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The needs analysis of archaeobacteria and eubacteria web-based biology learning media



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ABSTRACT

The media used in learning archaeobacteria and eubacteria are very varied, but there are still obstacles in the delivery of subject matter, so the media must develop. The purpose of this research was to analyze the needs of developing web-based biology learning media on archaeobacteria and eubacteria material for students of X-grade high school. The research sample was determined by a purposive sampling technique considering school status, conditions, school facilities, and students' characteristics. There are 3 samples of schools, namely 2 public schools and 1 private school in Balikpapan city. The research data were collected using observation and interview guidelines, the research data were also analyzed descriptively and quantitatively. The conclusions of this study: 1) the use of learning media as a teaching resource in the biology learning process that occurs in the field has not been carried out optimally; 2) archaeobacteria and eubacteria material is difficult material; 3) Learning media that need to be developed on archaeobacteria and eubacteria material is web-based media, namely multimedia that combines learning resources in the form of text, images, animation, practice questions, glossaries, sounds, and videos equipped with back sounds and captions.

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INTRODUCTION

The learning process is an important activity to achieve learning objectives. Sadiman, Rahardjo, Haryono, & Rahardjito (2012), state that the learning process is essentially the process of delivering messages from teachers to students. Sudjana (2010) suggests that the teaching and



learning process or the teaching process is an activity to implement the curriculum of an educational institution so that it can influence students to achieve the set educational goals. An effective learning process is a key to achieving learning objectives, namely students can understand the learning concepts conveyed by the teacher.

The characteristics of biology learning can form active students in developing basic science process skills in the learning process so that optimal learning outcomes are achieved, both understanding concepts, science process skills, and student's scientific attitudes (Fakhrah, Muhibbuddin, & Sarong, 2014). According to Suhermiati, Indana, & Rahayu (2015), understanding the concept of biology is one of the important goals to learn biology, which is to give the understanding that the concepts taught to students are not just memorization but must be understood. Understanding the concept of biology is one of the learning objectives conveyed by the teacher because the teacher acts as a student's guide during learning to achieve the expected concepts.

Students may experience difficulties in studying biology because students find it difficult to understand biological concepts because of the complex concepts and terms or because biology challenges students to form an integrated understanding from microscopic to macroscopic scales (National Science Teacher Association, 2013). This allows students to experience difficulties in understanding the concept of biology whose objects are microscopic for example in the concept of Archaeobacteria and Eubacteria in X-grade. This material is a concept that misconceptions often happened in learning because student's cognitive experiences occur incomplete, as stated by Tarwoko (2005) found that student's misconceptions about the concept of bacteria in each sub-concept tested. Student's cognitive values are a reference in assessing the success of delivering archaeobacteria and eubacteria material to students, such as the results of research from Khotimah (2014), which states that the concepts of Archaeobacteria and Eubacteria are biological concepts that have a formative value below average compared to other concepts in X-grade first semester. This concept is a prerequisite for other concepts such as the concept of biotechnology and the body's defense system. Based on the coverage of archaeobacteria and eubacteria material, teachers are required to be able to understand and convey correctly so that students can more easily understand so that there are no misconceptions or misunderstandings of concepts.

One of the efforts that teachers can use to present archaeobacteria and eubacteria material which is microscopic has a concept with complex terms and overcoming any misconceptions by students is to use media. Arsyad (2012) also states that media can help students improve their understanding. Sukiman (2012) explains the practical use of learning media in the teaching and learning process, namely learning media can clarify the presentation of messages and information so that it can expedite and improve the learning process and results. The use of learning media is the one that must receive special attention from teachers in every teaching and learning process so that the learning process will be more effective and efficient. Based on national journal information, one of the places that have the potential to provide material for archaeobacteria and eubacteria is the fish quarantine center, quality control, and food safety (BKIPM) second class Semarang. The use of research at BKIPM is an effort to increase student's knowledge of Archaeobacteria and Eubacteria. If this research can be put in the form of learning media, it will allow learning to be more effective and efficient (Birch & Burnet, 2009). Therefore, teachers need to learn how to use learning media to effectively achieve learning objectives in the teaching and learning process, especially for some materials that are classified as difficult to understand, such as archaeobacteria and eubacteria material.

The learning media which is very influential and very close to teenagers or students today is the internet, the advantages offered by computer technology and the internet are not only in the speed to obtain the information that has been provided but also some multimedia facilities can



make learning more attractive, visual, interactive, and fun so that it will foster motivation and interest in learning of students (Sari & Suswanto, 2017). Besides, a well-regulated web can create a more attractive display of subject matter to increase student motivation (Oliver, 2008). Web-based learning also affects teacher achievement better than face-to-face learning (Wuryaningsih, Susilastuti, Darwin, & Pierewan, 2019).

Based on the background, this research needs to be carried out as an initial study in the development of archaeobacteria and eubacteria learning media for X-grade high school before media development is carried out so that it can strengthen the reasons for generating media that will be developed through descriptions of the reality of learning in schools. The formulation of the problem in this research is about the description of the use of learning media as a source of teaching in the biology learning process that has been happening in the field, the views and obstacles faced by teachers on the field in the delivery of archaeobacteria and eubacteria material, formulating learning media that need to be developed in learning archaeobacteria and eubacteria.

RESEARCH METHODS

Research Design

This research was survey research whose steps were adapted from Groves, Robert, Fowler, Floyd, Couper, Mick, Lepkowski, James, Singer, Eleanor, Tourangean, & Roger, (2004). All instruments in the survey were validated by 2 validators. The survey was conducted once in each school, while interviews were conducted in an unstructured manner until all the data required by the researcher were complete. Surveys and interviews were conducted in the odd semester of the academic year 2018/2019.

Population and Samples

The research population was 20 senior high schools (SMA) in the city of Balikpapan, while the sampling technique used was purposive sampling. The criteria used as a reference for sampling are schools with accreditation during research, there are wi-fi facilities that can be used by students when learning at school, there are separate chemistry, biology, and physics laboratories, students have never carried out biology learning using web-based learning, students from the sample schools had academic achievement in the last 5 years. The samples in this study were 1 principal/deputy head of curriculum, 1 class X biology teacher, and 37 class X students of SMA Negeri 1 Balikpapan, 1 principal/deputy head of curriculum, 2 class X biology teachers, and 23 students. class X SMA Negeri 2 Balikpapan and 1 principal/deputy head of curriculum, 3 class X biology teachers, 27 class X students of Patra Dharma Balikpapan private high school.

Instruments

The research instrument consisted of observation sheets, questionnaires, and interviews. The observation sheet consists of a grid of questions that are asked to the principal/deputy head of curriculum regarding school identity, school conditions, the curriculum used, learning tools, and the teaching process and facilities available at the school that can be used by students in the learning process. The observer provides an observation answer by filling in short entries. The questionnaire was in the form of questions to students regarding biology learning, achievement in learning biology, the learning process of biology, media, learning resources and methods used in the learning process of biology, as well as student's difficulties in understanding biology material (multiple choices and short answers). Also, the interview question sheet contains a grid of questions for the teacher that leads to questions about teacher teaching and learning activities, teaching resources, teaching media, the subject of archaeobacteria and eubacteria, and the

development of learning media that has been carried out in the learning process. The data obtained from these instruments is quantitative descriptive data.

Procedures

Problem identification begins by observing learning and school conditions directly to several senior high schools in Balikpapan. During the observation, the researcher made observations about learning problems in these schools. After that, the researcher analyzed common problems found in all observed schools. In the next stage, the researcher conducted an instrument analysis and sampling method which was then consulted with the validator. After the instrument analysis and sampling method were determined, the writer made a matrix of observation questions, questionnaires, and interviews. Then the questions are arranged based on the matrix. The questions are then validated by two validators. The writer designed the sampling technique by considering the requirements of the sampling method that had been determined. All valid instruments were used to collect data from the researcher. Collecting data in each school, using an average of one week of schooling. Then the data obtained were analyzed with the percentage formula and quantitative descriptive. If there is data that deemed insufficient, the researcher returns to consult with the school. The research procedure carried out in this study was adapted from Groves et al., (2004) with the following [Figure 1](#).

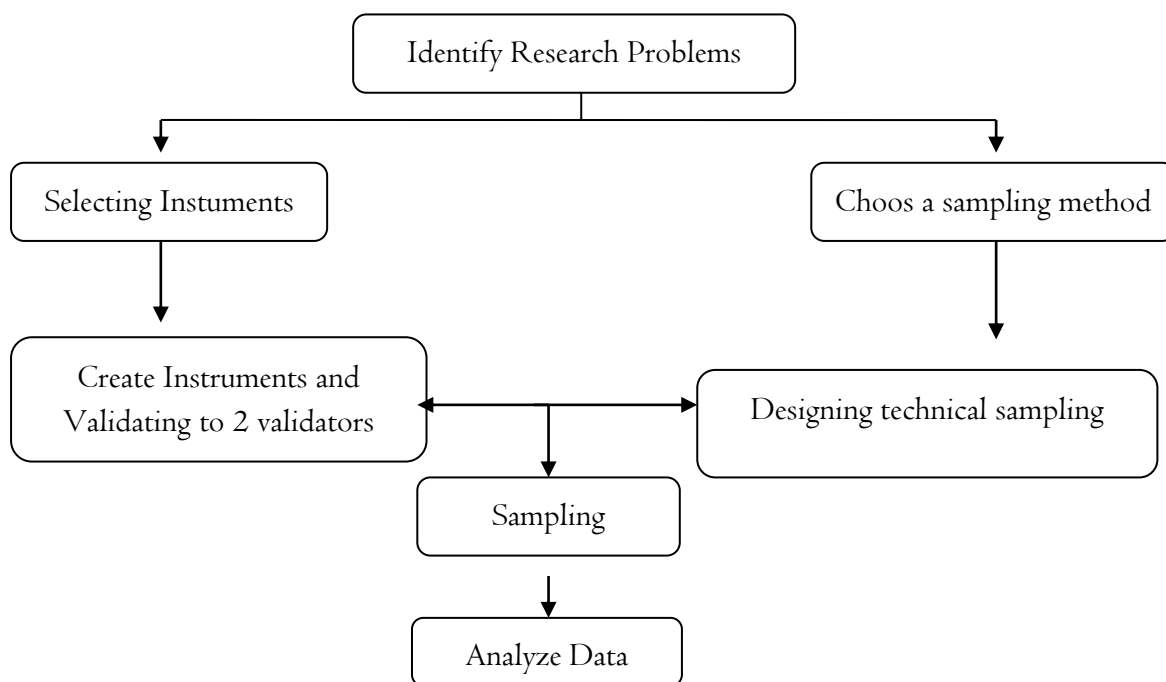


Figure 1. Survey Research Procedure

Data Analysis

The quantitative data obtained during the study were in the form of data on the biology learning process and its constraints which were analyzed using quantitative descriptive techniques, namely calculating the percentage of responses from respondents. The largest percentage is used to describe the real conditions in the biology learning process. The percentage of respondent's answers was processed using the following percentage [Formula 1](#).

$$P = \frac{f}{n} \times 100\% \dots\dots\dots \text{(Formula 1)}$$

Description:

P = Percentage

f = Frequency of respondent's answers

n = Number of samples processed (Walizer, Michael, & Wienir, 1990)

The interpretation of the processed percentage used the interpretive parameter (Warsito & Hermawan, 1992) which can be seen in [Table 1](#).

Table 1. Percentage and category of responses from respondents

No.	Percentage range	Category
1	0%	None
2	1-25%	Small portion
3	26-49%	Almost half
4	50%	Half
5	51-75%	Most
6	76-99%	Almost All
7	100%	Whole

RESULTS

Based on the results of observations made by researchers at SMAN 1 Balikpapan, SMAN 2 Balikpapan, and Patra Dharma Balikpapan private high school, it is known that the cognitive learning outcomes of students in Biology subjects so far have largely not reached the expected standard (KKM). 83.3% (almost all) of the teachers stated that in the process of delivering biology material there were obstacles, one of which was due to student's misconceptions on the material being taught and student's diverse cognitive abilities, even though the teacher had carried out learning according to the steps in the 2013 curriculum. The majority of students indicated a positive response to the learning process in class but there were still some passive students. The problems encountered by the teacher were due to the absence of media for some biology material that was able to explain the material that formed an integrated understanding from a microscopic scale. Students have not yet mastered the concept of the subject well.

The materials that have complex concepts and terms are abstract and microscopic according to the teachers, one of which is archaeobacteria and eubacteria. As many as 66.7% (most) of the teachers stated that the subject was difficult. Based on the results of the student survey, it was obtained 66.6% (most) students also said that the material is difficult because they are living things that are microscopic so they find it difficult to imagine. The teacher has problems in delivering the archaeobacteria and eubacteria material, namely the abstractness of the material because it cannot be observed directly (microscopically), and the difficulty of understanding students on the sub-topics of the material in it because there are too many concepts or terms that need to be memorized. One of the sub-topics in the structure and classification of bacteria.

The delivery of subject matter can use several learning media. The learning media that teachers usually use during learning can be in the form of power points, preparations, worksheets, videos, teaching aids, and the web. The following is presented the percentage of learning media use by teachers in a circle diagram in [Figure 2](#).

Based on the results of [Figure 2](#) it can be concluded that the use of learning media in the form of worksheets is more widely used by teachers, while web media is still not optimally utilized. All teacher respondents also stated that material that has complex concepts and terms is abstract and microscopic, needs to be conveyed by presenting the material clearly with various biological processes in detail, and can motivate students in the learning process.



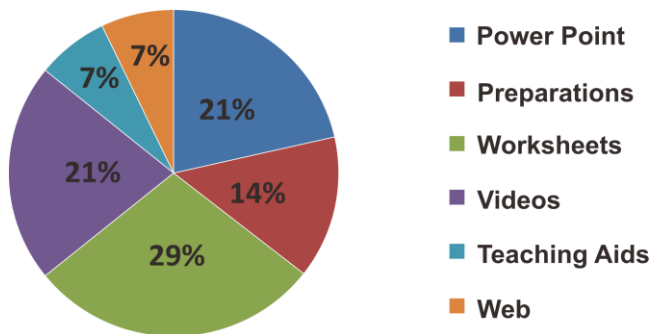


Figure 2. Percentage learning media used by the teacher.

Based on the data on the test results of class X odd semesters in the last three years in three schools that have been observed, there are still students whose scores have not reached the minimum completion criteria (KKM) in biology subjects. The results of the observations stated that in preparation for learning, as many as 66.7% (most) teachers did not always make their learning media but obtained them from publisher books using PowerPoint media and worksheets. Based on the results of observations, it was also found that all students were more interested in learning using various media. As many as 71.4% (most) students are interested in web media as a learning medium that can be used in the learning process. Students prefer to learn with media that shows procedures with video shows, pictures, glossaries, practice questions, animations, and materials in more detail and realistically compared to learning using only textbooks, modules, or teaching books. Teaching sources from publishers are also deemed less varied and cannot be used as a complete reference source in delivering material.

The teacher has tried to make learning media by himself, but almost all (83.3%) of the teachers experienced problems in making it such as difficulty developing material to be more detailed, difficult to visualize objects so that they are easy to understand, inadequate facilities, development of too many discovery concepts and requiring more thoroughness and patience. As a result, the learning media used by the teacher is felt by students to be less than optimal and they do not understand the material being taught. So that if research and development are carried out related to web-based teaching media, it will greatly assist teachers in delivering material, and for the future teachers can develop web-based media independently. Because based on observations, the facilities in schools are also adequate, one of which is equipped with computer laboratory facilities complete with internet and wi-fi (wireless fidelity) facilities. Besides, students can also access the internet via smartphones. Based on the results of observations, it was also seen that almost all students already have smartphones or tablets as gadgets for daily use. These gadgets are generally connected to the internet. So that with the complete computer facilities and wifi in schools, it allows students to easily access the internet via computers or notebooks and even gadgets. The teacher also stated that the learning resources needed to be developed and could be used as independent learning sources for students were web-based learning media because they were easier to convey, and can arouse student's activeness in learning.

DISCUSSION

Before developing a web-based biology learning media, the researcher made observations at three schools in Balikpapan, namely SMAN 1 Balikpapan, SMAN 2 Balikpapan, and Patra Dharma Balikpapan private high school. This observation was carried out to determine the condition of the school, especially the achievement, process, and learning media. The results obtained are that most students in biology subjects have not reached the expected standard (KKM) because in the delivery of subject matter there are misconceptions, especially in abstract and

microscopic material, namely archaeobacteria and eubacteria. This is in line with the results of research by Khotimah (2014) that there are misconceptions in the concept of Archaeobacteria and Eubacteria experienced by 19% of students, this number is less than students who do not understand the concept, namely as much as 61%. The teacher has problems in delivering the subject matter because bacteria cannot be observed directly (microscopic). Media can present objects that are physically difficult to present in learning (Herlanti, Rustaman, & Setiawan, 2007) and provide students with a concrete learning experience (Indiana, 2011). Besides, the use of learning media in the form of worksheets is more often used by teachers, but students are more interested in learning using a variety of media, namely media that shows procedures with video shows, pictures, glossaries, practice questions, animation, and material in more detail and realistically. This is also in line with the results of research by (Sari & Suswanto, 2017) that computer and internet technology can make learning more attractive, visual, interactive, and fun so that it will foster motivation and interest in learning.

In simple terms it can be said that all learning is carried out by utilizing internet technology and during the learning process it is felt that it occurs by those who follow it, then this activity can be called web-based learning (Rusman, 2012). The learning process using multimedia that combines several learning resources will provide easier, clearer, more varied, and complete messages in its delivery. This is in line with the opinion (Kemp & Dayton, 1985) which states that the material developed using information communication technology by placing it on a website that is connected to the internet can attract attention and keep students focused on the learning process. Web-based learning also has a significant impact on improving student learning skills and performance (Al-Abdullatif, 2020). Although the use of web-based learning media has several benefits that can help achieve learning goals, there are still many schools that have not used web-based learning media as a support for learning activities in the classroom.

Teaching materials that are packaged as web-based learning media are a form of application of the e-learning system which is not only able to present learning material in a more attractive and up to date manner but also allows interactive elements and feedback between teachers and students in learning so that the method learning carried out by the teacher will be more varied and students will be more active in learning (Hanum, 2014). The results of observations obtained from schools indicate that web-based media development has never been carried out by teachers or other developers. Therefore it is necessary to develop a media that can demonstrate learning material, especially biology, which aims to make it easier for students to understand the concepts of learning materials that have complex concepts and terms, abstract or not directly observed (microscopic). One of the sub-topics that will be explained is the structure and classification of bacteria which requires a detailed explanation, so that students may have misconceptions about the archaeobacteria and eubacteria material. More misconceptions experienced by students were in the form of complete misconceptions than partial misconceptions.

Many students prefer to learn using media that shows procedures by showing videos, pictures, glossaries, practice questions, animations, and materials in more detail and realistically. This is by the results of research by Rosen (2009) which states that video or animation in learning can increase student motivation. Also, a well-regulated web can create a more attractive display of subject matter to increase student motivation (Oliver, 2008). The advantage of web-based learning media is that it can make it easier for the material to be conveyed to students, can be accessed at any time, is practical, and can arouse student activity in learning. This is also by research Mahmud (2008) which states that the allocation of time for fewer subjects can be anticipated by providing material over the internet to be accessible at any time, and the material uploaded through the website will make students more active in learning (Sawant & Shinde, 2012).

The research and development will be carried out by researchers in the next stage. It is limited to archaeobacteria and eubacteria subject matter. The availability of adequate computer and internet network facilities is another supporting factor in the success of web-based learning (Sari & Suswanto, 2017). Considering these restrictions is also based on many considerations such as limited manpower, time, and cost.

CONCLUSION

The conclusions from the results of this study are: 1) the use of learning media as a teaching resource in the biology learning process that occurs in the field has not been carried out optimally. There are constraints in the delivery of material, especially material that cannot be directly observed (microscopic), abstract, and has complex concepts and terms; 2) archaeobacteria and eubacteria material is difficult material. Teachers need easy, complete, practical media that can arouse student's activeness in learning so that students do not have misconceptions about archaeobacteria and eubacteria material; 3) Learning media that need to be developed on archaeobacteria and eubacteria material is web-based media, namely multimedia that combines learning resources in the form of text, images, animation, practice questions, glossaries, sounds, and videos equipped with back sounds and captions.

Based on these conclusions, it is suggested: 1) development of web-based media for archaeobacteria and eubacteria material for X-grade high school; 2) for every teacher in SMA, especially X-grade, it is hoped that later they can use web-based media for archaeobacteria and eubacteria material and it is also hoped that they can develop their own for several other materials; 3) for local governments and school leaders can provide both moral and material support related to the use of web-based media through the provision of facilities and infrastructure in schools, increasing and understanding the importance of using media for teachers and creating a sense of security, comfort and building motivation in learning for the student.

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