



Literature Review of the Development of UKBM Teaching Materials on Human Circulatory System Material Based on Physics

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Abstract: Teaching materials commonly used in science learning include visual, audiovisual, and interactive multimedia teaching materials. The research design is a review of journals published in Sinta 2016-2021 with categories Sinta 6 to Sinta 2. The final result obtained is that there are 24 journals regarding the development of teaching materials. Teaching materials that have been developed include printed and digital teaching materials. Print teaching materials in the form of books, modules and comics. Digital teaching materials in the form of virtual reading rooms, videos and interactive CDs. Based on the SWOT analysis that has been carried out, there are weaknesses in the teaching materials that have been developed, namely they cannot be applied to independent learning without a teacher and are limited to material whose phenomena are easily observed by students. For this reason, UKBM (Independent Learning Activity Unit) teaching materials are very appropriate for students to study independently without a teacher. In addition, material for the circulatory system based on physics in this UKBM teaching material can help students understand abstract concepts that students cannot observe directly.

Keywords: Literature review; The human circulatory system; Teaching materials; UKBM

Introduction

Science learning covers three fields of science, namely physics, chemistry and biology. Through science learning, students are trained to be able to develop knowledge through the phenomena around them (Brandstetter et al., 2017). Along with technological developments, science learning also uses technological assistance to make it easier for students to understand concepts (Daston et al., 2017). However, there are several events where students cannot sense directly. So innovative teaching materials can help students understand the meaning of abstract concepts during the learning process (Retnowati, 2018). Learning tools are the key to learning activities in the classroom (Depdiknas, 2008). Learning tools include syllabus, lesson plans, learning media, teaching materials, learning resources, assessment instruments and scenarios of learning activities (Permendikbud, 2016).

In interviews with science teachers at State Junior High School 8 Malang, the development of learning tools is always carried out before learning as a guide for the teacher in the classroom. Teaching materials are used in learning at all levels, from elementary school to university. Teaching materials can be utilized by teachers in knowing how far the development of students' abilities during the learning process. Teachers have the authority to choose teaching materials used in learning, use publisher teaching materials with standard features or use teaching materials produced by teachers (MOEC, 2016). Teaching materials that have been developed and used by teachers vary according to class needs. Teaching materials commonly used in learning include UKBM, posters, brochures, leaflets, worksheets, books, handouts and modules (Al-Tabany, 2014).

Teaching materials can be combined with learning models and strategies according to class needs. In addition, teaching materials are also developed by the teacher according to the learning objectives that have

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been developed, for example as a means to improve critical thinking skills, creative and scientific literacy. UKBM is one of the components in learning tools that can be used by students in achieving completeness of Core Competencies and Basic Competencies individually (Kemendikbud, 2016). According to Piaget's developmental theory, the age of junior high school children is a transition from the concrete thinking stage to the formal thinking stage (Santrock, 2008). For this reason, UKBM is usually combined with several learning models that can train students' activeness and independence in class through Discovery Learning, Inquiry Learning, Problem Based Learning, and Project Based Learning (Markhus et al., 2019). UKBM can be developed based on the needs of the material that will be taught by the teacher, for example material on the human circulatory system. This material is considered as material that is difficult for students to understand, because it cannot be seen directly the process of blood circulation in the human body. In addition, teaching materials on the circulatory system that have been developed are still mostly focused on biology alone, while physics is not available yet. In learning natural sciences, material on the circulatory system should be explained more comprehensively than biology, physics, and chemistry if possible. During a pandemic, students must study from home so they cannot be accompanied directly by the teacher. For this reason, this research was conducted to map the development of UKBM teaching materials that had been carried out. In addition, it is also to find out the advantages and disadvantages related to teaching materials that have been developed and used by teachers. So that it can be used by teachers as learning to improve future learning. Analysis of literature studies is needed to get a more detailed view of the development trends of teaching materials produced by teachers (Chang et al., 2010).

Method

Literature review presents search results regarding a study that can be used as a topic for further research. Literature review was conducted with a focus on original articles containing abstracts, introductions, methods and results. An article search was carried out on the Sinta database with the keywords developing teaching materials, UKBM and circulatory system material. Journal data criteria used include:

- 1) Journals published within the 2016-2020 timeframe.
- 2) Journal data obtained through <https://sinta.ristekbrin.go.id/>
- 3) The data used is in the form of journals related to teaching materials and circulatory system material.

Result and Discussion

Science learning is presented in an integrated form between the fields of chemistry, physics and biology through events that often occur in students' daily lives (Yustiqvar, 2019). But in reality there are several events that cannot be sensed directly by students. This concept becomes abstract for students. For this reason, teaching materials are used to help students understand the meaning of abstract concepts. Based on the results of the literature review, there were 24 journals regarding the development of teaching materials in the 2016-2021 publication period with a distribution of Sinta 6 to Sinta 2.

The development of science teaching materials was carried out from junior high school to university levels. Teaching materials that are widely used when learning science are in the form of print and digital. Printed teaching materials are combined with class needs, for example by using certain learning models (eg scientific, guided inquiry, discovery learning, problem based learning), based on science process skills, contextual, socio scientific issues, constructivism, learning cycle (LC), advanced organizer SETS vision, so that it is integrated with Islamic values. Many printed teaching materials have been developed in the form of books and comics. Digital teaching materials contain audio and visual content to make it easier for students to understand a concept. These teaching materials are aligned with the needs and characteristics of students, so that the objectives of developing teaching materials are diverse such as improving metacognition skills, critical thinking skills, science process skills, creative thinking skills, scientific literacy, attitudes and learning achievement, understanding concepts to student learning outcomes. Teaching materials are presented in print and digital form for a wider range of access. Printed teaching materials are presented in the form of books and comics. Trends in teaching materials used in learning can be seen in Figure 1.

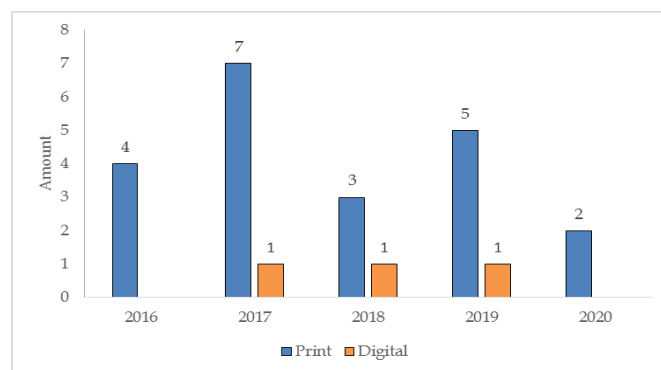


Figure 1. Trends in Teaching Materials in Learning

Figure 1 shows that the most developed trend of teaching materials in the 2016-2020 range is printed

teaching materials. Print and digital teaching materials are developed using certain development methods. The methods used in developing teaching materials can be seen in Table 1.

Table 1. Methods of Developing Teaching Materials

Method	Amount
R&D	9
4D	5
ADDIE	3
Quasi experiment	2
Fenrich's instructional development cycle	1
Experiment	1
Dick and Carey	1
Quantitative description	1
Not explained	1

In Table 1, the most widely used method for developing teaching materials is the R&D method. Printed teaching materials used in learning are in the form of books and comics. Digital teaching materials in the form of virtual reading rooms, videos and interactive CDs. Teaching materials are developed to support science, physics, chemistry and biology learning. The percentage of teaching materials developed in learning can be seen in Figure 2.

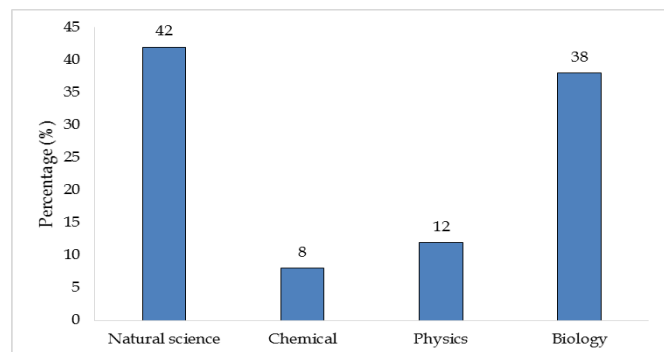


Figure 2. Percentage of Teaching Materials in Learning

Figure 2 shows the print and digital teaching materials that have been most developed to support science, biology, physics and chemistry learning. Based on the review of the article above, a SWOT analysis can be carried out on the teaching materials that have been developed. The following is a SWOT analysis of teaching materials that have been developed so far:

Strength

- Help achieve learning goals.
- Can be adapted to the needs of the class.
- Using many learning models.
- In the form of print and digital so as to increase the motivation and quality of student learning.
- Can be used by teachers in training certain skills, for example critical thinking skills, communication skills and creative thinking skills.

- Students' knowledge of physics increases after reading texts in teaching materials.
- Improving students' ability to understand problems seen from the perspective of physics.

Weakness

- Cannot be used for students to study independently without teacher direction.
- Focus on developing material concepts whose events are easily observed by students.

Opportunity

- Make learning not teacher-centered but student-centered.
- Students are more active in learning.
- Teachers can use different learning methods.
- Students can associate phenomena in teaching materials with abstract concepts in physics.
- Students can associate phenomena in teaching materials with the laws of physics.

Threat

- Passive students in learning cannot absorb knowledge optimally.
- Passive students in learning cannot associate phenomena in teaching materials with abstract concepts in physics.
- Limited internet access by students.

Based on the results of the SWOT analysis that has been carried out, there are several weaknesses in the teaching materials that have been developed. These weaknesses are that students cannot use them to study independently without being accompanied by a teacher and development only focuses on material concepts whose events are easily observed by students. Even though the teaching materials developed should stimulate student activity. So that it can strive for learning that focuses on student learning activities (Faisal et al., 2019).

The main focus in learning science is to make students understand scientific concepts obtained from scientific knowledge. One of the materials in natural science that contains an abstract concept is the circulatory system. Where students cannot observe directly the phenomena that occur in the circulatory system. The circulatory system is an organ system that functions to distribute substances throughout the body (Nurharyani et al., 2015). The main organs or components in the circulatory system are the heart, blood vessels and blood. Knowledge about the characteristics of each component of the circulatory system cannot be observed directly by students. For example, knowledge about the causes of differences in human blood groups will be difficult for students to understand if only seen from a biological point of view.

Because this difference is caused by the presence or absence of protein molecules called antigens and antibodies which can be observed using tools that apply the laws of physics (Amsalu et al., 2019).

For this reason, learning the circulatory system in terms of physics is needed to make it easier for students to imagine the meaning in each abstract concept. Circulatory system material can be associated with the concept of physics, namely fluids. The workings of the heart and blood flow can be related to the field of physics studies, namely Bernoulli's law. When blood flows, the oxygen supply for every cell of the body is fulfilled and humans can move. Judging from the study of physics, students should be able to relate blood circulation with flow events flowing in pipes. Students can associate their knowledge with observable/perceptible disorders of blood circulation such as Anemia, Thalassemia, Leukemia, Hemophilia, Stroke, and heart attack (Retnowati, 2018). So that students can map knowledge about the causes of circulatory disorders. After that, students can formulate ways to maintain and prevent disorders related to human blood circulation. From these problems there is one solution, namely learning using UKBM teaching materials.

UKBM stands for Independent Learning Activity Unit which is arranged systematically so as to enable students with different learning speeds to study independently without a teacher (Kemdikbud, 2017). UKBM can be presented in print or digital form according to student needs (Hermawan, 2019). UKBM is usually used by schools that use the Semester Credit System (Septiana et al., 2020). The reference in designing UKBM is the lesson plan which contains student independent learning activities. For this reason, in UKBM, detailed activities must be carried out by students from the beginning to the end of learning. UKBM can help teachers carry out learning during a pandemic. The results of research conducted by Dwipayanti et al. (2020) show that UKBM based on the STEM approach to material on the respiratory system is very suitable for use as a new alternative in teaching materials. In addition, Pratiwi et al. (2020) which shows the development of e-UKBM with the kvisoft flipbook maker application in physics learning is feasible to improve students' problem solving abilities.

UKBM can be used by students to achieve completeness of Core Competencies and Basic Competencies individually (Kemendikbud, 2016). UKBM can be combined with several learning models that can train students' 4C skills in class through Discovery Learning, Inquiry Learning, Problem Based Learning, and Project Based Learning (Markhus et al., 2019). UKBM teaching materials that are developed based on certain scientific topics such as the circulatory system which are studied in terms of physics, chemistry and biology will be very interesting and help teachers

strive to improve students' 4C abilities (Levrini et al., 2021). Through UKBM students can develop Critical thinking, Creativity and Innovation, Collaboration, and Communication skills (Charles Fadel, 2009). The use of UKBM in learning provides space for students to improve the quality of their learning. With the help of UKBM on the circulatory system material in terms of the field of physics studies, students independently learn about components, how they work, disorders and efforts to overcome disorders related to blood circulation. UKBM on the circulatory system material in terms of physics allows students to be active in learning, discussing and collaborating with friends or independently solving problems. This kind of learning can help students who have slow learning speeds thereby reducing gaps in understanding caused by differences in learning speeds between students (Freeman et al., 2011). At the end of learning students carry out reflection activities by recalling the understanding that has been obtained from the beginning to the end of learning. Reflection activities can train students' metacognitive abilities (McConnell et al., 2017).

Conclusion

Journals that discuss the development of teaching materials in the period 2016 to 2021 are as many as 24 journals spread across sinta 6 to sinta 2. Teaching materials that have been developed include print teaching materials and digital teaching materials. Print teaching materials in the form of books, modules and comics. Digital teaching materials in the form of virtual reading rooms and interactive CDs. Based on the results of the SWOT analysis, there are several weaknesses in the teaching materials that have been developed. These weaknesses are that students cannot use them to study independently without being accompanied by a teacher and development only focuses on material concepts whose events are easily observed by students. For this reason, UKBM teaching materials are very appropriate for students to study independently without a teacher. In addition, UKBM on the circulatory system material viewed from the field of physics studies can help students understand the concept of material that is considered abstract by students because it cannot be sensed directly. Suggestions for future researchers are to review the latest journals regarding the development of teaching materials, especially UKBM.

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