10.23887/jjpgsd.v12i1.72757

Ethnoscience-based Digital Comic on Plant Material for Grade IV Elementary School Students

Dita Aminatur Rofiqoh[1]*, Siti Maryatul Kiptiyah[2]

[1,2]Elementary School Teacher Education, Semarang State University, Semarang, Indonesia

ARTICLE INFO

Article history:
Received December 12, 2023
Accepted March 21, 2024
Available Online April 25, 2024

Kata Kunci:
Etnosains, Komik Digital, Media Pembelajaran, Tumbuhan

Keywords:
Ethnoscience, Digital Comic, Learning Medium, Plant

ABSTRAK

Minimnya penggunaan media pembelajaran yang inovatif di sekolah terutama pada jenjang SD, padahal pada jenjang SD siswa sedang sangat membutuhkan bantuan media pembelajaran untuk memahami materi yang disampaikan oleh guru. Termasuk dalam materi Tumbuhan pada mata pelajaran IPAS kelas IV. Tujuan dari penelitian ini adalah untuk mengembangkan media pembelajaran komik digital bernuansa etnosains pada materi tumbuhan. Pengembangan ini menggunakan model ADDE. Subjek dari penelitian ini adalah 1 orang ahli materi, 1 orang ahli media pembelajaran, 1 orang praktisi yaitu guru. Subjek uji coba yaitu 28 siswa kelas IV. Metode pengumpulan data yaitu obervasi, wawancara, kuesioner, dan tes. Instrumen pengumpulan data berupa lembar kuesioner dan soal tes. Teknik analisis data yang digunakan yaitu analisis deskriptif kualitatif, kuantitatif, dan statitik inferensial. Hasil penelitian yaitu hasil uji validitas media komik digital berdasarkan penilaian dari ahli materi dan media didukung oleh tanggapan guru dan siswa menunjukkan bahwa nilai validitas media sangat tinggi dan layak dengan rata-rata nilai persentase 92%. Hasil uji keefektifan penggunaan media komik digital menunjukkan bahwa media tersebut efektif. Hasil uji T-test menunjukkan bahwa terdapat perbedaan signifikan hasil belajar siswa dari sebelum dan sesudah penggunaan media. Disimpulkan bahwa media pembelajaran komik digital bernuansa etnosains pada materi tumbuhan layak digunakan dan efektif meningkatkan hasil belajar siswa.

ABSTRACT

There is minimal use of innovative learning media in schools, especially at the elementary school level, even though students need help with learning media to understand the material presented by the teacher. Included in Plant material in class IV science subjects. The aim of this research is to develop digital comic learning media with ethnoscience nuances using plant materials. This development uses the ADDE model. The subjects of this research were 1 material expert, 1 learning media expert, 1 practitioner, namely the teacher. The test subjects were 28 class IV students. Data collection methods are observation, interviews, questionnaires and tests. The data collection instruments are in the form of questionnaires and test questions. The data analysis techniques are qualitative descriptive analysis, quantitative and inferential statistics. The results of the research, namely the results of the validity test of digital comic media based on assessments from material and media experts supported by teacher and student responses, show that the validity value of the press is very high and feasible, with an average percentage value of 92%. The effectiveness test results using digital comic press show that the media is effective. The results of the T-test show that there is a significant difference in student learning outcomes before and after media use. It was concluded that digital comic learning media with ethnoscience nuances based on plant material is suitable for use and is effective in improving student learning outcomes.

1. INTRODUCTION

The important components of learning are teachers, students, objectives, methods, materials, media and learning evaluation. These components are mutually sustainable and related to achieving the expected learning outcomes (Agustiana et al., 2020; Esi Febrina & Mukhidin, 2019; Mahardika & Siswoyo, 2021). Learning can be interpreted as an effort to create a good environmental system to optimize the learning process (Nemeth et al., 2019; Prihatin et al., 2018; Shishigu et al., 2018). Therefore, in learning activities it is necessary to pay attention to the components contained in it. One important component in

Corresponding author
*E-mail addresses: isnadifans@students.unnes.ac.id (Dita Aminatur Rofiqoh)

learning activities is media. Media plays an important role in delivering material in learning activities, namely as an intermediary between teachers and students (Hasanah et al., 2019; Saripudin et al., 2018; Suwiantini et al., 2021). Learning media is one of the elements that must be present in the learning implementation plan. Media can be said to be a tool in the learning process that functions as a means of conveying material. Other research also reveals that learning media is anything that can be used to convey messages or information in the learning process so that it can stimulate students' attention and interest in learning (Basak et al., 2018; Hanafi et al., 2021; Ibrahim et al., 2023). Therefore, the media used in learning must be appropriate. This is due to the use of appropriate learning media, the material delivered by the teacher will be conveyed and received well by students (Hidayati et al., 2020; Satria & Herumurti, 2021). This can realize the achievement of goals in learning. However, when the media used is inappropriate, it is not impossible that the learning objectives will never be achieved.

Based on the explanation above, it can be seen that learning media is an important element that must be present in learning activities. However, in reality there are still many schools in Indonesia, one of which is at the elementary school level, which do not pay much attention to the media that will be used in learning activities (Janah et al., 2019; Sumanto & Sadewo, 2021; Wati et al., 2021). This can certainly interfere with achieving the expected learning objectives (Fahyuni et al., 2020; Hasanah et al., 2019; Mariyah et al., 2021; Saripudin et al., 2018; Suwiantini et al., 2021). Apart from that, the problem that is often found today is that there are still many teachers who have difficulty developing learning media. Previous research findings also state that current learning activities are less interesting due to the lack of learning media that facilitates students in learning (Masturah et al., 2018; Widiarti et al., 2021). Previous research also revealed that teachers have difficulty developing learning media, which has an impact on students' lack of motivation in learning (Diah Purnami Dewi et al., 2022; Jerry Radita Ponza et al., 2018). Other research also confirms that a lack of learning media can affect student learning outcomes (Juniari & Putra, 2021; Wulandari & Wiarta, 2022). The choice of media for learning activities must be considered carefully, and requires several considerations.

This problem was also found in one elementary school. Based on the results of observations, interviews and distribution of questionnaires conducted in class IV of SD MII Kebumen, Tersono District, Batang Regency, Central Java, several problems were found. Based on the results of observations, in class IV MII Kebumen it is known that learning in this class still uses less interesting media. The media used in class IV learning are printed books which contain more writing than pictures. This makes fourth grade students bored and not interested in studying printed books. This condition was proven when the fourth grade teacher gave instructions to students to read the printed science textbook, only a few students actually read the book while the majority of students only looked at the pictures and only read the first few paragraphs.

Based on these problems, the solution offered is to develop innovative media that can help students learn. The use of media in the learning process is direct experience (enactive), image experience (iconic) and abstract experience (symbolic). Students will understand better when teachers use real media to explain learning compared to teachers only explaining or through abstract experiences (Kurniawan et al., 2020; Masturah et al., 2018; Roemintoyo et al., 2022). The use of media is also supported by previous research findings that the achievement of learning outcomes will be successful if the right learning media is used (NMD Handayani et al., 2017; Kusuma et al., 2021; Suharsiwi et al., 2022). Obtaining learning outcomes with the sense of sight is around 75%, then with the sense of hearing around 13%, and with other senses around 12%. One of the basic theories that is often used is Dale's theory, namely Dale's Cone of Experience (Nursyaida & Hardiyanti, 2020).Teachers must be able to develop learning materials taught creatively. The ability to develop material creatively can be proven by using unique and interesting learning media.

In choosing the right media for students, a questionnaire on learning media needs was distributed to fourth grade elementary school students. The results of the questionnaire were that the majority of class IV students answered that they preferred learning media that contained more images. Students said that the learning media used previously was less interesting because it contained text with minimal images. This causes them to lose motivation in learning. Therefore, the right media to develop is digital comic media. The selection of comic media as a learning medium for class IV MII Kebumen students is not only based on observations, interviews and distribution of questionnaires, but is also based on several existing principles in selecting media, namely efficiency, relevance and productivity (Sukmanasa et al., 2017; Zahwa & Syafi'i, 2022). Media selection criteria include suitability, level of difficulty, cost, availability, and technical quality (Hidayah et al., 2017; Wijaya et al., 2020; Zahwa & Syafi'i, 2022). Based on these criteria, the comic has met these criteria.Digital comics can be used as learning media (Dewi, 2019; Syahmi et al., 2022). This is because students in the 6-12 year age range, where fourth grade students are also in that age range, tend to be more interested in books that are dominated by interesting

pictures. Digital comics are also a medium that can be used to convey material clearly (Azizul et al., 2020; Supartayasa & Wibawa, 2022). This is because comic media contains images, making it easier for students to understand the material through images(Astutik et al., 2021; Hidayah et al., 2017; Pinatih & Putra, 2021; Wijaya et al., 2020; Zahwa & Syafi'i, 2022).

The comic media that will be developed also uses a learning approach, namely an ethnoscience approach. Ethnoscience has the meaning of combining culture with science(Damayanti et al., 2017; Utari et al., 2021; Wibowo & Ariyatun, 2020). The choice to use this approach was based on various expert opinions, namely that the appropriate approach to be applied in Indonesian education today is Ethnoscience. Ethnoscience contains original knowledge in the form of language, customs and culture, morals and technology created by certain groups of people or people that contain scientific knowledge (Nisa et al., 2015; Puspasari et al., 2020; Rahayu & Sudarmin, 2015). This is in line with research which states that learning processes based on culture or cultural realization provide opportunities for students to create meaning and sharpen students' understanding of the material they study (Resterina et al., 2020; NP Sari et al., 2020; Winangun, 2020). Therefore, with the existence of interesting learning media, in this case, comics with ethnoscience nuances, it is hoped that it can motivate students in learning and make learning more meaningful.

Previous research findings stated that the use of digital comic media can increase students' enthusiasm for learning so that it is suitable for use in learning (Angga et al., 2020; T. Handayani, 2021). Previous research also confirms that the use of comics can improve student learning outcomes (Hobri et al., 2019; Rahmata et al., 2020; Siregar et al., 2019). Other research also states that the ethnoscience approach can help students learn (Nisa et al., 2015; Puspasari et al., 2020; Rahayu & Sudarmin, 2015). Based on this, it can be concluded that the use of Ethnoscience digital comic media can help students learn. The advantage of using Ethnoscience digital comic media is that the digital comic media that will be developed combines cultural elements so that students not only understand the learning material about plants, but also know the cultures that exist around the students. However, there has been no study regarding the development of Ethnoscience digital comic media for class IV elementary school plant material. Based on this, the aim of this research is to develop Ethnoscience digital comic media for class IV elementary school plant material.

2. METHOD

This type of research is development research. The research method used is the development method or Research and Development. The development method is a research method used to produce a particular product and test the effectiveness of the product. In this research, the product that will be produced is a learning media product, namely comics. The development model used by ADDIE. The stages in developing the ADDIE model include the analysis, design, development, implementation and evaluation stages (Anugrahini & Windrawanto, 2017).The first stage is analysis (Analyze), at this stage the problems occurring in the school are identified, through various methods, namely observation of the learning process, non-structured interviews with teachers and students, as well as analysis of the needs of students and teachers through distributing needs questionnaires to find problems. to find the right solution to overcome this problem. Then, after finding the problem and solution, the second stage is continued, namely the design stage. Second, the design stage. In the stage of designing the media that will be developed. First, start compiling the storyline of the digital comic, starting from the comic plot, the characters in it and the material that will be conveyed through the digital comic. After the storyline is arranged, start developing media using the Canva application. However, before developing the results of the storyline that has been prepared using the Canva application, first ask for suggestions and responses from the supervisor regarding the storyline that the researcher has created. After the media design is complete, the development stage continues with the digital comic that has been designed, then validated by experts to determine the quality and validity of the media that has been created. After the media is declared valid by experts, the next step is the product testing stage. After testing the product, it was then continued to distribute response questionnaires regarding media use to practitioners and students. In this research, the role of the practitioner was the teacher.

The research subjects who will assess the feasibility of this digital comic media are 1 material expert, namely a science course lecturer, 1 learning media expert, namely a media expert lecturer, then 1 practitioner, namely a class IV teacher, and 28 class IV students. The role of material content experts and media experts is to provide values, comments and suggestions related to theoretical science on material and media to ensure scientific truth in the product. Product trials were carried out in 2 groups, namely a small group and a large group. Data collection techniques in this research are test and non-test techniques. Data collection techniques using tests were obtained using question instruments (pretest and posttest),

needs questionnaires and response questionnaires. Meanwhile, non-test data collection techniques were obtained using non-structured interview instruments with teachers and students as well as observation. Qualitative data was obtained through observation, non-structured interviews, expert advice and responses from teachers and class IV MII Kebumen students. Then quantitative data is obtained from questionnaires, questionnaires and tests (pretest and posttest) which are converted into a numerical score. The data collection instrument uses a questionnaire sheet. The questionnaire sheet grid is presented in Table 1 and Table 2.

Table 1. Expert Assessment Grid for Digital Comic Material Plant Material

No	Aspect	Indicator
1	Content Eligibility	Conformity of content I, KD, Indicators, and learning objectives Accuracy of material Organization of material Compliance with laws and regulations
2	Linguistic Feasibility	Student development Readability Conformity with Indonesian rules Use of Terms and Symbols
3	Feasibility of Presentation	Presentation techniques Learning presentation Feasibility of presentation

Table 2. Digital Comic Media Expert Assessment Grid for Plant Material

No	Aspect	Indicator
1	Images/Illustrations	1. Digital comic media images/illustrations are of good quality 2. The digital comic media images/illustrations look interesting 3. Digital comic media images/illustrations have proportional sizes 4. Pictures/illustrations depict the characters well
2	Appearance	1. The choice of fonts used in digital comic media can be read clearly. 2. Use the right font size, so that the writing can be read clearly 3. Select the font color used to match the background 4. The writing is placed correctly, so it can be read clearly. 5. The composition of text, colors and images is correct 6. Precise layout settings. 7. The color choices used are good, so that digital comics look more attractive. 8. Suitability of images to support the material 9. The neatness of the digital comic media layout is good
3	Media Use	1. Educational digital comic media is easy to use in learning. 2. Digital comic media is appropriate as a tool for developing learning media. 3. Digital comic media provides clear instructions for using the media. 4. Digital comic media can be accessed via PDF and can be read via PC, laptop and cellphone
4	Media Convenience	1. Digital comic media can be accessed offline 2. Digital comic media includes a table of contents. 3. Digital comic media includes material.

The data analysis techniques used in this research are qualitative descriptive analysis, quantitative and inferential statistics. Qualitative descriptive analysis was used to analyze data in the form of input and suggestions provided by experts regarding the digital comic media Ethnoscience. Quantitative descriptive analysis is used to analyze data in the form of scores given by experts regarding the digital comic media Ethnoscience. Inferential statistics are used to test product effectiveness. The data analysis techniques used to process the data are the normality test, the T test and the N gain test. The normality test is used to determine that the data obtained is normal, so that it can determine what type of statistics can be used (Sugiyono, 2016).Then the T test aims to test the researcher's hypothesis in differentiating the means in the two populations. Then finally the N gain test is used, this test is used to determine the effectiveness of the media used.

3. RESULT AND DISCUSSION

Result

The results of this research include the development of learning media in the form of digital comics with ethnoscience nuances in science and science subjects, plant material for class IV elementary school, the results of the feasibility of digital comics as a learning media and the results of the effectiveness of using digital comic media in improving learning for class IV MII students in Kebumen Regency. Stem. The digital comic media was developed using the ADDIE model, but this research only used 3 stages of the ADDIE model, namely the analysis, design and development stages.

The first step in this research is the analyze or analysis stage, at this stage the researcher identifies problems that occur in learning activities where it is found that in class IV MII Kebumen learning there is still minimal use of creative digital media and only relies on textbooks as learning media. Then, so that the media developed meets needs, the researcher carries out a needs analysis by distributing a needs questionnaire to teachers and students. Apart from that, the analysis stage also analyzes the curriculum, basic competencies, indicators, teacher books and student books. The second stage is design, at this stage the researcher begins to develop the storyline of the comic that will be developed. The final stage is development, in this stage the researcher is able to produce learning media products, namely digital comics whose validity has been tested by media experts and material experts and received responses from teachers and students. The following are the results of the media development that has been developed by researchers. Media presented on Figure 1.

Figure 1. Digital Comic Media "Adventures in the World of Plants

The results of the feasibility test of the digital comic media "Adventures in the World of Plants" with an ethnoscience nuance show that this media is suitable for use as a learning medium to support the learning process. In this feasibility test, the media is assessed by experienced education experts (lecturers in the PGSD FIPP UNNES science course as material experts and lecturers in the PGSD FIPP UNNES learning media course as media experts). Responses from teachers and class IV MII Kebumen students also took part in the assessment. The results of these assessments show that digital comic media with ethnoscience nuances is in line with the existing curriculum, practical and easy to use as a learning medium and effective in increasing student motivation and learning outcomes. The results of the feasibility test for digital comic media are presented in Table 3.

Table 3. Results of the Feasibility Test for Digital Comic Media with Ethnoscience Nuances

Subject	Percentage Results	Criteria
Materials Expert	92%	Very Worth It
Media Expert	88.75%	Very Worth It
Teacher Responses	95%	Very Worth It
Students Responses	95%	Very Worth It
Average	92%	Very Worth It

Based on Table 3, it can be seen that digital comic media with an ethnoscience nuance is worthy of being implemented in science and science learning about plant material in order to increase the motivation and learning outcomes of fourth grade elementary school students. The results of the effectiveness test of the digital comic media "Adventures in the World of Plants" with an ethnoscience nuance show that the media is effective. The effectiveness of digital comic media is proven by the completeness of student learning outcomes that exceed the predetermined KKTP (Learning Goal Achievement Criteria), and there are differences in student learning outcomes before and after using digital comic media. The following is the completeness of student learning outcomes before and after using media Table 4.

Table 4. Completeness Results of Student Learning Scores Before & After Using Media

Data	Many Students	Average	Information
Pretest	22	58.68	8 students completed; 14 students did not complete
Posttest	22	81.86	21 students completed; 3 students did not complete

The results of the effectiveness of digital comic media, apart from being seen from the completeness of student learning outcomes, are also known through a series of data analysis tests, which go through 2 stages, namely initial data analysis using a normality test and then final data analysis using the T-test and N-gain test. In the first stage, initial data collected from the pretest and posttest results of class IV MII Kebumen students on a large scale consisting of 22 students were analyzed using a normality test using the Liliefors formula in Microsoft Excel. The results of the normality test are presented below Table 5.

Table 5. Normality Test Results

Data	Many Students	Average	Standard Deviation	L-count	Table	Information
Pretest	22	58.68	15.39754576	0.122660854	0.189	Normal Data
Posttest	22	81.86	10.50304017	0.085135415	0.189	Normal Data

Based on the results of the normality test for digital comic media with ethnoscience nuances Table 5 It is known that Lcount < Ltable so it can be concluded that the data is normally distributed. After the data is verified as normal, the next stage is final data analysis using the t-test and N-gain test. The t-test was carried out using parametric statistical techniques to determine the difference in average pretest and posttest scores. The following t-test test results are presented below Table 6.

Table 6. t-test test results

Data	Many Students	Average	Standard Deviation	*t-count*	*t-table*	Information
Pretest	22	58.68	15.39754576	-13.71832826	2.080	H_a accepted,
Posttest	22	81.86	10.50304017			H_o was rejected

Based on the t-test for digital comic media with ethnoscience nuances Table 6 It can be seen that tcount > ttable so that Ha is accepted and Ho is rejected. So it can be concluded that there is a significant difference in student learning outcomes before and after using digital comic media. Once the data is known to have significant differences, it can be continued with the N-gain test. The N-gain test results are presented in Table 7.

Table 7. N-gain Test Results

Data	Many Students	Average	Maximum Score	Average Difference	N-gain value	Criteria
Pretest	22	58.68	100	23.18	0.58	Currently
Posttest	22	81.86				

The N-gain test aims to determine the effectiveness of using the media that has been developed. Based on the results of the N-gain test on digital comic media with deep ethnoscience nuances Table 7 It can be seen that the use of digital comic media can improve student learning outcomes. The N-gain test results above show that digital comic media has medium N-gain score criteria.

Discussion

The results of data analysis show that the digital comic media "Adventures in the World of Plants" has an ethnoscience nuance, indicating that this media is suitable for use as a learning medium to support the learning process. This is caused by the following factors. First, the digital comic media "Adventures in the World of Plants" with ethnoscience nuances is suitable to be used because it can improve student learning outcomes. The development of digital comic content must be adjusted to the curriculum, KD, indicators and learning objectives (Aeni & Yusupa, 2018; Hidayah et al., 2017; Sukmanasa et al., 2017). This causes digital comics to be developed to make it easier for students to learn. The language used in digital comics is in accordance with students' development in reading, the language, symbols and terms used are also in accordance with linguistic rules and use language that is easy for students to understand (Azizul et al., 2020; T. Handayani, 2021; Lestari & Irwansyah, 2020; Wijaya et al., 2020). The presentation of material in comics is complete and coherent. This is what causes the digital comic media that has been developed to make it easier for students to learn and improve student learning outcomes (Kanti et al., 2018; Pinatih & Putra, 2021). Ethnoscience-based digital comic media has been proven to be effective in improving student learning outcomes in various subjects and contexts. The use of digital comics containing ethnoscience elements can increase students' understanding, engagement and critical thinking skills, making them a suitable medium for learning.

Second, the digital comic media "Adventures in the World of Plants" with ethnoscience nuances is suitable to be used because it increases students' learning motivation. This is because digital comic media has several good aspects, where these aspects include image or illustration aspects, appearance aspects, media use aspects and good and appropriate media comfort aspects. The images in digital comics are of good quality, attractive, proportional in size and depict the characters well so they are interesting. Previous research findings also reveal that good digital comic media can increase students' learning motivation (Astutik et al., 2021; Hidayah et al., 2017; Pinatih & Putra, 2021; Wijaya et al., 2020; Zahwa & Syafi'i, 2022).Ethnoscience-based digital comic media is suitable for increasing student learning motivation because it is able to attract and involve students. Previous research also shows the effectiveness of digital comic-based learning media in increasing student motivation and learning outcomes (Hobri et al., 2019; Rahmata et al., 2020; Rochmah & Fahyuni, 2021). Other findings also show that the use of comic-based learning media can improve students' understanding and critical thinking skills in various subjects (Aeni & Yusupa, 2018; Laksmi & Suniasih, 2021). Therefore, evidence suggests that ethnoscience-based digital comic media can be a valuable tool for increasing student motivation and learning engagement.

Third, the digital comic media "Adventures in the World of Plants" with ethnoscience nuances is suitable for use because it is practical and easy to use. The results of responses from teachers and students of class IV MII Kebumen show that the ethnoscience continent digital comic media is very easy to use and helps them in learning activities, so the digital comic media is suitable for use as a learning medium. This was also revealed by previous research findings which stated that practical digital comic media would make it easier for students to learn (Abdurrohim et al., 2020; Hobri et al., 2019; Indriasih et al., 2020). Judging from the usage aspect, the digital comic media is also very clear, includes instructions for use, and is easy and practical to use. Lastly, there is the media convenience aspect, digital comics are comfortable to use because they can be accessed anywhere and anytime, both online and offline (Abdurrohim et al., 2020; Udayani et al., 2022).

Digital comic media with ethnoscience nuances that have been created by researchers are very suitable to be used as learning media. Previous research findings also state that comic media that has been validated by experts with high validity values and then tested is suitable to be used as learning media (Azizi & Prasetyo, 2018; Melliyanti & Suniasih, 2022). Using digital comics as a learning medium can make students more motivated to learn because the media used is interesting so learning can be more meaningful (Febriyandani, 2021; Sukmanasa et al., 2017). Based on the explanation above, it can be concluded that the digital comic media "Adventures in the World of Plants" with ethnoscience nuances in Class IV Elementary Plants material is very suitable to be used as a learning medium, because it is easy to use and is able to increase student learning outcomes and motivation. This digital comic is considered interesting for students because by using digital comics students not only read text but students also see colorful pictures. Apart from that, digital comics are suitable to be used as a learning medium because

digital comics can be a medium for visualizing material that sometimes cannot be presented directly in learning activities.

The implication of this research is that in this research the researcher used an ethnoscience approach in developing digital comics, which is different from previous research which only researched digital comics but did not use an ethnoscience approach (Ramadhani et al., 2022). Then, although this research has similarities with research conducted by research related to digital comics using regional languages, namely that both use culture as an approach in comics, there is a difference in that this research explains Javanese culture, namely siraman and regional food from Central Java (RK Sari, 2023). Therefore, this research has novelty value and is different from previous studies. However, it cannot be denied that the development of comic media has limitations, namely that media use requires internet support, so that schools that have difficulty accessing the internet may experience problems, but researchers have a solution to overcome this by making digital comics accessible online. offline even though there are video features that cannot be accessed.

4. CONCLUSION

Based on the results of the development of digital comic media, it shows that the media was declared valid by material experts and media experts, and received a positive response from teachers and students. The digital comic media has also been tested for its effectiveness as seen from the completeness and significant differences in learning outcomes before and after using digital comic media, as well as the results of the N-gain test which shows that the media is effective with moderate criteria. It was concluded thatThe digital comic media "Adventures in the World of Plants" with ethnoscience nuances in Plant material for Class IV Elementary School is very feasible and effective in improving student learning outcomes.

5. REFERENCES

Abdurrohim, M., Tryanasari, D., & Hartini. (2020). Development of Puppet-Based E-Comic Material on Changing Energy Forms and Alternative Energy Sources for Class IV Elementary School. *Journal of Smart and Smart Children's Education, 4(2), 53–65.* https://doi.org/https://doi.org/10.52802/pancar.v4i2.4.

Aeni, WA, & Yusupa, A. (2018). *E-Comic Learning Media Model for High Schools. Kwangsan Journal, 6(1), 1.* https://doi.org/10.31800/jtpk.v6n1.p1--12.

Agustiana, IGAT, Agustini, R., Ibrahim, M., & Tika, IN (2020). Learning Tools (RPS and SAP) Science Model (OPPEMEI) to Improve Creative Thinking Skills of PGSD Students. *Elementary School Science Journal, 4(2), 309–323.* https://doi.org/10.23887/jisd.v4i2.25190.

Angga, PMW, Sudarma, IK, & Suartama, IK (2020). Educational E-Comics to Shape Character and Improve the Learning Outcomes of Class V Students in Indonesian Language Subjects. *Undiksha Edutech Journal, 8(2), 93*. https://doi.org/10.23887/jeu.v8i2.28920.

Anugrahini, MY, & Windrawanto, Y. (2017). Development of the Bubble Match Game as a Learning Media for Division in the Form of Repeated Subtraction for Grade 2 Elementary School Students. *Elementary Education Professions, 4(1), 75–83.* https://repository.uksw.edu/handle/123456789/15800

Astutik, AF, Rusijono, & Suprijono, A. (2021). Development of Digital Comic Media in Social Studies Learning to Strengthen the Character of Class V Students at SDN Geluran 1 Taman. *Journal of Education and Development, South Tapanuli Education Institute, 9(3), 543–554.* https://doi.org/https://doi.org/10.37081/ed.v9i3.2894.

Azizi, M., & Prasetyo, S. (2018). Contribution to the Development of Science Comic Media Containing Characters in Natural Resources Material for Middle School/Elementary Students. Al-Bidayah: *Journal of Islamic Basic Education, 9(2), 75*. https://doi.org/10.14421/jpdi.2017.0902-07.

Azizul, A., Riski, WY, Fitriyani, DI, & Sari, IN (2020). Development of Digital Comic Teaching Materials on Motion Mater. Vox Edokasi: *Scientific Journal of Educational Sciences, 11(2).* https://doi.org/10.31932/ve.v11i2.829.

Basak, K., Wotto, S., Bélanger, M., & Paul. (2018). E-learning, M-learning and D-learning: Conceptual definition and comparative analysis. *E-Learning and Digital Media, 15(4), 191–216*. https://doi.org/10.1177/2042753018785180

Damayanti, C., Rusilowati, A., & Linuwih, S. (2017). Development of an ethnoscience integrated science learning model to improve learning outcomes and creative thinking abilities. *Journal of Innovative Science Education, 6(1), 116–128.* https://doi.org/10.15294/JISE.V6I1.17071.

Dewi, C. (2019). Development of Digital Environmental Conservation Comics based on Religious Character Values for Thematic Learning for Elementary School Students. Muaddib: *Educational and Islamic Studies, 1(2), 100–109*. http://journal.umpo.ac.id/index.php/muaddib/article/view/1213.

Diah Purnami Dewi, P., Wayan Suniasih, N., & Kunci, K. (2022). Ethnomathematics-Based Mathematics Learning Video Media with Introduction to Plane Figures. *Undiksha Edutech Journal, 10(1), 156–166*. https://doi.org/10.23887/jeu.v10i1.44775.

Esi Febrina, & Mukhidin. (2019). Metacognition as Higher Order Thinking Skills in 21st Century Learning. Educentric: *Journal of Education and Teaching Science, 6(1), 25–32.* https://doi.org/10.17509/educentric.v6i1.451

Fahyuni, EF, Wasis, W., Bandono, A., & Arifin, MBUB (2020). Integrating Islamic values and science for millennial students' learning on using seamless mobile media. *Indonesian Journal of Science Education, 9(2)*. https://doi.org/10.15294/jpii.v9i2.23209.

Febriyandani, R. (2021). Development of Comic Media in Mathematics Learning Fraction Material for Class IV Elementary School. *Journal of Pedagogy and Learning, 4(2), 323–330.* https://doi.org/10.23887/jp2.v4i2.37447.

Hanafi, Y., Ratna Ma'rifah, D., Abdillah Nurusman, A., & Alif Fahmi Rizki, G. (2021). *Effectiveness of Video Learning on Environmental Pollution Material in the Environmental Science Course, Biology Education Study Program, FKIP UAD. Biodic, 7(4), 127–135.* https://doi.org/10.22437/bio.v7i4.14186.

Handayani, NMD, Ganing, NN, & Suniasih, NW (2017). Picture and Picture Learning Model Assisted by Audio-Visual Media on Science Knowledge. *Journal of Educational Technology, 1(3), 176.* https://doi.org/10.23887/jet.v1i3.12502.

Handayani, T. (2021). Development of STEM-Based Digital Comic Media to Improve Elementary School Students' Scientific Literacy. *Journal of Elementary Education Didactics, 5(3), 737–756.* https://doi.org/10.26811/didaktika.v5i3.343.

Hasanah, E., Darmawan, D., & Nanang. (2019). The Effect of Using Articulate Learning Media in the Problem Based Learning (PBL) Method on Increasing Students' Creative Thinking Abilities. JTEP-*Journal of Educational and Learning Technology, 4(1), 826–838.* https://doi.org/10.31980/tp.v4i1.503.

Hidayah, YF, Siswandari, S., & Sudiyanto, S. (2017). Development of Digital Accounting Comic Media on Material for Preparing Bank Reconciliation Reports for Vocational School Students. *Journal of Education and Culture, 2(1), 135–146*. https://doi.org/10.24832/jpnk.v2i2.588.

Hidayati, AN, Dewi, NSN, Nurhaedin, E., & Rosmala, D. (2020). The Effect of Google Classroom in Blended Learning on University Students' English Ability. J-SHMIC : *Journal of English for Academics, 7(1), 66–76.* https://doi.org/10.25299/jshmic.2021.vol8(1).6216

Hobri, Murtikusuma, RP, & Hermawan, LI (2019). Development of e-comic using pixton and classe web on linear program of two variables assisted by geogebra. *Journal of Physics: Conference Series, 1265, 012010.* https://doi.org/10.1088/1742-6596/1265/1/012010.

Ibrahim, F., Hendrawan, B., & Sunanih, S. (2023). Development of PACAS Learning Media to Improve Student Learning Outcomes. JLEB: *Journal of Law, Education and Business, 1(2), 102–108.* https://doi.org/10.57235/jleb.v1i2.1192.

Indriasih, A., Sumaji, S., Badjuri, B., & Santoso, S. (2020). Development of E-Comic as a Learning Media to Improve the Life Skills of Early Childhood. Educational Reflections: *Educational Scientific Journal, 10(2), 154–162.* https://doi.org/10.24176/re.v10i2.4228.

Janah, FNM, Sulasmono, BS, & Setyaningtyas, EW (2019). Improving Mathematics Learning Outcomes Through the Problem Based Learning Model Assisted by Puzzle Media for Class IV Elementary School Students. *Journal of Mathematics Education Works, 6(1), 8.* https://doi.org/10.26714/jkpm.6.1.2019.8-14.

Jerry Radita Ponza, P., Nyoman Jampel, I., & Komang Sudarma, I. (2018). Development of Animation Video Media in Class IV Student Learning in Elementary Schools. *Ganesha University of Education EDUTECH Journal, 6*(1). https://doi.org/10.23887/jeu.v6i1.20257.

Juniari, IGAO, & Putra, M. (2021). Efforts to Increase Students' Enthusiasm for Learning Through Interactive Multimedia Learning Media in Class V Elementary School Science Lessons. *Undiksha Edutech Journal, 8(1), 140–148.* https://ejournal.undiksha.ac.id/index.php/JEU/article/download/33091/18780/88499.

Kanti, FY, Suyadi, B., & Hartanto, W. (2018). Development of Digital Comic Learning Media on Basic Competencies in Payment Systems and Payment Instruments for Class X IPS Students in Man 1 Jember. JOURNAL OF ECONOMIC EDUCATION: *Scientific Journal of Education, Economics and Social Sciences, 12(1), 135.* https://doi.org/10.19184/jpe.v12i1.7642.

Kurniawan, IK, Parmiti, D., & Kusmariyatni, N. (2020). Science Learning with the Problem Based Learning Model Assisted by Audio Visual Media Improves Students' Understanding of Concepts. *Undiksha Edutech Journal, 8(2), 80.* https://doi.org/10.23887/jeu.v8i2.28959.

Kusuma, WM, Sudira, P., Hasibuan, MA, & Daryono, RW (2021). The Perceptions of Vocational School Students of Video Animation-Based Learning Media to Operate Lathes in Distance Learning. *Journal of Educational Technology, 5(2), 200–206*. https://doi.org/10.23887/jet.v5i2.33139.

Laksmi, NLPA, & Suniasih, NW (2021). Development of E-Comic Learning Media Based on Problem Based Learning on Water Cycle Material in Science Content. *Scientific Journal of Education and Learning, 5(1), 56–64.* https://doi.org/10.23887/jipp.v5i1.32911.

Lestari, AF, & Irwansyah. (2020). Line Webtoon as a Digital Comic Industry. *Journal of Communication Studies, 6(2), 134–148*. https://doi.org/10.35308/source.v6i2.1609.

Mahardika, C., & Siswoyo, AA (2021). Development of Ecosystem Component Box (KOKOSIS) Learning Media for Elementary Schools. JUDIKDAS: *Indonesian Journal of Basic Education, 1(1), 39–50.* https://doi.org/10.51574/judikdas.v1i1.184.

Mariyah, YS, Budiman, A., Rohayani, H., & Audina, WD (2021). Increasing Student Learning Motivation Through the Use of Audio Visual Media: *Experimental Study in Dance Learning. Journal of Education, Humanities and Social Sciences (JEHSS), 4(2), 959–967.* https://doi.org/10.34007/jehss.v4i2.778.

Masturah, ED, Mahadewi, LPP, & Simamora, AH (2018). Development of Pop-Up Book Learning Media in Science Subjects for Class III Elementary Schools. *Ganesha University of Education EDUTECH Journal, 6(2), 212–221.* https://doi.org/10.23887/jeu.v6i2.20294.

Melliyanti, NMS, & Suniasih, NW (2022). Feasibility and Effectiveness of Contextually Based Comic Media on Natural Resources Material Science Content. *Pulpit Science, 27(1), 124–133*. https://doi.org/10.23887/mi.v27i1.44587

Nemeth, L., Werker, K., Arend, J., Vogel, S., & Lipowsky, F. (2019). Corrigendum: Interleaved Learning in Elementary School Mathematics: *Effects on the Flexible and Adaptive Use of Subtraction Strategies. Frontiers in Psychology, 10(October).* https://doi.org/10.3389/fpsyg.2019.02296.

Nisa, A., Sudarmin, & Samini. (2015). Effectiveness of Using Ethnoscience Integrated Modules in Problem-Based Learning to Improve Students' Scientific Literacy. *Unnes Science Education Journal, 4(2), 1049–1056.* https://doi.org/10.15294/USEJ.V4I3.8860.

Nursyaida, N., & Hardiyanti, A. (2020). Effectiveness of Using Power Point Media on Social Sciences Learning Results for Class V Elementary School 128 Turungan Beru, Herlang District, Bulukumba Regency. *JRPD (Journal of Elementary Education Research), 3(1), 71–76.* https://doi.org/10.26618/jrpd.v3i1.3092.

Pinatih, SAC, & Putra, DKNS (2021). Development of Digital Comic Media Based on a Scientific Approach to Natural Science Content. *Journal of Educational Research and Development, 5(1), 115–121.* https://doi.org/https://doi.org/10.23887/jppp.v5i1.32279

Prihatin, A., Sudiyanto, -, & Joebagio, H. (2018). Developing Formative Evaluation Model to Improve Students' Learning Outcomes at Vocational High Schools. *International Journal of Multicultural and Multireligious Understanding, 5(5).* https://doi.org/10.18415/ijmmu.v5i5.377.

Puspasari, A., Susilowati, I., Kurniawati, L., Utami, RR, Gunawan, I., & Sayekti, IC (2020). Implementation of Ethnoscience in Science Learning at Elementary School of Muhammadiyah Alam Surya Mentari Surakarta (Implementation of Ethnoscience in Science Learning at Elementary School of Muhammadiyah Alam Surya Mentari Surakarta). *SEJ (Science Education Journal)*. https://doi.org/10.21070/sej.v3i1.2426.

Rahayu, WE, & Sudarmin, S. (2015). Development of an integrated science module based on ethnoscience on the theme of energy in life to instill a spirit of conservation in students. *Unnes Science Education Journal, 4(2)*. https://doi.org/10.15294/USEJ.V4I2.7943.

Rahmata, A., Tuljannah, LaiRahmata, A., Tuljannah, L., Chotimah, SC, & Fiangga, S. (2020). Validity of Mathematics E-Comic Based on Problem Solving on Congruence Material. *Journal of Mathematics Learning Review, 5(1), 53–65.* https://doi.org/10.15642/jrpm.2020.5.1.53-65.

Ramadhani, A., Tambunan, MA, Saragih, VR, Sirait, J., & Sitanggang Gusar, MR (2022). The Influence of Digital Comic Media to Improve Short Story Writing Ability. JBSI: *Journal of Indonesian Language and Literature, 2(02), 251–260.* https://doi.org/10.47709/jbsi.v2i02.1870.

Resterina, RA, Untari, S., & Atok, AR Al. (2020). Development of Enrichment Books on Local Cultural Themes Based on Strengthening Character and Literacy Education. *Journal of Education: Theory, Research and Development, 5(11).* https://doi.org/10.17977/jptpp.v5i11.14146.

Rochmah, AHN, & Fahyuni, EF (2021). Use of E-Comic Fiqh to Improve Student Learning Outcomes Mi Ma'arif Ngering. *Journal of Islamic Education, 12(1), 129–141.*

https://doi.org/10.24042/atjpi.v12i1.7069.
Roemintoyo, R., Miyono, N., Murniati, NAN, & Budiarto, MK (2022). Optimizing the utilization of computer-based technology through interactive multimedia for entrepreneurship learning. *Cypriot Journal of Educational Sciences, 17(1), 105–119*. https://doi.org/10.18844/cjes.v17i1.6686.
Sari, NP, Suhirman, & Walid, A. (2020). Development of an Ethnoscience-Based Science Learning Module Material on the Interaction of Living Creatures with Their Environment to Instill a Spirit of Conservation in Class VII Middle School Students. BIO-EDU : *Journal of Biology Education, 5(2), 62–73.* https://doi.org/10.32938/jbe.v5i2.554.
Sari, R.K. (2023). Development of Tidung Language Digital Comics as a Media for Literacy Learning at SD Muhammadiyah 3 Al-Hilal Tarakan. LITERACY: *Journal of Non-formal Education Science, 9(02), 1249–1260*. https://doi.org/10.37905/aksara.9.2.1249-1260.2023.
Saripudin, E., Sari, IJ, & Mukhtar, M. (2018). Using Macro Flash Animation Media on Motion Material to Improve Learning Achievement for Learning Science in Junior High School. *Journal of Science Research and Learning, 4(1), 68–75*. https://doi.org/10.30870/jppi.v4i1.3316.
Satria, VH, & Herumurti, D. (2021). Role-Playing Game as Learning Media To Support Online Learning. *Journal of Educational Technology, 5(4), 579–587*. https://doi.org/10.23887/JET.V5I4.39718.
Shishigu, A., Hailu, A., & Anibo, Z. (2018). Problem-based learning and conceptual understanding of college female students in physics. *Eurasian Journal of Mathematics, Science and Technology Education, 14(1), 145–154.* https://doi.org/10.12973/ejmste/78035.
Siregar, N., Suherman, Rubhan Masykur, & Rahma Sari Ningtias. (2019). *Development of E-Comic Learning Media in Mathematics Learning. Journal of Mathematics Education and Science, 2(1), 11–19.* https://doi.org/10.32665/james.v2i1.47.
Sugiyono. (2016). Educational Methodology. Alphabet.
Suharsiwi, S., Fadilah, N., & Farokhah, L. (2022). The Use of Audio-Visual Media in Improving Students' Reading Comprehension and Prayer Movements in Online Learning. *Journal of Educational Technology, 6(1), 19–28*. https://doi.org/10.23887/jet.v6i1.40797.
Sukmanasa, E., Windiyani, T., & Novita, L. (2017). Development of Digital Comic Learning Media in Social Sciences Subjects for Class V Elementary School Students in Bogor City https://doi.org. *JPsd (Primary School Education Journal), 3(2), 171–185.* https://doi.org/10.30870/jpsd.v3i2.2138.
Sumanto, Y., & Sadewo, Y.D. (2021). Training on making learning videos as an online learning medium at Sojopuro State Elementary School during the Covid-19 period. *Journal of Educational Learning and Innovation (ELIa), 1(1), 1–14.* https://doi.org/10.46229/elia.v1i1.237.
Supartayasa, IKR, & Wibawa, IMC (2022). Learning the Water Cycle with Digital Comic Media Based on Tri Hita Karana. *Journal of Pedagogy and Learning, 5(1), 127–137*. https://doi.org/10.23887/jp2.v5i1.46279.
Suwiantini, LA, Jampel, IN, & Astawan, IG (2021). Learn Energy Sources with Interactive Learning Multimedia. *Primary School Scientific Journal, 5(1), 119.* https://doi.org/10.23887/jisd.v5i1.35000.
Syahmi, FA, Ulfa, S., & Susilaningsih. (2022). Development of Smartphone-Based Digital Comic Learning Media for Elementary School Students. JKTP: *Journal of Educational Technology Studies, 5(1), 81–90.* https://doi.org/10.17977/um038v5i12022p081.
Udayani, NKRTK, Wibawa, IMC, & Rati, NW (2022). Development Of E-Comic Learning Media On The Topic Of The Human Digestive System. *Journal of Educational Technology, 5(3), 472–481.* https://doi.org/10.23887/jet.v5i3.34732.
Utari, R., Andayani, Y., Savalas, LRT, & Anwar, YAS (2021). Utilizing the Results of Ethnoscience-Based Chemistry Module Development to Instill Environmental Conservation Attitudes at MAN 2 Schools in Central Lombok. *Journal of Master of Science Education Service, 4(1).* https://doi.org/10.29303/jpmpi.v4i1.593.
Wati, U., Hastuti, WS, & Mustadi, A. (2021). Analysis of Student Creativity in Developing Science Learning Media during the COVID-19 Pandemic. AL-ISHLAH: *Journal of Education, 13(3), 2790–2799.* https://doi.org/10.35445/alishlah.v13i3.612.
Wibowo, T., & Ariyatun, A. (2020). Science Literacy Ability in High School Students Using Ethnoscience-Based Chemistry Learning. *Education Science, 12(2), 214–222.* https://doi.org/10.15408/es.v12i2.16382.
Widiarti, NK, Sudarma, IK, & Tegeh, IM (2021). Improving Mathematics Learning Outcomes for Grade V Elementary School Through Learning Video Media. *Undiksha Edutech Journal, 9(2), 195–205*. https://doi.org/10.23887/jeu.v9i2.38376.
Wijaya, SN, Johari, A., & Wicaksana, EJ (2020). Development of Digital Comic Learning Media Based on Indonesian Hero Characters on Blood Circulatory System Material. Biology Didactics: *Journal of*

Biology Education Research, 4, 67–78. https://doi.org/10.32502/dikbio.v4i2.2582.

Winangun, IMA (2020). Local Culture-Based Media in Elementary School Science Learning. Education: *Journal of Elementary Education, 1(1), 65–72.* https://doi.org/10.55115/edukasi.v1i1.529.

Wulandari, NPD, & Wiarta, IW (2022). Interactive Learning Media on the Properties of Building Spaces Based on Guided Discovery of Cubes and Blocks Material. *Undiksha Edutech Journal, 10(1), 21–32.* https://doi.org/10.23887/jeu.v10i1.46270.

Zahwa, FA, & Syafi'i, I. (2022). Selection of Information Technology Based Learning Media Development. Equilibrium: *Journal of Educational and Economic Research, 19(01), 61–78.* https://doi.org/10.25134/equi.v19i01.3963.