Digital Comics Material on Human and Animal Circulatory Organs in Elementary School

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Abstract
This research is motivated by the lack of variety of learning media used by teachers in learning science. The teacher only uses the theme book as a reference in the learning process of the blood circulatory organs of humans and animals. This results in students getting bored quickly and less motivated to learn. The purpose of this study was to determine the process of development and feasibility of digital comic products material for the circulatory organs of humans and animals in fifth grade elementary school students. This type of research is R&D (Research and Development) with the ADDIE development model. Collecting data using a questionnaire. Based on the results of research and development, it is known that the results of the validation of media experts are 3.69, the results of validation of material experts are 4.3, the results of teacher responses were 4.84, and the results of student responses were 92.2%. Based on the results obtained, it can be concluded that digital comic material on the circulatory organs of humans and animals in fifth grade elementary school students is very feasible to use.

Keywords: *Learning Media, Digital Comic, Blood Circulatory Organ.*

Abstrak
Penelitian ini dilatarbelakangi oleh kurang bervariasinya media pembelajaran yang digunakan oleh guru dalam pembelajaran IPA. Guru hanya menggunakan buku tema saja sebagai acuan dalam proses pembelajaran materi organ peredaran darah manusia dan hewan. Hal tersebut mengakibatkan siswa menjadi cepat bosan dan kurang termotivasi untuk belajar. Tujuan dari penelitian ini untuk mengetahui proses pengembangan dan kelayakan dari produk komik digital materi organ peredaran darah manusia dan hewan pada siswa kelas V SD. Jenis penelitian ini adalah *R&D (Research adn Development)* dengan model pengembangan *ADDIE*. Pengumpulan data menggunakan angket atau kuesioner. Berdasarkan hasil penelitian dan pengembangan, diketahui hasil dari validasi ahli media sebesar 3,69, hasil validasi ahli materi sebesar 4,3, hasil respons guru sebesar 4,84, dan hasil respons siswa sebesar 92,2%. Berdasarkan hasil yang didapat, maka dapat disimpulkan bahwa komik digital materi organ peredaran darah manusia dan hewan pada siswa kelas V SD sangat layak digunakan.

Kata Kunci: Media Pembelajaran, Komik Digital, Organ Peredaran Darah

INTRODUCTION

Learning is a process in which students interact with teachers and various learning resources in the learning environment(Suardi, 2018). Learning is the process of helping students learn well. In this sophisticated era, learning has been greatly influenced by technology. Currently, technology is considered very important for people's lives because it helps them do various things, such as work and study(Agustian & Salsabila, 2021). The use of this technology is none other than to simplify the learning process. Teachers can also use technology to create learning media. Eggen Paul(in Rahayu et al., 2022)states that teachers and students apply technology for learning which is the learning standard for the 21st century or the century of digitalization. Teachers are not the only source of information in the learning process, therefore teachers need to provide support and motivation to students to actively seek and use digital knowledge.

Learning media is a form of tool used by teachers to help facilitate the delivery of material to students. To foster student learning motivation so that learning objectives can be achieved well, it is very important for teachers to use learning media in delivering material.(Tafonao in Anggraini et al., 2022). On the other hand, it is suspected that the use of learning media is still less varied.Yulia & Ervinalisa (2017)stated that the use of new media is needed because teachers' use of media is less varied. Using varied learning media will help students to be more enthusiastic about learning and not get bored easily, especially in science learning.

Science learning is not just mastering knowledge, but a discovery process that encourages students to participate actively(Kelana & Wardani, 2021). Using theme

books alone as a reference in science learning will make it difficult for students to understand the material. So that science learning is memorable and doesn't just rely on theme books, teachers need a variety of media. At elementary school age, students are still in the concrete thinking stage, therefore media is needed in the learning process. Piaget(in Fanani et al., 2021)states that at elementary school age, students are able to concentrate logically on thinking numbers that are relevant to reality. In other words, they have been able to think in a more concrete direction.

Science learning on the circulatory system material is considered difficult because there are blood circulation mechanisms that must be understood so it often confuses students and is difficult to understand.(Wijaya et al., 2020). In the process of understanding human and animal circulatory organ material, one alternative can be used, namely digital comics.

According toOctaviana (2022)Graphic visual media such as comics can help students understand abstract material. Prado et al(in Astutik et al., 2021)states evidence that comics in the world of education are in the form of textbooks which function as an alternative that can attract students' attention and not only to illustrate. Digital comics are classified as technology-based visual media which are believed to help to increase students' motivation in learning science. Comics function as a visual medium to attract students' attention and make them concentrate on the lesson through the visual meaning displayed(Arsyad in Afifah et al., 2018). According to McCloud(in Riwanto & Wulandari, 2018)Comics are a collection of images that are sequential and lined up for the purpose of producing a beautiful response or conveying a message to the reader. Digital comics are a series of images that have a coherent text flow, frames, word balloons, writing style as their visual meaning which are uploaded digitally.(Lestari & Irwansyah, 2020).

Digital comics developed using the IbisPaint X application. IbisPaint X was chosen because of its ease of use and complete features. The work can be stored in a light size. Apart from that, IbisPaint(Setiaji, 2023).

The digital comics developed have advantages, including being able to be accessed via digital devices so they are paperless, can be used anywhere and at any time, access is done via LinkCanva which is directly aimed at digital comics so users don't need more storage space and don't need other supporting applications to open comics. digital, the addition of navigation buttons to make it easier for students to run digital comics, the material focuses not only on human blood circulation but also the blood circulation of animals, namely birds, parts of the circulatory organs and the similarities between human and bird blood circulation, writing the contents of comic stories packaged in language everyday ones that are light so that students will easily understand them. Based on the results of this presentation,

METHOD

This research adopts the Research and Development (R&D) method, which is a research approach focused on examining, developing and manufacturing special products(Sugiyono, 2022). Research and Development is a type of research used to create and test products in education(Maydiantoro, 2020). The development model used is the ADDIE model (Analyze, Design, Development, Implement, evaluate) but this research is limited to the development stage only due to time and cost limitations. The ADDIE model chart in this research which has been limited can be seen in Figure 1.
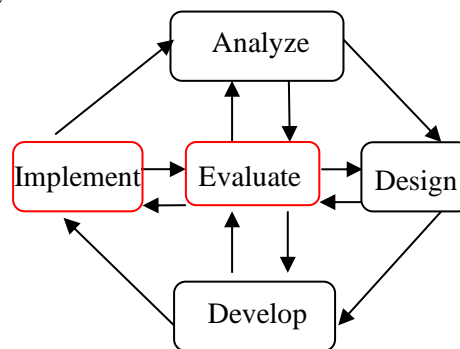

Figure 1. Digital Comic Development Procedure Chart

The data in this study were obtained from questionnaire scores resulting from media expert validation, material, and questionnaire scores

resulting from responses. Data sources were obtained from validators, media experts, material experts, students and class V teachers at SDN Kebondalem. The data collection method applied in this research is using questionnaires, which include media validation questionnaire sheets and material validation questionnaire sheets, student and teacher response questionnaire sheets with checklists as a way to respond to questions in the questionnaire.

The data analysis technique uses a five-point Likert scale which is used to calculate the average of the questionnaire scores obtained. The average of the questionnaire scores is calculated using the following formula:

$$Average = \frac{Total\ Score}{Question\ Items}$$

Meanwhile, student responses use percentages because there are more than one student.

$$Percentage = \frac{Total\ Score}{Highest\ Score} x100\%$$

The criteria for the suitability of digital comics are seen from the results of media validation and material validation. The score criteria for media expert validation, material expert validation and teacher responses can be seen in table 1.

Table 1. Likert Scale Score Criteria

Score Range	Category
4.21 – 5.00	Very Decent/Good
3.41 – 4.20	Decent/Good
2.61 – 3.40	Not worthy/good
1.81 – 2.60	Not Worthy/Good
1.00 – 1.80	Very Inadequate/Good

Meanwhile, the criteria for the percentage of student responses are presented in table 2.

Table 2. Student Response Percentage Criteria

Score Range	Category
81 – 100%	Very good
61 – 80%	Good
41 – 60%	Pretty good
21 – 40%	Not good
0 – 20%	Not good

Source: Adapted from Tania & Susilowibowo (2017)

RESULTS AND DISCUSSION

This research adopts the ADDIE model which involves the steps of analysis, design, development, implementation and evaluation.

However, in the context of this research, the focus is only on the development stage due to constraints related to time and budget. The stages carried out in this research are as follows:

1. *Analyzing*

The digital comic development stage begins with analysis. The analysis carried out includes needs analysis and material analysis. The analysis was carried out with Kebondalem Elementary School teachers with open discussions regarding problems in the learning process. The results obtained from the needs analysis were that the learning process only used theme books as a reference. The learning process regarding human and animal circulatory organs in class V still does not use technology-based media. Maritsa et al (2021) states that educational technology is expected to help teachers and students in the learning process, enabling teachers to provide information to students easily. From the needs analysis that has been explained, technology-based media is needed on human and animal circulatory organ material, namely digital comics.

After carrying out the needs analysis, proceed with material analysis, namely to determine the material to be included as digital comic material. Material analysis carried out mapping of Basic Competencies, formulating Learning Indicators and Learning Objectives. The material that will be used as material for digital comics is in the book theme 4 Health is Important, Sub-theme 1 My Blood Circulation is Healthy, Lessons 1 and 2 in science content.

2. *Design* **(Planning)**

At the design or planning stage, software is selected to design digital comics about human and animal circulatory organ material. The software used for design is IbisPaint X and Canva. IbisPaint X was chosen because it has quite a lot of features for creating digital comic sketches. Meanwhile, Canva is devoted to organizing images per page of digital comics that have been completed with the addition of navigation buttons.

After determining the software, proceed with determining the comic format. The

digital comic format developed is A4 paper with a description of the size 210 x 297 mm or 1240 x 1754 pi in PNG (Portable Network Graphics) image format. The next stage is determining the story characters. The story characters are determined to create the storyline in the digital comic with material about human and animal circulatory organs. The digital comic story characters being developed are Dudung, Luna and Merpati. After determining the story characters, we will continue with creating the storyline. The storyline was created by adapting the book theme 4 Health is Important, Sub-theme 1 My Blood Circulation is Healthy, Learning 1 and 2 in the science content. The storyline focuses on the blood circulation of humans and animals including organs, functions, and how human and animal blood circulation works. Students consider the circulatory system to be abstract because they are required to fantasize about the topics discussed(Hidayah et al., 2018).

The final stage of design is making a storyboard, namely translating the storyline that has been created into image form. With an initial sketch on paper to determine the layout of images and text.

3. *Development*(**Development**)

The development stage includes the digital comic production process, media expert validation, material expert validation, and limited group trials. The digital comic production process begins with scanning the images that have been designed. Scanning is carried out to import images into IbisPaintgivenpanels that are characteristic of comics. Panels can convey a story or message if they are aligned with panels after or before according to the storyline(Mataram, 2016).Or in other words, a panel in a comic is a frame that contains the storyline according to the place and time setting. Once the panel has been given, then proceed with thickening the line art with a dip pen with a pen thickness of 1.6 px. Providing line art to facilitate the coloring process so that the colors do not mix with each other. Coloring is done so that the digital comics developed are colorful and

attractive. Bayharti & Novita (2014)stated that cute cartoon images and bright colors would attract students' interest.

After the coloring process, it continuesby providing word balloons and text as stories in digital comics. Word balloons are an illustration element and can be used to place stories or words(Musnur & Faiz, 2019). After this stage, each section of the digital comic is downloaded in PNG format and arranged in the Canva application to add navigation buttons. The final result of the comic is a link that can be shared via digital devices.

The digital comics that have been created are then subjected to validation tests by media experts and material experts. The suitability of the media is seen from the media appearance and presentation. The results of the validation test by media experts in the display aspect were 3.5 in the "decent" category, and in the presentation aspect it was 4.0 in the "decent" category with an overall average result of 3.69 in the "decent" category. The results graph for valThe media expert's opinion is stated in Figure 2.
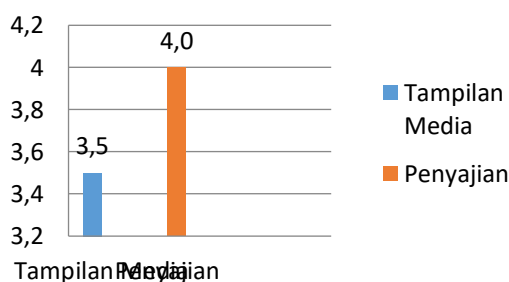

Figure 2. Graphic of Media Expert Validation Results

In material expert validation, the suitability of digital comics is seen from the suitability of the material content, story presentation and comic language. The feasibility results from material experts in the content aspect were 4.4 in the "very feasible" category, the story presentation aspect was 4.3 in the "very appropriate" category, and the linguistic aspect was 4.0 in the "very appropriate" category. Meanwhile the overall average is 4.3 in the "very decent" category. The graphic of material expert validation results is presented in Figure 3.
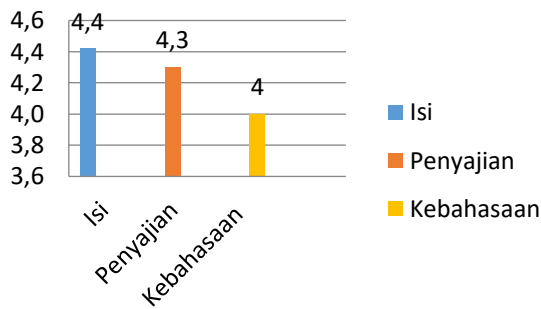
Figure 3. Graphic of Material Expert Validation Results

Assessments from media and material experts state that the digital comic products developed are suitable for use, however there are several suggestions for revisions by validators to improve digital comics. The revisions to digital comics are presented in figures 4, 5, 6, 7, and 8.

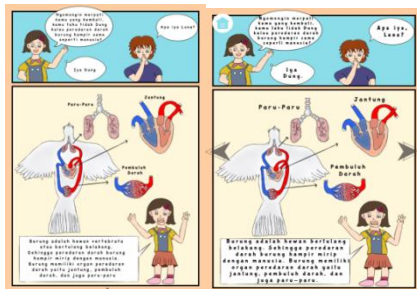**Figure 4.**Display of instructions for using the comic before and after revision.

Figure 5. Comic font display before and after revision.

Figure 6. Display of learning objectives before and after revision.
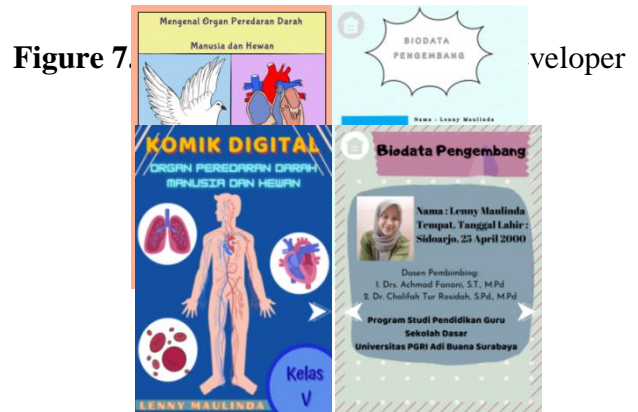
Figure 7. .... veloper

Figure 8. Display of cover layout and developer biodata after revision.

Some results from digital comics about human and animal circulatory organs for fifth grade elementary school students are presented in Figure 9.
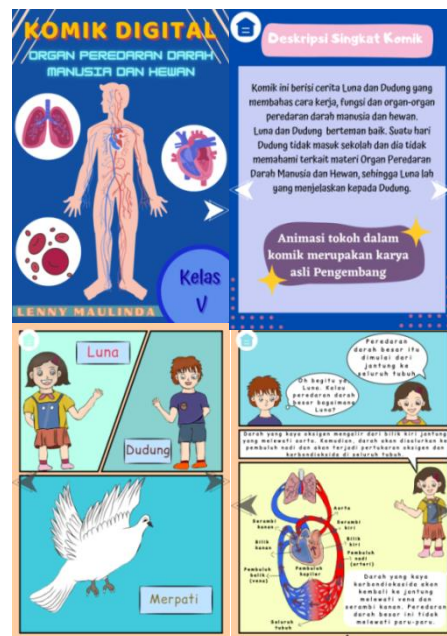

Figure 9. Digital Comic Snippets of Human and Animal Blood Circulatory Organ Material

Based on the results of media expert validation, it was stated that the development of digital comics with material on human and animal circulatory organs is suitable for use. Judging from the aspect of media appearance and presentation, it is good and able to attract students' attention, thereby making students motivated.Suparmi(2018)in his research stated

that comics can help reduce boredom during learning at school. Characters, facial expressions of characters, word balloons, movement lines, backgrounds and panels are good characteristics of comics (Susanti et al., 2021). Susanti's opinion is in line with the results of digital comic development which was carried out in the media display aspect. So digital comic media is suitable for use.In achieving learning objectives, validation of the material must be declared feasible(Betschart; Castro in Rosidah et al., 2022). The feasibility of the material validation test results is seen from the suitability of the material content, the presentation of digital comic stories that are in accordance with the learning objectives which include the ability to understand the organs, functions and workings of the human and animal circulatory system in Theme 4 Health is Important, Subtheme 1 My blood circulation is healthy, Lessons 1 and 2. Students who read are expected to be able to understand the meaning that the author wants to convey so that students will get new information(Ahmat & Sukartiningsih, 2013). In other words, in order for students to understand reading, the language used must be easy for students to understand and not ambiguous. This is in line with the results of the feasibility test of material expert validation on linguistic aspects which is good and does not give rise to double perceptions by students. In this case, digital comics are considered capable of making it easier for students to understand the material on human and animal circulatory organs.

After the digital comic was declared feasible, the next stage was a limited group trial on 10 class V students at SDN Kebondalem Mojosari and class VA teacher Mrs. Heavy Evasari, S.Pd.In this limited trial, it was found that the teacher's response to digital comics about human and animal circulatory organs in class V elementary school students reached 4.84 in the "very good" category. Meanwhile, student responses to the digital comics developed reached 92.2% in the "very good" category. From the results of this trial, the media is very good when used in the learning process in class V elementary school.

Research related to digital comics was carried out by(Wijaya et al., 2020)which is in line with the results of research that has been carried out. Research with the title "Development of Digital Comic Learning Media Based on Indonesian Hero Characters on Blood Circulatory System Material" produces digital comic products that are suitable for use for VIII SMP students with very good material and media validation results.

Furthermore, other research related to digital comics is entitled "Development of Android-Based Biological Comics as Learning Media for Circulatory System Material" which was carried out by(Octaviana et al., 2022)with product results with "very good" criteria by design experts and material experts. In other words, the comic product developed can be used by XI SMA students.

The digital comic material on human and animal circulatory organs that has been developed is considered capable of increasing students' knowledge regarding material on human and animal circulatory organs. The digital comics developed make students more enthusiastic about reading and foster interest in reading. In line with researchSyarifah(2021)that comics can help students understand the material presented in teaching and learning activities. The development of digital comics about human and animal circulatory organs for fifth grade elementary school students can empirically help teachers in teaching material about human and animal circulatory organs, as well as motivate students to study them. In line with researchSiregar & Siregar(2021)that digital comic media in science learning can help teachers convey material to their students and make students more motivated to learn.

CONCLUSION

Based on the research and development carried out, it was concluded that the process of developing digital comics with material on human and animal circulatory organs for fifth grade elementary school students used the ADDIE development model 1) Analyze, 2) Design, 3) Development. The Implement and Evaluate stages are not carried out, so they are limited to the development stage.

The assessment results from media experts reached 3.69 in the appropriate category,

material experts reached 4.3 in the very appropriate category. The teacher response was 4.84 in the very good category and the student response was 92.2% in the very good category. By obtaining these scores, the digital comic media material on human and animal circulatory organs for fifth grade elementary school students is very suitable for use in the learning process.

SUGGESTION

To increase the level of validity of the products that have been developed, it is hoped that other researchers can increase the number of expert validators. Teachers can use the results of this research as a reference source in developing products or other learning media.

THANK-YOU NOTE

The research activities that have been carried out can run because of the collaboration of several parties involved, including:
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