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# DEVELOPMENT OF COMIC MEDIA BASED ON PROJECT-BASED LEARNING (PJBL) TO IMPROVE SCIENCE LITERACY IN JUNIOR HIGH SCHOOL

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**Abstract :**
This research is a development of comic media based on Project Based Learning (PjBL) which is motivated by the lack of variation of learning media in improving students' scientific literacy. This study aims to determine the validity, practicality, and effectiveness of comic learning media based on Project Based Learning (PjBL) on the digestive system sub-material. This research and development uses the R & D development model with ADDIE research procedures. Data analysis techniques in this study include analysis of the validity of comic media before the media is used in learning with a validity sheet instrument from an expert validator's assessment, analysis of the practicality of comic media related to students' views on comic media used in learning through student response questionnaire instruments, and analysis of the effectiveness of comic media related to improving students' scientific literacy results from the scientific literacy test instrument conducted at the beginning and at the end of learning (pretest and posttest). The results of the study indicate that the learning media is categorized as very feasible, very practical, and effective with n-gain scores that show high criteria. Based on the results of this study, the development of comic learning media based on Project Based Learning (PjBL) can be an alternative innovative media in improving the scientific literacy of eighth grade junior high school students.

Keywords: Comics, digestive system, Project Based Learning, science literacy.

**Abstrak:**
Penelitian ini merupakan pengembangan media komik berbasis *Project Based Learning* (PjBL) yang dilatarbelakangi oleh minimnya variasi media pembelajaran dalam meningkatkan literasi sains siswa. Penelitian ini bertujuan untuk mengetahui validitas, kepraktisan, dan efektivitas media pembelajaran komik berbasis *Project Based Learning* (PjBL) pada sub materi sistem pencernaan. Penelitian dan pengembangan ini menggunakan model pengembangan R & D dengan prosedur penelitian ADDIE. Teknik analisis data dalam penelitian ini meliputi analisis validitas media komik sebelum media digunakan dalam pembelajaran dengan instrumen lembar validitas dari penilaian validator ahli, analisis kepraktisan media komik terkait pandangan siswa terhadap media komik yang digunakan dalam pembelajaran melalui insrumen angket respon siswa, dan analisis keefektifan media komik terkait peningkatan literasi sains siswa hasil dari instrumen tes literasi sains yang dilakukan di awal dan di akhir pembelajaran (*pretest* dan *posttest)*. Hasil penelitian menunjukkan bahwa media pembelajaran dikategorikan sangat layak, sangat praktis, dan efektif dengan skor *n-gain* yang menunjukkan kriteria tinggi. Berdasarkan hasil penelitian ini pengembangan media pembelajaran komik berbasis *Project Based Learning* (PjBL) dapat menjadi alternatif media inovatif dalam meningkatkan literasi sains siswa kelas VIII SMP.

Kata kunci: Komik, literasi sains, *Project Based Learning*, sistem pencernaan.

## INTRODUCTION

Natural science (science) is a complex subject. Science instruction in schools often does not fully optimize students' scientific literacy. Science learning is still dominated by conventional approaches, such as lectures and memorization of concepts. This type of learning often makes students less interested and engaged in science learning (Parisu et al., 2025). Educators need tools that facilitate and support the continuity of the learning process to ensure students can master the material presented (Ramadhani et al., 2021). As a means of supporting classroom learning, innovative learning media are needed to arouse interest, educate, deepen students' knowledge, and enable smoother interactions between educators and students, so that learning can be more effective and efficient (Kasih et al., 2022). Innovative learning media are used in learning to improve students' scientific literacy (Lina, 2024).

The TIMSS (Trends in International Mathematics and Science Study) survey results in 2018, Indonesia ranked sixth from the bottom or 74th (Habibah & Amaniatul'Ulya, 2024). In December 2023, PISA released the latest data showing that Indonesia ranked 11th from the bottom in literacy, and 15th from the bottom in science (Isnaeni & Sa'diyah, 2024). The Indonesian Student Competency Assessment (AKSI) showed that the majority of students were categorized as lacking in reading and science skills (Dayantri & Nasution, 2024). Based on the results of the survey related to scientific literacy, which is part of 16 skills, it was categorized as very low among Indonesian students (Handayani et al., 2024).

Based on the results of observations at SMP Negeri 26 Banjarmasin during the teaching assistance process and interviews with science teachers, obstacles were found in learning, namely the science material presented was full of writing, had to be understood, and memorized by students in science textbooks as companion books for students in the learning process or activities. As a result, students became passive and less interested in reading science materials. In addition to causing a lack of scientific literacy in students, this shows that the variety of learning media applied in science learning activities is still minimal. Students expect more interesting learning media, for example those containing many images or interesting activities. A solution that can be implemented is to develop learning media in the form of science learning comics based on Project Based Learning (PjBL) to improve the scientific literacy of grade VIII junior high school students.

The above facts also refer to research conducted by Khotijah (2023), Magfiroh (2023), Pradana (2020), Purwaristi (2024), and Kristyowati (2020) which developed and tested the feasibility of learning media in the form of comic books to improve students' scientific literacy. The results showed that the development of learning media in the form of comics was proven to be feasible, easy to use (practical), and effective in improving students' scientific literacy. The difference between previous research and the research conducted is in the learning media developed, namely comic media based on Project Based Learning (PjBL), the material in the comics is adapted to the material being taught, namely the digestive system, and the integration of projects in learning related to making creative posters. The Project Based Learning (PjBL) model and question and answer methods, group discussions, projects, and presentations in the learning process.

The problem of low student scientific literacy is caused by factors such as the condition of facilities and infrastructure, as well as the selection of learning methods and models, including learning media (Ristiani & Malichatin, 2023). Scientific content, processes, and applications are the focus of assessing student understanding in scientific literacy (Priyangga et al., 2023). Learning media in the form of comics are composed of art that forms a storyline from the use of images arranged in such a way. The advantages of comics for learning include being able to improve scientific literacy, helping students remember material longer, and facilitating understanding of the material due to the illustrations (Puyanti et al., 2023). Comic learning media is not only part of the media that has the potential to provide students with insight into understanding learning materials but is also an effective and efficient method (Muhaimin et al., 2023). This is also why comic media is used before the completion step of project creation. Students read the comic first to understand the material in it, then work on the project in the comic (Panglipur et al., 2024).

The appropriate learning approach required is the application of the Project-Based Learning (PjBL) approach. This model can realize everything in a visual representation depicted in two dimensions, allowing students to express their thoughts during learning. This innovative learning approach or method emphasizes contextual learning through a series of complex activities, known as Project-Based Learning (Halawa, 2021).

The digestive system is a focus of science teaching in eighth-grade junior high schools, using the Project-Based Learning (PjBL) approach. This topic covers the digestive process, the parts of the digestive system, and their functions (Syavira, 2021). The digestive system encompasses abstract material because the digestive process in the body cannot be observed with the naked eye. To help students understand this material clearly, researchers chose to use comics as a learning aid. Comics about the digestive system enable students to recognize the shape of the digestive organs through illustrations, helping students not only memorize but also grasp the material well (Hayati & Hermita, 2022). Therefore, this study aims to describe the feasibility of developing comic media based on Project Based Learning (PjBL) in improving scientific literacy for grade VIII junior high school students.

## METHODS

This research took place at SMP Negeri 26 Banjarmasin, located at Jl. A. Yani KM.2.5 No. 180, Sungai Baru, Banjarmasin Tengah District, Banjarmasin City, South Kalimantan 70122. The sample consisted of 28 students from grade VIII-B at SMP Negeri 26 Banjarmasin. The instruments used in this study were a validation sheet to measure the validity of the teaching modules and learning media, a student response questionnaire, and a scientific literacy test. The student response questionnaire and scientific literacy test were used at the beginning and end of the lesson, as pre-test and post-test sheets.

The trial design involved administering treatment to one group. Prior to the treatment, the initial research activity included administering a science literacy test (pretest). A posttest was then administered afterward. This is related to the one-group pretest-posttest design, with the aim of testing the results of the media development. The research design is shown in Table 1.

**Table 1.** Trial design

| Pretest | Treatment | Posttest |
|---|---|---|
| $O_1$ | X | $O_2$ |

Description:
$O_1$ = Pretest
X = Treatment
$O_2$ = Posttest

This research is a Research and Development (R&D) development study using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The analysis stage involved performance analysis and needs analysis to analyze problems, generate appropriate solutions, and determine student competencies. The design stage included specific competency planning, product design, learning media, and relevant learning strategies. The development stage involves producing and validating products that will be implemented in learning programs. Validity sheets are used to collect data related to validator assessments and responses regarding the comic learning media being developed, as well as to collect and calculate data from validity tests that influence the final results of the media being developed.

The data was analyzed using calculations from expert validation assessments related to validity scores using the product feasibility formula:

$$\text{Score} = \frac{Total\ score\ awarded}{Total\ score\ overall} \text{ x } 100\%$$

The validity results of the figures obtained are adjusted based on the criteria listed and explained in Table 2.

**Table 2.** Product eligibility criteria

| Average validator value | Category | Description |
|---|---|---|
| 1% – 50% | Not suitable | Must not be used |
| 51% – 70% | Less suitable | Should not be used, needs major revision |

| Average validator value | Category | Description |
|---|---|---|
| 71% – 85% | Suitable | Can be used with minor revisions |
| 85% – 100% | Very suitable | Very good to use |

(Akbar, 2013)

The next stage, the implementation phase, involves implementing the learning program by implementing the product and involving students. This study used a student response questionnaire to determine students' responses and views regarding the comic learning media used in the learning process. The questionnaire contained statements to determine the practicality of the learning media.

Test the practicality of the content using calculations:

$$PK = \frac{Total\ score\ of\ data\ collection\ results}{Criteria\ score} \times 100\%$$

Description:
PK = Percentage of practicality (%)
Criteria score = Total maximum practicality score

The following percentage adjustments are based on the criteria.

**Table 3.** Overall student response categories

| No. | Percentage | Category |
|---|---|---|
| 1. | 76 – 100% | Very Practical |
| 2. | 51 – 75% | Practical |
| 3. | 26 – 50% | Less Practical |
| 4. | 0 – 25% | Not Practical |

(Akbar, 2013)

This study used a pre-test and post-test at the beginning and end of the lesson. The purpose of this study was to determine the extent to which students' scientific literacy improved after using project-based learning (PjBL)-based comic media development products for the digestive system.

The N-Gain statistical test provides a general comparison of learning activity scores before and after the application of Project Based Learning-based comic media. The N-Gain test formula is as follows.

$$\text{N-Gain} = \frac{Post\ Test\ score - Pre\ Test\ score}{Ideal\ score - Pre\ Test\ score}$$

To determine how much the pretest and posttest scores have developed, the following is the scope of the N-Gain scores shown in Table 4.

**Table 4.** N-Gain score category

| N-Gain Score | Category |
|---|---|
| N-Gain > 0,7 | High |
| 0,3 ≤ N-Gain ≤ 0,7 | Medium |
| N-Gain < 0,3 | Low |

(Hake, 1999)

Finally, at the evaluation stage, evaluate the quality of the product and the learning process, before and after implementation.

**RESULTS AND DISCUSSION**

The results of the research and development model stages include Analysis, Design, Development, Implementation, and Evaluation. The results of the analysis phase were project-based learning comic media for the digestive system, based on the performance and needs analysis conducted previously. Initial data collection was based on observations during teaching assistance activities and interviews with science teachers. Researchers conducted observations and were given the opportunity to directly observe the learning activities carried out by the science teacher and to conduct teaching activities in grades VIII-B. This allowed them to identify student challenges in the learning process.

Students were observed to be more enthusiastic about learning using the provided learning media than the lecture method. Students engaged in learning activities both in groups and individually related to the provided learning media, leading them to expect the learning media and activities to be engaging and enjoyable. This indicates a lack of variety in learning media.

After the teaching and learning activities in class, the science teacher emphasized the need for students to read before presenting the learning material to familiarize themselves with the material. The researchers implemented this principle by observing several students who showed a lack of interest in reading and were less active during question-and-answer sessions. This also indicates low literacy levels among students. The researchers also asked several questions related to the science teacher's presentation regarding what happened during the learning process and addressed the issues they had encountered and addressed during the teaching assistance activities to ensure and identify any remaining issues. These questions were conducted both face-to-face at school and online via WhatsApp.

The results of observations and interviews with science teachers at SMP Negeri 26 Banjarmasin are as follows:

a) Learning in grade VIII is based on the Merdeka Curriculum.
b) Teaching materials implemented in the learning process include science textbooks under the Merdeka Curriculum and student worksheets (LKS).
c) The methods used by educators when presenting science material include lectures, assignments, and discussions.
d) Learning media are still not varied.
e) Low student literacy.

A possible solution is to develop learning media, specifically comics based on project-based learning. In addition to being an engaging learning medium, comics include project activities to encourage student engagement. This could also be an effective option to support or improve student science literacy. This is supported by the fact that comics have never been used in the teaching and learning process at SMP Negeri 26 Banjarmasin. The formative evaluation process, starting with the analysis stage, requires a solution in the form of developing engaging learning media, namely project-based comics using question-and-answer methods, group discussions, projects, and presentations, which are expected to improve students' scientific literacy.

The next stage, after collecting the primary materials needed by the researcher, which serve as reading materials and references, becomes the main stage in creating learning media, such as a syllabus related to learning outcomes for the human digestive system and textbooks related to the material to be included in the comic.

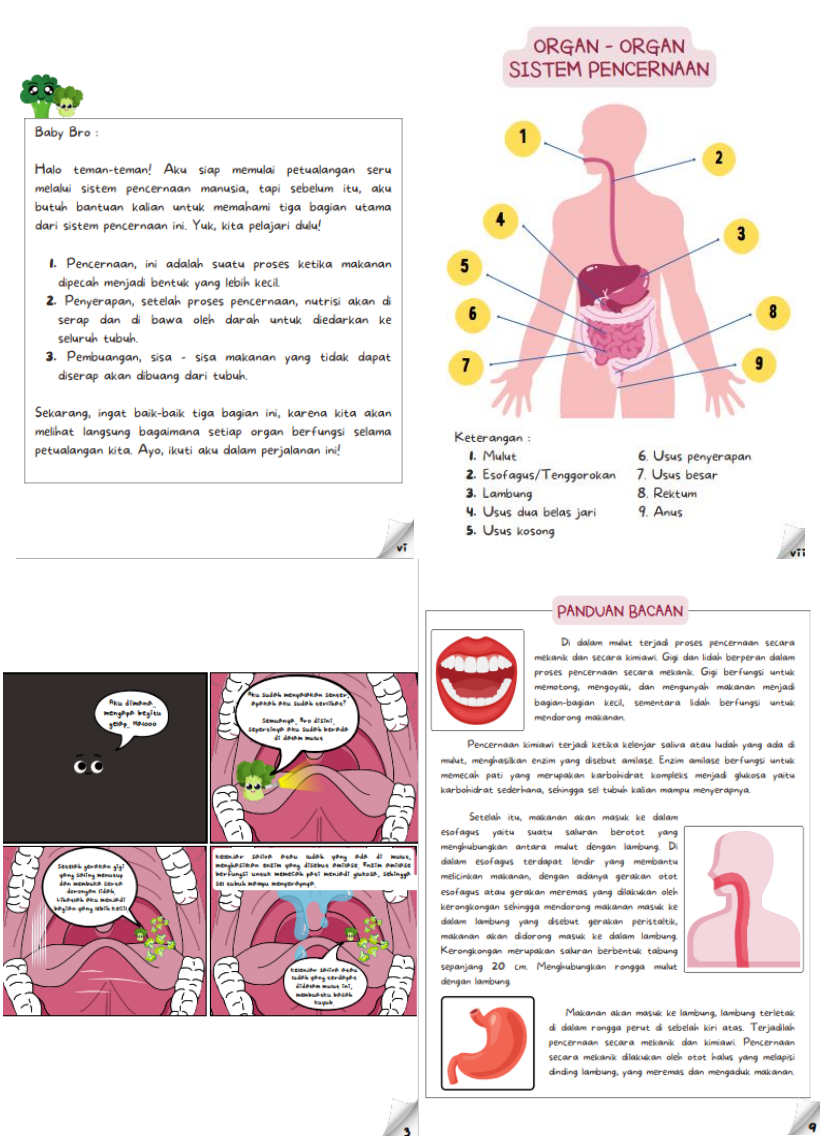


**Figure 1.** Comic Book Content

This resulted in a plan for the media format that encompasses the objectives, goals, and material to be included in the comic. Evaluation during the design stage also required references from teaching materials, such as textbooks used to determine the student competencies to be achieved, and the syllabus used as the basis for planning the learning process, which was also aligned with the curriculum.

The development stage, after the research instruments were prepared, required the product to be developed and the instruments to be tested to determine whether they were suitable or valid for use in learning. The validation results for the project-based learning comic media were obtained from three expert validators with an average validation score of 86.79% (very suitable). The expert validation results are shown in Table 5.

**Table 5.** Results of the validity of learning media

| Validator | Validation Questionnaire | Total Score | Maximum Score | Percentage | Category |
|---|---|---|---|---|---|
| 1 | Teaching modules and media | 146 | 156 | 93,59% | (Very suitable) |
| | Student response questionnaire | 31 | 32 | 96,87% | (Very suitable) |
| | Test instruments | 35 | 40 | 87,5% | (Very suitable) |
| 2 | Teaching modules and media | 136 | 156 | 87,18% | (Very suitable) |

| Validator | Validation Questionnaire | Total Score | Maximum Score | Percentage | Category |
|---|---|---|---|---|---|
| | Student response questionnaire | 25 | 32 | 78,12% | (suitable)) |
| | Test instruments | 30 | 40 | 75% | (suitable)) |
| 3 | Teaching modules and media | 139 | 156 | 89,10% | (Very suitable) |
| | Student response questionnaire | 30 | 32 | 93,75% | (Very suitable) |
| | Test instruments | 32 | 40 | 80% | (suitable)) |
| | **Average** | | | 86,79% | (Very suitable) |

This research is relevant to Khotijah (2023) research, where the validation results for the learning media were categorized as very feasible. Similarly, Purwaristi (2024) research found that comics can be used as a learning medium to improve students' scientific literacy in the classroom.

In line with Darniyanti et al (2021) statement, the designed comic media was categorized as valid after improvements were made based on the opinions and recommendations of the validator. Several aspects that need to be measured include content, material, and language, which can be considered valid. This PjBL-based comic learning media is suitable for use as a learning tool in the classroom because it aligns with learning outcomes and objectives. The language used is simple and practical for students to learn. The comic design is very attractive and the colors used are also appealing. Therefore, PjBL-based comic media is sufficiently engaging to improve students' scientific literacy (Salsabila et al., 2024).

Evaluation at the development stage of the validation results was categorized as very feasible, and improvements were made to the developed comic media based on suggestions provided or requested by the validator.

The effectiveness of the comic media development was then tested based on the student science literacy test instrument. The science literacy test used a pretest and posttest. The results of the effectiveness of the learning media on student learning outcomes obtained an overall average n-gain score of 0.71, which means it is included in the high criteria. Learning outcomes are included in the high criteria if the value is more than 0.7 or N-Gain > 0.7. The pretest and posttest applied the N-Gain formula calculated using the SPSS application as shown in Table 6.

**Table 6.** Results of the effectiveness of learning media

**Descriptive Statistics**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Ngain_Score | 26 | -1.00 | 1.00 | .7176 | .44144 |
| Ngain_persen | 26 | -100.00 | 100.00 | 71.7582 | 44.14366 |
| Valid N (listwise) | 26 | | | | |

The N-gain results table obtained through analysis using the SPSS application provides an overview of improvements based on a comparison between pretest and posttest scores. The N-gain calculation based on scientific literacy indicators using the application is shown in Table 7.

**Table 7.** N-gain results for each scientific literacy indicator

| No. Question Item | Scientific Literacy Indicator | Pre-test Average | Post-test Average | N-gain Average | Category |
|---|---|---|---|---|---|
| 1 & 2 | Explain phenomena scientifically. | 67,86 | 85,71 | 0,5555 | Medium |
| 3 & 4 | Evaluate and design scientific investigations. | 69,64 | 94,64 | 0,8235 | High |
| 5 & 6 | Interpret scientific evidence and data. | 60,71 | 89,28 | 0,7273 | High |

| No. Question Item | Scientific Literacy Indicator | Pre-test Average | Post-test Average | N-gain Average | Category |
|---|---|---|---|---|---|
| 7 & 8 | Analyze and interpret data to draw sound conclusions. | 73,21 | 92,86 | 0,7333 | High |
| 9 | Nature of science: Interest in scientific issues. | 75 | 96,43 | 0,8571 | High |
| 10 | Nature of science: Support for inquiry activities. | 50 | 89,29 | 0,7857 | High |

Comic-based learning media based on Project-Based Learning (PjBL) has been shown to significantly improve students' scientific literacy and make learning more enjoyable. This research is relevant to Magfiroh (2023) study, which found that students' scientific literacy improved after being taught using science comics. This demonstrates that science comics are quite effective in teaching within the learning domain. Similarly, Pradana (2020) research found that the use of developed comics effectively impacted students' scientific literacy. The conclusion was that students' scientific literacy improved after implementing Project-Based Learning (PjBL) comics.

In line with Emilia et al (2022) statement, learning media is defined as a tool applied by teachers to deliver material to students throughout the teaching and learning process. The media applied is expected to stimulate students' thinking processes, feelings, focus, and learning potential, thus optimizing teaching and learning activities. Appropriate learning media are expected to help students understand and comprehend the material. Learning success depends not only on the media but also on the learning model implemented by the teacher. The selection of an appropriate model is thought to influence the effectiveness of the learning process. The learning media, in the form of Project-Based Learning (PjBL) comics for the digestive system, aims to increase the effectiveness of material comprehension.

Following this, the practicality of developing the PjBL-based comic book media was assessed using a student response questionnaire. Upon completion, in the final meeting, students completed a questionnaire assessing the use of project-based learning comic books. Regarding the student response questionnaire, good learning media is, of course, easy to use. The overall assessment of the PjBL-based comic book learning media was good, and the developed learning media met the criteria of being very practical. This practicality resulted in an average score of 90.65%, as shown in Table 8.

**Table 8.** Practical results of learning media

| No. | Aspect | Indicator | Number of items | No. of items | Total score | Maximum score | Percentage | Category |
|---|---|---|---|---|---|---|---|---|
| 1. | Learning Media | Ease of use<br>Attractivenes<br>Accuracy of learning media | 3 | 1,2,3 | 314 | 336 | 93,45% | Very Practical |
| 2. | Materials | Accuracy of content<br>Language | 3 | 6,8,9 | 299 | 336 | 88,99% | Very Practical |
| 3. | Benefits | Interest<br>Learning motivation | 4 | 4,5,7, 10 | 401 | 448 | 89,51% | Very Practical |
| | | **Average** | | | | | **90,65%** | Very Practical |

This research is relevant to Kristyowati (2020) research, which found that comics are suitable for use in science literacy teaching and learning activities, and student responses to comics demonstrated

positive outcomes. This is in line with Putro & Setyadi (2022) statement that students consider learning tools related to understandable and easy-to-use material in the field as prerequisites for practical media. Evaluation results at the implementation stage demonstrated that the comic media, developed from student-administered test instruments, improved students' scientific literacy. Practicality was categorized as very practical, with several student criticisms and suggestions regarding the developed comic media.

The resulting comic media contains principles that can be implemented in learning activities. The material in the comic, adapted to the subject matter taught, namely the digestive system, supports PjBL-based learning. Starting with the problem statement, the problem presented is to differentiate the digestive system, which consists of organs classified into three main groups: digestion, absorption, and excretion, based on their functions. The comic then presents a visualization of the concept, outlining the processes or organs within the digestive system, linking the learning material to real life and providing a more contextualized approach. This project continued with the creation of a poster on differentiating the organs of the digestive system based on their functions, featuring images of the organs and explanations of the related processes.

The research demonstrated the strength of the Project-Based Learning (PjBL)-based comic media developed, which offers an engaging alternative learning medium that teachers can utilize to improve students' scientific literacy. This comic also provides opportunities for students to learn through simpler visualizations, making complex material easier to understand. Furthermore, this research can serve as a reference for other researchers in further developing similar products. However, this research still has limitations, particularly in the visual aspects, which are not fully optimized. For example, the use of color and design details still need to be improved due to the limited supporting applications used. The content is also limited, both in terms of depth of information and the variety of characters and stories presented. Some explanations in the comic are also not detailed, such as those regarding the detailed functions of certain organs.

The final evaluation (summative) was carried out based on the results of the data analysis that had been carried out. This study showed that the PJBL-based comic media was appropriate or met the eligibility requirements, succeeded in achieving the objectives that had been formulated, namely producing valid, effective, and practical comic media as a learning tool and succeeded in answering the problems presented in the background and problem formulation.

## CONCLUSION AND SUGGESTION

Based on the research results, it can be concluded that the development of comic media based on Project Based Learning (PjBL) in science learning on the digestive system sub-topic for eighth grade junior high school students is declared feasible, practical, and effective. In addition to being an interesting learning medium, comic media contains project activities to support students to be more active. This can also be another effective option to support or improve scientific literacy in students. The applied learning media needs to convey material that is able to stimulate the thinking process, feelings, focus, and learning potential of students so that teaching and learning activities become more optimal. Appropriate learning media, students are expected to understand and comprehend the discussion. Learning success depends not only on the media, but also on the learning model implemented. However, this study still has limitations, especially in the visual aspects and depth of the material that can be continuously developed. Therefore, further researchers suggest refining the visual design of the comic to make it more attractive, adding more detailed characters and storylines to make the media richer in information, enriching the material with additional content and more detailed illustrations so that the resulting media becomes more optimal in supporting learning.

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