



# Development of Science Handouts Based on Critical Thinking Skills on the Topic of the Human Digestive System

Ai Sulastri<sup>1\*</sup>, Badruzsaufari<sup>1</sup>, Dharmono<sup>1</sup>, Mohamad Nor Aufa<sup>1</sup>, Muhammad Aditya Saputra<sup>1</sup>

<sup>1</sup>Science Education Study Program PPs Lambung Mangkurat University, Banjarmasin, Indonesia

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**Abstract:** Improving the achievement of competencies which are indicators in the study of the quality of education in Indonesia, can be done by procuring quality and innovative teaching materials. This study aims to develop a science learning handout on the human digestive system to improve critical thinking skills for class VIII SMP. Development is done by (Educational Design Research). This study aims to develop a science learning handout on the human digestive system to improve critical thinking skills for class VIII SMP. This article describes the results of the validity and practicality of science learning handouts on the human digestive system. The instrument used in this study was a validity and practicality questionnaire. Data analysis techniques include descriptive data analysis, validation sheets, and questionnaires. The handout validation sheet is given to 5 validators. Instead, 31 grade VIII students of SMP Negeri 5 Banjarmasin were given practice sheets. The results of the validity questionnaire analysis concluded that the validity of the handout was 3.67 very valid categories. Practicality test of content average of 87.41 was obtained in the very practical category. The results of the practicality test of expectations average of 87.78 in the very practical category. Finally, the actual practicality test results average of 85.65 with a very practical category. This means that science handouts are valid and practical in the learning process to practice critical thinking skills.

**Keywords:** Handout; Critical thinking skill; Validity and practicality

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## Introduction

Critical thinking skills are part of cognitive skills (knowledge) and are competencies in the Framework for 21st Century Learning. According to the 21st Century Learning Framework, critical thinking skills are abilities students need to acquire expertise and skills in a particular discipline. Critical thinking is also defined as solving problems, applying and using concepts; freedom of thought, use of knowledge and responsibility to make decisions; overcoming bias, fanaticism; thinking to make decisions, interpreting of problems; thinking based on skills and responsibilities that lead to assessments based on criteria and sensitive to problems (Ennis 2011; Zivkovic 2016). In addition,

critical thinking skills can train students to get used to scientific thinking to solve problems in everyday life (Caceres et al., 2020).

The results of previous studies indicate that the category of critical thinking skills of junior high school students is still low because they do not have the facilities to develop critical thinking skills due to the lack of textbooks or books that can support students to develop their critical thinking skills. In addition, most students are still not used to solving critical thinking skills questions because the questions are usually in the application or below. Although several questions are at levels analysis, evaluation, and creation, they are not the biggest problem in solving these problems (Daniati et al. 2018; Martawijaya 2015).

\* Corresponding Author: [aisulastriulm@gmail.com](mailto:aisulastriulm@gmail.com)

The topic of science (Biology) lessons at the junior high school level consists of facts, concepts, principles, and procedures systematically organized about humans and their natural surroundings. Facts, ideas, regulations, and techniques are discovered through the scientific method. One of the topics taught in science (Biology) learning is the human digestive system, introduced to class VIII semester, one student. The human digestive system is a complex process that breaks down and decomposes organic matter into tiny particles that the body uses as energy. This process involves the body's organs in the digestive system, such as the mouth, esophagus, stomach, small intestine, large intestine, and the final disposal channel (anus). The material for the digestive system in humans was chosen in this development research because the learning process carried out so far has not paid attention to the activities of students, so that student activity is not optimal and tends to only memorize and because "Human Digestive System" is an abstract lesson.

An alternative in practicing critical thinking skills in the science learning process is to use teaching materials in the form of handouts in the learning process. The user can be practical because the handout contains summaries of the material to immediately find out the essential parts of the material being studied (Fajarianingtyas, Akbar, and Herowati 2019; Prastowo 2012). The results showed that using handouts in the learning process could improve critical thinking skills and problem-solving skills (Khotimah and Hastuti 2021; Sumarni and Badruzsauhari 2020).

This is reinforced by the results of interviews with several science teachers and students at SMPN 5 Banjarmasin that there is still a lack of teaching materials in the form of handouts prepared by teachers to fulfill the requirements to train the demands of the 21st century, especially critical thinking skills because they are still having difficulties in making and developing these handouts. Furthermore, the research regarding teacher evaluations of textbooks ranges from 33% to 66%, so there is still a need for improvement. Furthermore, the teaching materials used have included critical thinking skills when introducing the material but have not covered all critical thinking skills (Makhrus et al., 2018). In addition, the results research show several causes of difficulty in learning science for junior high school/MTs students, including: (1) Difficulty understanding school manuals by 35.76%; (2) Lack of learning media The proportion is 10.22%; (3) The proportion of other book resources that are not sufficient is 5.84% (Sari et al., 2019).

The product criteria (mode) developed must meet valid, practical, and effective requirements (McKenney and Reeves 2014). This also applies to the science handout on the human digestive system, which was developed to train the critical thinking skills of class VIII

junior high school students to be feasible by fulfilling aspects of validity, practicality, and effectiveness. This research is the first step in fulfilling the feasibility and practicality aspects of the developed handout, namely the fulfillment of validity with aspects of language, content, and presentation and practicality of student responses. After the science handout on the human digestive system is valid and practical, it can theoretically test the effectiveness of the science handout on the topic of the human digestive system, which was developed to train critical thinking skills for class VIII junior high school students.

## Method

This type of research is education development research or Education Design Research (EDR). Educational Design Research is systematic research in designing, developing, and evaluating educational interventions (such as plans, learning strategies, teaching materials, products, and systems) to solve existing problems (McKenney and Reeves, 2014). The population in this study were students of class VIII SMP, while the research sample was students of SMP Negeri 5 Banjarmasin. Sampling using non-probability sampling with purposive sampling technique. The validators in this study consisted of three lecturers from Lambung Mangkurat University and two science teachers from SMP Negeri 5 Banjarmasin.

Data collection techniques were carried out through documentation, walkthroughs, and questionnaires. This documentation aims to collect various supporting documents to develop science handouts. The walkthrough is the evaluation stage of the validator to determine the validity of the science handout in terms of content, language, and presentation. Finally, a practicality questionnaire will be given to nine students to determine student assessments to identify possible errors such as poor grammar, wrong spelling, punctuation, unclear instructions, material system, ease of use, attractiveness, and student satisfaction.

The data analysis technique consisted of descriptive data analysis, validation, and questionnaire. Descriptive data analysis was carried out by analyzing the data collected from the validation sheet and questionnaire documentation. Data analysis of validation sheets and questionnaires was carried out by processing the values obtained at the expert validation stage and product practicality testing. A formula can determine the validity of the science handout. Namely the score obtained is divided by the total score (overall) 4 times and converted to Table 1. While the formula can determine the practicality of the handout, the score obtained is divided by the total score. (total) multiplied by 100 and converted to Table 2 (Akbar, 2013)

**Table 1.** Validity Criteria

Interval	Validation
3.25 < V ≤ 4.00	Very valid
2.50 < V ≤ 3.25	Valid
1.75 < V ≤ 2.50	Less valid
1.00 ≤ V ≤ 1.75	Invalid

**Table 2.** Practicality Criteria

Interval	Practicality
P ≥ 85%	Very practical
70% ≤ P < 85%	Practical
50% ≤ P < 70%	Less Practical
P < 50%	Inpractical

**Result and Discussion**

This research produces science handouts to practice critical thinking skills. This study focuses on the validity and practicality of science handouts. The Science Handout was developed by the three main stages of Educational Development Research (EDR), namely the preliminary stage (analysis stage), the product design stage, and the formative evaluation stage (Tessmer 1993). The validity and practicality of the science handouts will be obtained by evaluating the validators and student responses. Validators perform correctness to verify all content, language, and presentation aspects. Simultaneously practicality is proven by asking students' opinions in a questionnaire.

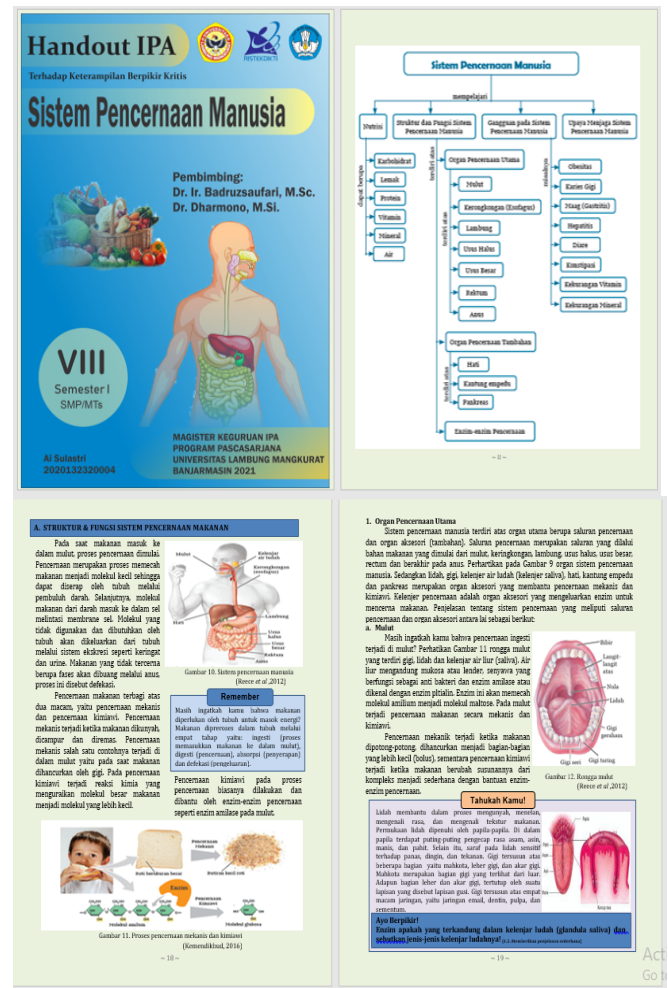
**Table 3.** The average results of the validation

Assessment indicator	Average
<b>Content aspects</b>	
Suitability of material with KI, KD, and IPK	3.60
Material accuracy	3.70
Supporting learning materials	3.56
Material finesse	3.80
<b>Presentation aspects</b>	
Presentation Technique	3.80
Serving Support	3.83
Presentation of Learning	3.40
Completeness of Serving	3.53
<b>Aspects of language</b>	
Straightforward	3.82
Communicative	3.64
Dialogue and interactive	3.80
Suitability with the level of development of students	3.62
Cluster and coherence of thought lines	3.80
Use of terms, symbols or icons	3.60

The results of the validation state that the development of a science handout on the topic of the human digestive system to train critical thinking skills for class VIII SMP is feasible in terms of validity based on aspects of language, content, and presentation. The results of the validity of the handouts can be seen in Table 3.

Based on Table 3. The average results of the validation of the science handouts on the topic of the human digestive system have very valid criteria. These results indicate that the developed science handouts are generally in the very valid category to be used in learning after going through the revision stage according to suggestions and input from the validator.

The results of developing a science handout on the topic of the human digestive system to practice critical thinking skills for class VIII SMP can be seen in Figure 1.



**Figure 1.** The results of the development of the science handout

The following is Figure 2 of the average results of the validation of the science handout on the topic of the human digestive system to practice critical thinking skills for class VIII SMP based on aspects of language, content, and presentation.

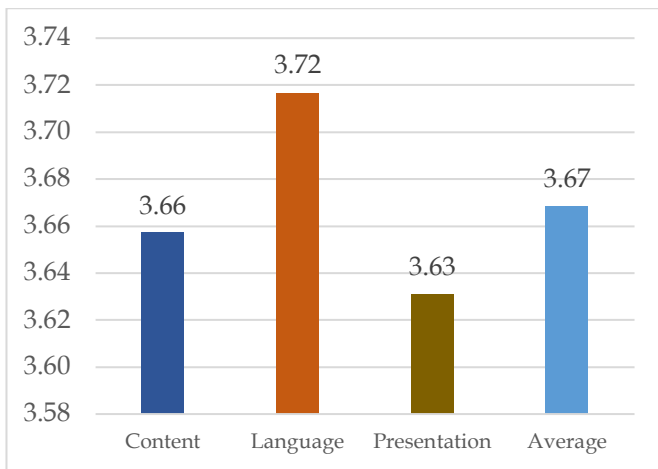


Figure 2. Average science handout validity results

Based on the analysis of the validity results, it is known that the validity value of the natural science handout is 3.67, with a very valid category. Even though it is in the very valid category, several parts of the handout need to be improved, such as the learning objectives and adding questions according to critical skills indicators for each piece of information in the form of " Did you know. The results of this study are in line with research (Dewi and Afrizon n.d.; Isdianti, Erman, and Nasrudin 2021; Shofwunnada, Nirwana, and Hakim 2018; Sudarsana, Sarwanto, and Marzuki 2021) which states that quality learning handouts are feasible to use. Besides that, the science handouts can be tested for practicality and effectiveness in the learning process.

The science handout on the topic of the human digestive system to train critical thinking skills for class VIII SMP students, which is already very valid based on the validator's assessment, is then tested for the practicality of content to 3 students, the practicality of expectations to 9 students and actual practicality to 31 students. The results of practical content, expectations, and actual can be seen in Table 3-5.

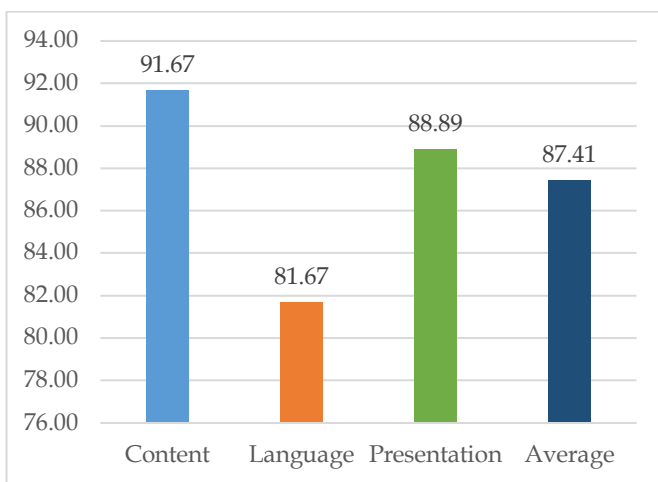


Figure 3. Average results of the practicality of contents

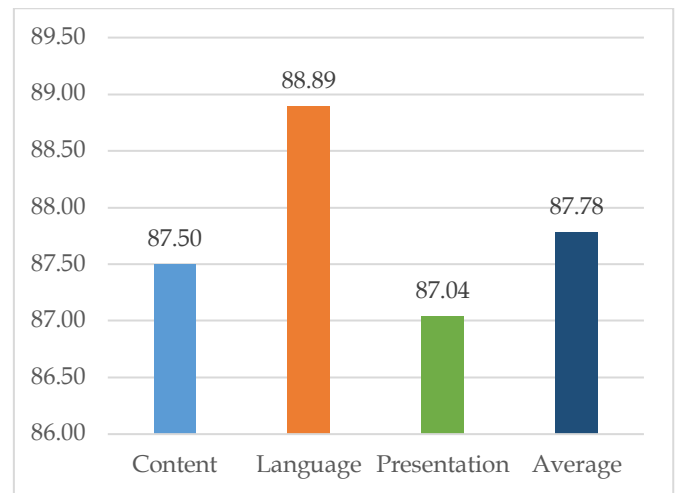


Figure 4. Average results of the practicality of expectations

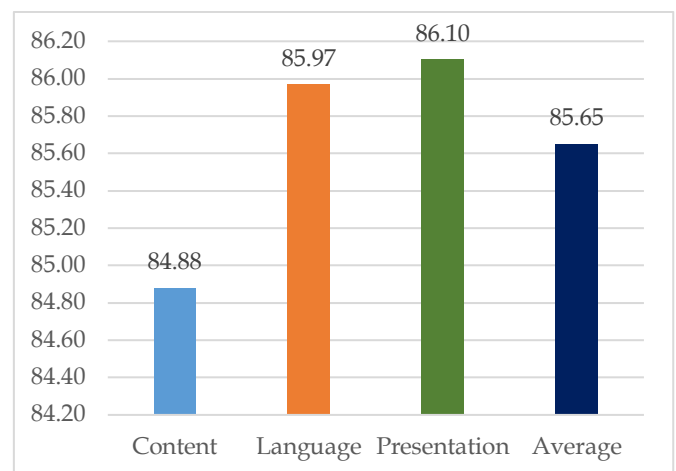


Figure 5. Average results of the practicality of actual

Based on the content practicality test, an average of 87.41 was obtained in the very practical category. The results of the practicality test of hope got an average of 87.78 in the very practical category. Finally, the actual practicality test results obtained an average of 85.65 with a very practical category. Therefore, the science handout that was developed based on the results of the practicality questionnaire can be used in the science learning process for class VIII SMP. This is in line with the results of previous studies which state that if the handout gets an average score in the practical/very practical category, it can be used in the learning process (Nerita, Maizeli, and Afza 2017; Rahmatsyah and Dwiningsih 2021; Saqdiyah, Armiami, and Yerizon 2018).

### Conclusion

Based on the results of the research that has been done, it can be concluded that the science handout on the topic of the human digestive system to practice critical thinking skills has validity and practicality based on validator and student assessments so that the handout

can be used in the learning process to see its effectiveness in practicing critical thinking skills.

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