

Digital comics learning media for high school on the human excretory system concept

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Abstract: Learning media is one of the key points in learning activities to achieve the expected goals. Learning media can describe the material clearly, briefly, easily understood, and can be used both in offline and online learning. This study aims to develop a digital comic learning media with the concept of a human excretory system. This study uses the Research and Development method with the ADDIE approach. The instruments in this study include a validation questionnaire, a practicality test sheet, a readability questionnaire, and a student response questionnaire sheet for the developed digital comic learning media. The research data were analyzed quantitatively by calculating the percentage. The results showed that digital comics learning media were valid and suitable to be used as learning media (combined average of 83%). The results of the student response test showed a very good response to digital comic learning media, with a percentage of 84%. So, it can be concluded that this digital comic about the human excretory system can be used as a medium for student learning.

Keywords: Digital comics; excretory system; learning media

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1. Introduction

Learning media is an intermediary to convey concepts in the learning process between teachers and students. The use of learning media impacts student learning success by increasing students' enthusiasm, motivation, conceptual understanding, and skills in using media (Badlisyah & Maghfirah, 2017; Dharmawan & Wahyuni, 2017; Wahyuningtyas & Rosita, 2019; Hamid et al., 2020). The learning media used in studying biology is mainly intended for abstract concepts following the benefits of learning media, namely making abstract concepts concrete (Batubara, 2017; Emda, 2011; Kurniawan, 2013; Sumiharsono & Hasanah, 2018). Media use is also expected to solve students' interest and motivation in studying biology concepts. The use of media in biology learning has not been carried out optimally. The learning objectives are not achieved optimally, which indirectly affects students' interests and learning outcomes (Argarini & Sulistyorini, 2018; Jailani, 2016; Emda, 2011). The not yet optimal use of the media is caused by learning media that is considered complex, inconvenient, and challenging. In addition, there is a thought that the learning process must be severe, while the use of learning media will only waste time because it is considered mere entertainment (Husamah & Pantiwati, 2014; Ikhsan, 2019).

Based on interviews conducted with biology teachers at Madrasah Aliyah Allstiqomah, the learning media used in biology lessons consist of pictures, videos, and kidney torso. However, in the current learning activities dominated by online learning, media use is more limited. The continued use of the same media, namely pictures, powerpoints, and videos, makes students feel bored, resulting in decreased learning

motivation. The limited internet quota is the main reason students cannot watch videos given by the teacher, so learning focuses on using pictures and teacher explanations. Another obstacle was found in students who did not have printed learning resources such as LKS books and textbooks, either due to financial conditions or lack of availability. Therefore, learning media is needed to review the outline of the subject matter and give students enthusiasm so that learning motivation is regained.

Many learning media have been developed, primarily visual media that can complement students' essential experiences when reading, discussing, practicing, and so on (Nurlatipah et al., 2015; Aditya, 2018; Kurniawan et al., 2019; Sari, 2016). Visual media can have a more significant impact on learning (Adittia, 2017; Argarini & Sulistyorini, 2018; Fujiyanto et al., 2016; Haryoko, 2012; Niswatuazzahro et al., 2018; Nurseto, 2012; Pascapurnama et al., 2018). Knowledge obtained by a person through sight reaches 83%, while the ability to remember the knowledge acquired is about 50% of what is seen. This is greater than the knowledge obtained through hearing (Emda, 2011). One visual media overgrowing is comics, which can be published in print and digital form (Siregar et al., 2018). At first, comics were known as light illustrated stories for entertaining reading. However, comics can be used as learning media because they have advantages as picture stories; their effectiveness in learning is also beneficial (Hidayah, 2017).

Learning media contains concepts to be studied; the concept used in this study is the excretion system. The excretory system removes waste products of metabolism that are no longer useful or harmful in the body (Azar et al., 2017). The excretory system also has a central role in homeostasis because it plays a role in waste disposal and water balance. Most of the excretory system produces urine from filtering body fluids (Rosita et al., 2016). The excretory system is an abstract concept, and the process physiology cannot be sensed, so media is needed to study it (Saragih & Tarigan, 2016).

Learning media suitable for the excretion system concept can visualize concepts to make them easier to understand, such as image media. Images can be used to represent an object in overcoming the space and time limits of things or events that are difficult to display in class (Utomo et al., 2020). One form of image media is digital comics. According to the biology teacher at Madrasah Aliyah Al-Istiqomah, no comic learning media has been used or developed at Madrasah Aliyah Al-Istiqomah. The learning media packaged in comics is very interesting and good to apply and can be used even if the learning is done online. Therefore, a study was conducted to develop digital comics on the concept of the excretion system and tested its validity and feasibility as a medium for learning biology.

2. Materials and Methods

This research is a Research and Development (R&D), which is the method used to validate and develop a product (Sugiyono, 2019). Development is carried out using the ADDIE approach, which stands for Analysis, Design, Development, Implementation, and Evaluation which is considered adequate to use and very appropriate to use for developing educational products and other learning resources (Sugiyono, 2019). To save costs, time, and energy, and by journal references, this research is limited to four stages with the following research procedure:

- a. Analysis Phase: Analyzing various things that support research, including needs analysis, student characteristics analysis, curriculum analysis, and concept analysis.
- b. Design Phase: Designing various things needed in making digital comics in the form of compiling research instruments and making comics modified from Art in Nurinayati et al. (2014), the making of the comics is summarized in 3 stages, namely: (1) scenario preparation and sketching; (2) the coloring and text entry; and (3) packaging.
- c. Development Phase: Includes various tests aimed at developing digital comics as expected, performed through validation test, practicality test, and test readability.
- d. Implementation Phase: This is the stage of implementing digital comic media declared suitable for use in learning trials. What is carried out at this stage is a student response test.

This research was conducted in class IX MIPA-1 with 20 sample students. The research location at Madrasah Aliyah Al-Istiqomah, Subang Regency, and carried out in July-August 2021. The data collection technique gives questionnaires to media experts, material experts, teachers, and questionnaires were given to students to assess the readability and response of students to media digital comics learning. The data obtained were then analyzed to define, following the formula (1) and table 1 of category criteria quoted from Utomo et al. (2020).

$$P = \frac{\sum Xi}{\sum Yi} \times 100\% \tag{1}$$

Description:

P: Percentage of the total score sought

Xi: Total score obtained for one aspect/item

Yi: Maximum score for one aspect/item

i: 1, 2, 3 , N

Table 1. Category Criteria

Response Rate	Response Category	Description
76%-100%	Valid	Very good product. ready to be used in the field for learning activities
51%-75%	Quite valid	The product is quite good, can be used by adding things that are lacking
26%-50%	Not valid	The product is not good; revision is carried out by reviewing and looking for product weaknesses
≤ 25%	Invalid	The product is not good; revisions are made massively and fundamentally about the product content

3. Results

3.1. Phases of the Digital Comic Learning Media Development Process

3.1.1. Analysis Phase

a. Needs analysis

This data was obtained from interviews with biology subject teachers at Madrasah Aliyah Al-Istiqomah. The results obtained include 1) Learning is mainly done online, so direct learning media use is reduced. The teacher also thinks that digital comics learning media will be very good if applied in learning. Comics are an engaging new learning media in biology learning. 2) In learning the excretory system, media focuses on the main concepts to be conveyed (organs and abnormalities in the excretory system)

The data were obtained from 16 students of class XI MIPA Madrasah Aliyah Al-Istiqomah. The data obtained are presented in percentage form in Table 2 below.

Table 2. Student Characteristics Data

Aspect	Percentage
Learning support	81%
Discipline	76%
Activity	81%
Understanding	82%
Resonsibility	72%

c. Curriculum analysis

The curriculum used at Madrasah Aliyah Al-Istiqomah is the revised 2013 curriculum. However, along with the emergency curriculum, Madrasah Aliyah Al-Istiqomah

also implemented several changes, namely the delivery of material on the focus of meaningful discussions, the time allocation was 3x25 minutes, and learning was carried out online and face-to-face (offline). The material developed in the learning media is the excretory system in humans with basic competence (KD) limited to KD 3.8 with KKO analysis.

d. Concept analysis

The material of organs and abnormalities of the excretory system were analyzed by concept to determine the type of concept. The results of the concept analysis can be seen in [Table 3](#).

Table 3. Concept Analysis

Concept label	Concept type
Excretory system	Abstract
Excretory organ	Abstract
Urine formation process	Abstract
Diseases and disorders	Abstract

The description material organ and abnormalities of the excretory system are adjusted to the fundamental competencies (KD) used so that indicators of competency achievement (IPK) and learning objectives are obtained.

3.1.2. Design Phase

At the design phase, research instruments and products were obtained. The instruments arranged are validation sheets, practicality test sheets, readability tests, and student response questionnaires. The data on the manufacture of digital communication products are described at each stage, namely as follows.

a. Scenario preparation and sketching

At this stage, scenarios and comic sketches are produced, in which seven characters are used, namely Ms. Zahra, Ziva, Kenan, Anisa, Kevin, Rahma, and Aldi. The scenario is made into seven chapters with a panel number of 6-13. This comic uses row panels combined with diagonal panels. The scenarios are arranged sequentially with the material as follows.

- 1) Chapter 1: Are the kidneys the central organ of the excretory system?
- 2) Chapter 2: Why are the lungs part of the excretory system?
- 3) Chapter 3: Why is the skin part of the excretory system?
- 4) Chapter 4: Why is the liver part of the excretory system?
- 5) Chapter 5: How do the kidneys form urine?
- 6) Chapter 6: What are the most common diseases related to the excretory system?
- 7) Chapter 7: What technologies are used regarding the excretory system?

The scenario is made in a sketch by starting with a rough sketch manually. The final sketch is thickening using pen drawing sizes 0.4, and 0.2 then scanned using the CamScanner application into JPG form. The end of this stage is a digital image that has been cleaned through the IbisPaintX application.

b. Coloring and text entry

Coloring is done using the IbisPaintX application with consistent colors for each character and place. Text input is done using the PicsayPro application, and text is entered using various types of letters according to the needs of the dialogue, namely Serif Italic, Comic, Daniel, and Foo fonts. The font size used is nine except for specific places and circumstances with 12.

The size and type of text balloons are adapted to the scene. In this comic, the text balloons used are a square shape for narration quotes and descriptions, a circle shape for conversation, a wavy shape for thinking activities, a circle shape with dotted lines to communicate, and a polygon shape with pointed sides for emotional speech such as anger and shock.

c. Packaging

The last comic packaging is in pdf format with 62 pages, namely five pages of description, seven covers for each chapter, and 50 pages of dialogue between characters. The following is an excretory system comic packaging sequence.

- 1) Cover of Excretion system comic
- 2) KD, IPK, and learning objectives
- 3) Description of characters and how to read comics
- 4) Chapter 1-7 Excretory system
- 5) Back cover of Excretory system comic


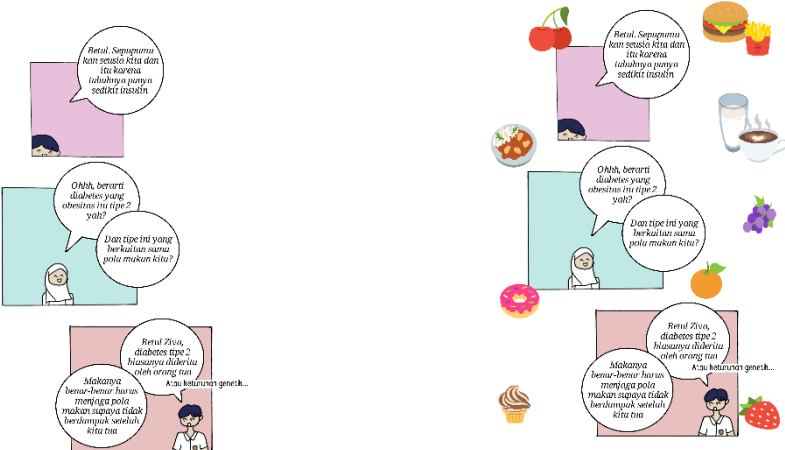
3.1.3. Development Phase

Validation data were obtained from material expert validators, media experts, and biology teachers who stated that the digital comic learning media was very good and valid with few revisions. Revise suggestions from material expert validators by adding pictures on page 47, chapter 6, because the panel contains the least amount of content. Media expert revisions were cover improvements, the addition of structural images, and infographics. These improvements are presented in Table 4.

Practical test data were obtained from biology subject teachers with very good results and valid criteria and were not revised. The advice given is that it is hoped that the creation of digital comics will be improved. Readability test data were obtained from 12 students with very good and valid results, and no revision was needed. The comments and suggestions obtained are pictures and letters that are visible and easy to read and understand. In this readability, there are obstacles during the research, namely from reading devices with different screen sizes and obstacles related to how to read comics, especially for those who are not used to reading comics who are still confused about the location of the image column and the order of the text balloons.

At the development stage, there were several improvements to the developed e-comic. The first fix is to add a background or image on a blank page (page 47, chapter 6). Panels with little dialogue (no images or backgrounds) are added with images of various foods related to the discussion in the dialogue. The second improvement is revising the cover by including the author's name. The third improvement is the addition of an image of the kidney structure. The last thing to add is the creation of an infographic with bits and pieces of comic chapters. The summary in the infographic is divided into four points according to the number of competency achievement indicators and related chapters. Before and after the revision can be seen in Table 4 below.

Table 4. Revision of Digital Comic Learning Media

Before Revision	After Revision
 <p>Panel 1: <i>Batal. Sayangnya hari senesio kita dan itu karena tabungnya mepin sedikit tressin</i></p> <p>Panel 2: <i>Ohh, berarti diabetes yang obesitas itu tipe 2 ya?</i> <i>Dan tipe ini yang ber kaitan sama pola makan kita?</i></p> <p>Panel 3: <i>Batal Zico, diabetes tipe 2 biasanya diherita oleh orang tua. Atau keturunan genetik... Maksudnya bener-bener harus pnyakit polid maken supaya tidak berdarah? sebetul, kita tau</i></p>	 <p>Panel 1: <i>Batal. Sayangnya hari senesio kita dan itu karena tabungnya mepin sedikit tressin</i></p> <p>Panel 2: <i>Ohh, berarti diabetes yang obesitas itu tipe 2 ya?</i> <i>Dan tipe ini yang ber kaitan sama pola makan kita?</i></p> <p>Panel 3: <i>Batal Zico, diabetes tipe 2 biasanya diherita oleh orang tua. Atau keturunan genetik... Maksudnya bener-bener harus pnyakit polid maken supaya tidak berdarah? sebetul, kita tau</i></p>

Before Revision

After Revision



GAMBAR

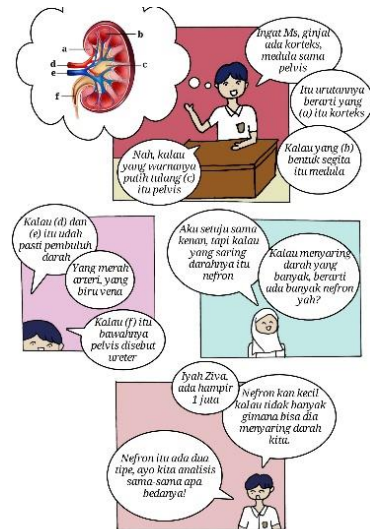
Intan Nur Agustini

SKENARIO

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TATA LETAK

Intan Nur Agustini



3.1.4. Implementation Phase

The test results of student responses in class XI MIPA-1 (20 students) were in the very good category without any additions or improvements. This media could be used in a broader scale implementation. Short learning of excretory system material is done by reading and acting as characters in comics. There are comments and suggestions given, namely very good pictures. The material presented is easy to understand, concise, detailed, and concise with detailed pictures, and the media is legible. These results follow the learning media needed by students, namely media that clearly explain the material accompanied by pictures.

3.2. Feasibility of Digital Comic Learning Media

3.2.1. Validation Test

Validation data obtained from three validators stated that the digital comic learning media on the excretory system material was very valid, the average value shown in [Table 5](#).

Table 5. Validation data of digital comic

Aspect	Percentage (%)	Category
Material validation	84	Valid
Media validation	75	Quite valid
Biology teacher validation	85	Valid
Combined Presentation	81	Valid

More specifically, from each aspect of the assessment, it can be seen that the value of the material expert validation test shows varying values ([Figure 1](#)). The media expert's validation results showed the same value in all aspects with a value of 75% ([Figure 2](#)), and the biology teacher's validation showed very diverse values ([Figure 3](#)).

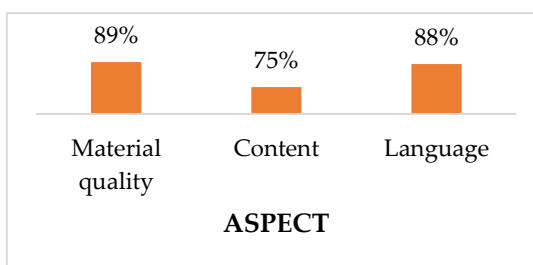


Figure 1. Material expert validation test results

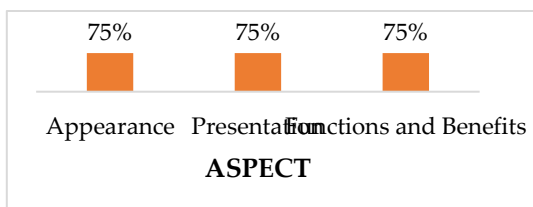


Figure 2. Media expert validation test scores

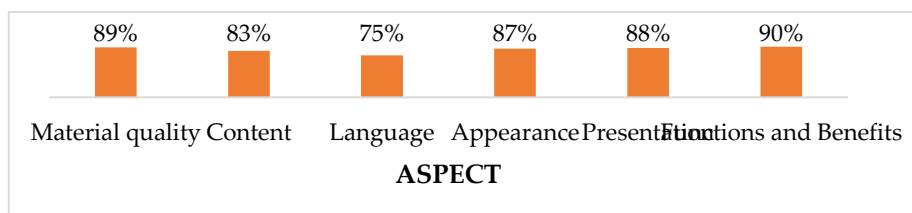


Figure 3. Biology teacher validation test scores

Learning media is said to be feasible if the results of the analysis are by predetermined criteria. Based on the decision table, digital comic learning media products are ready for learning activities without revisions.

3.2.2. Practicality Test

The results of the practicality test conducted by the biology teacher showed that the category was very good or valid, and there were no revisions. The aspects of this practicality test are almost the same as other tests, including media, material, and presentation, but they refer more to practicality in their use (Figure 4).

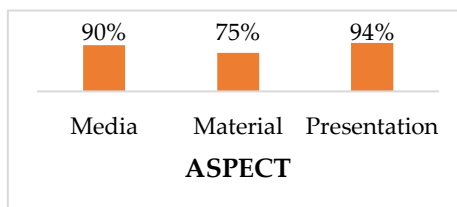


Figure 4. Practicality test scores

3.2.3. Readability Test

Readability test data were obtained from the responses of 12 students from class XI MIPA Madrasah Aliyah Al-Istiqomah with very good results (valid), and nothing had to be revised. The readability test aims to get the feasibility value from the student's point of view through the readability aspect by Figure 5.

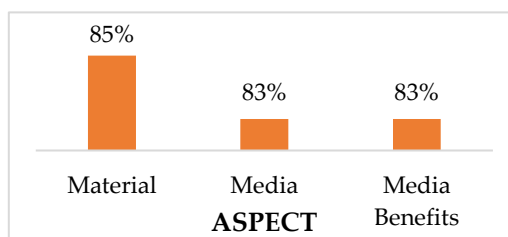


Figure 5. Readability test scores

3.3. Student Response to Digital Comic Learning Media

Student response data were obtained from 20 students of class XI MIPA regarding their responses to digital comics. The responses were converted into quantitative data, which showed that the students' responses were very good, with an average percentage of 84%. The average is obtained from various aspects. The data from the test results of student responses in each aspect can be seen in Figure 6.

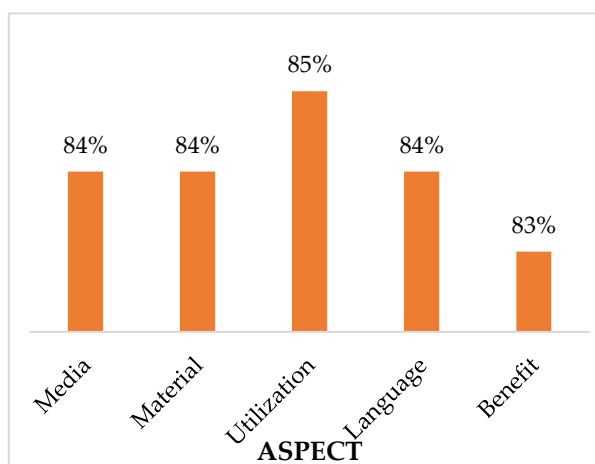


Figure 6. Student response scores

4. Discussion

4.1. Phases of the Digital Comic Learning Media Development Process

4.1.1. Analysis Phase

The development of digital comics has been developed according to the proper stages, namely through ADDIE with four stages. Utomo et al. (2020), said that the learning media developed and used must be by the needs of students, curriculum and competencies, and the times. In the analysis phase, it was obtained that the media that was appropriate to the situation and needs must be suitable for students. Students still do not understand the material presented even though they already have supporting textbooks; most of them expect easy-to-understand learning by presenting explicit material and accompanied by pictures. This is because the media used namely video, cannot be adequately accessed due to limited resources. This situation relates to the percentage of discipline and responsibility, which are the two lowest percentages of the other aspects (Table 2). Learning with fewer resources and inaccessible media causes other aspects, namely aspects of understanding and activeness, affected. The curriculum must also be considered because it is related to learning objectives. Madrasah Aliyah Al-Istiqomah applies a curriculum of special conditions that free schools to change learning policies about the national curriculum. The central policy is that learning is not done entirely online but also face-to-face (offline).

The concept used in the development of this e-comic media is the concept of a human excretory system with basic competence (KD) limited to KD 3.8. Dharmawan (2017) reveal that the use of visual media is necessary because biology contains many abstract concepts and phenomena that require observation, as shown in the results of the concept analysis in Table 3. According to Roosita et al (2017) Excretory system material is also one of the materials that are difficult to understand with many sub-chapters. Based on the concept analysis (Table 3), organ material and disorders have abstract concept types, but technology discussions have concrete concept types. Even so, referring to Hamid et al (2020) the discussion of excretory system technology is intended to overcome the limitations of space, time, energy, and senses because they cannot be observed directly.

Of course, the results of this analysis have different results from previous studies because of the differences in the conditions in terms of needs, student character, materials, and the curriculum used. Different schools also have different needs and environments, while the current curriculum is still in particular conditions.

4.1.2. Design Phase

The design stage is the stage of instrument preparation and product manufacture. The instruments are prepared, equipped with objectives, descriptions of how to fill in the instruments, and statements on the instruments arranged according to their aspects. The creation of digital comic media includes the preparation of scenarios and sketches, coloring and text entry, and packaging. Scenario making is the basis for making comic sketches, scenarios represent each scene that will be made into a story, then comic sketches are ready to enter the coloring stage. Batubara (2020) states that scenario creation is the initial stage of comic design which must determine goals and targets which can be in the form of learning topics, target readers, characters in comics, background locations, etc. This digital comic raises the topic of the excretory system with the target audience being students of class XI MIPA Madrasah Aliyah Al-Istiqomah. The characters in the comics consist of teachers and students, the background of the comics, the topics of learning in comics, and the way comics are discussed per chapter referring to basic competencies, indicators of competency achievement, and predetermined learning objectives.

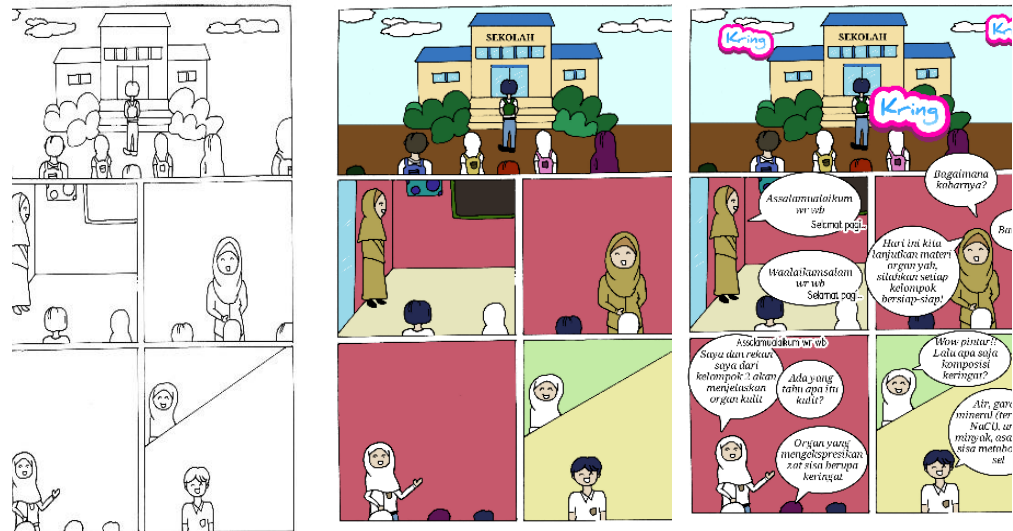


Figure 7. The phase of Digital Comic Making

The process of making a sketch begins with the creation of a neemu which is done manually using the row panel (Figure 7). In some scenes, the comic panels are not filled. This can be seen from the scenes and dialogues on the panels. The flow of reading comics is the same, namely from left to right and scrolling from top to bottom. The coloring process is carried out after the sketch is complete; background coloring in each dialogue scene takes a relatively long time, so the only color is added. The coloring is wholly followed by text entry using the PicSayPro application. The text entered can be in the form of dialogue, quotes, and descriptions. The type and size of the letters used vary, but specifically for dialogue, Serif Italic font size 9. The use of other letters is adjusted to the conditions and functions in the image. The size and type of text balloons are adjusted to the dialogue scene. Batubara (2020) stated that there are many choices of text balloons, including text balloons for normal speaking, whispering, talking silently or thinking, shouting, voice communication tools, sad or grumbling dialogue, and text balloons for narrative description, situation, place, and time. The final packaging of the comics is a pdf, which is packaged sequentially from chapters 1-7.

Packaging comics in pdf form is the same as packaging books which consist of three parts, as stated by Siregar (2018), which consists of the introduction, description, and closing. Comics are converted to pdf using the Cam-Scanner app. There are no significant changes in terms of size, clarity, color, and writing on each comic panel. Comic images can also be easily rearranged using the "manual order" option. The downside of using CamScanner without paying is the footer with the CamScanner logo on every comic page. The design stage of making comics is, the same in every study, namely the presence of scenarios, sketches, text entry, and packaging. However, there are differences in the stages and frameworks, the applications used, and the final packaging of the digital comics developed.

4.1.3. Development Phase

The development of digital comics is carried out by correcting various aspects that are still lacking. The development test in each study has the same goal, namely developing comics based on the suggestions for improvement obtained. Comments and other suggestions are not improvements in terms of material or media, but suggestions in developing comics to improve comic creations. This is undoubtedly true because comics have various creations when viewed from relevant studies. These creations can be in the form of packaging creations such as in Utomo et al. (2020), packaged in the form of an Android-based interactive comic and retrieval by Nurinayati et al. (2014), who adds quizzes and is packaged into a book with an exe file type. Even so, comics in pdf form still positively impact

their use in learning. As a result, media use attracts students' attention and increases their enthusiasm for learning. Another response is that the pictures and letters are visible and easy to read and understand. This means that the size and type of font used do not experience problems and can be said to be correct, even though the font size is nine small for a book, but it is not a problem for comics in the form of pdf.

4.1.3. Implementation Phase

Testing responses to 20 respondents have carried out implementation, but at the implementation stage, it was comprehensive. Implementation can be in the form of trials with several classes or with various objectives, such as to find out the increase in motivation and other variables. In each study, the number of respondents is a sample which, of course, varies according to the population in the study. In the research of [Utomo et al. \(2020\)](#), the implementation phase was carried out by testing the responses of students and teachers. However, limited response trials were only conducted on students in this study. At the implementation stage, excellent results were obtained without any additions or improvements so that this media could be used on a broader implementation scale. Improvement decisions are, of course, obtained from comments and suggestions that do not indicate suggestions for improving materials or media and their benefits in learning. The comments stated that digital comics have been able to attract attention in learning; the material presented is easy to understand, concise, and detailed with pictures. This is by the need to learn media at the analysis stage, which states that media that clearly describes the material accompanied by pictures.

3.2. Feasibility of Digital Comic Learning Media

The feasibility of digital comic media is taken from three tests, namely the validation test, practicality test, and readability test. In the validation test based on Table 3, the average percentage obtained from material experts, media experts, and biology teachers shows that digital comics are feasible and valid to use with a value of 81%. The remaining 19% of the validation results stated that they were still lacking or not yet valid. This became the focus because parts still needed to be improved, such as image placement, background, and cover display. Solutions that can be given are improving the background by adding images, adjusting image placement, and improving the description on the comic cover.

Practicality tests are carried out by users such as lecturers. Because this research was conducted at the SMA/MA level, the users were biology subject teachers. Based on the graph ([Figure 4](#)), the practicality test aspect got different results, but the lowest was in the material aspect, which was 75%. The average percentage obtained is very good (86%) with a valid category and ready for learning activities without revisions. The remaining 14% stated that comics still lacked creativity. Solutions that can be provided are by interactively packing comics or packaging in exe form [Nurinayati et al., \(2014\)](#).

The last feasibility test is the readability test to find out the difficulties experienced when using the media. Based on its function related to validation, [Sukmadinata \(2012\)](#) revealed that a macro feasibility value can be obtained through a readability test. This is because the feasibility is also taken from the responses of media users. Based on the graph ([Figure 5](#)), the average percentage of the feasibility test is 84% which is classified as very good (valid category). The remaining percentage (16%) stated that comics are still lacking because of reading difficulties related to the display on mobile phones with small screens. The solution that can be given for the display on the screen is to use a pdf opening application that provides a zoom feature so that the display can be enlarged. Besides that, it can also increase the font size ([Utomo et al, 2020](#)).

Assessing the feasibility of digital comics as learning media is done by calculating the average for each test ([Nurinayati et al, 2014](#)). Thus, in this study, the average obtained from material validation, media validation, biology teacher validation, practicality, and legibility are 83%, meaning that digital comic learning media is valid, so it is very feasible to be used in learning activities.

3.3. Student Response to Digital Comic Learning Media

Student responses were obtained from 20 responses from class XI MIPA-1 students. Based on the graph (Figure 6), data from various aspects got varying percentages but still above 80%, so the average obtained was very good (84%), which indicated that the media digital comic learning received a very positive response. The remaining 16% stated that there were still deficiencies or invalids because this comic media was not sufficient to support good learning as a whole. Hence, the solution that can be given is to use additional media that can complement these deficiencies, such as video media. According to L

Limbong & Simarmata (2020), video media can help present material and alternatives in the learning process. The positive response obtained shows that digital comics have acted according to their functions and benefits, from functions and benefits. As a visual medium, digital comics have fulfilled the function of attention and effectiveness. Irwandani & Juariah (2016) revealed that attention is attracting and directing students' attention to focus on the material presented. The effective function is to foster students' enthusiasm when reading illustrated texts. In terms of benefits, which refers to Hamid et al. (2020), digital comics already have the benefit of helping the learning process and increasing enthusiasm and interaction between students, of course also overcoming the limitations of space and time.

5. Conclusions

Digital comic learning media for excretory system material has been developed following the ADDIE method through the analysis, design, development, and implementation stages. The feasibility of digital comics from the assessment of media experts, material experts, biology teachers, teacher practicality, and student readability scores 83% with valid categories at the highest level of validity. Student responses to digital comics learning media on the excretory system material received a positive response with a very good percentage of 84%.

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