International Journal of Biology Education Towards Sustainable Development
Vol.2, No.1, 2022, pp. 34-43
e-ISSN 2809-5073 DOI. 10.53889/ijbetsd.v2i1.130

Development of Portfolio Assessment Instruments Based on Scientific Literacy on the Archaebacteria and Eubacteria Concepts

Submitted 18 May 2022 Revised 27 June 2022 Accepted 27 June 2022

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Abstract

This research aimed to develop the portfolio assessment instruments based on scientific literacy on the concept of the archaebacteria and eubacteria and to know the feasibility of the product. The research method was used Research and Development with research design: problem pontential and data collection, design of product, product development. The result of this research is portfolio assessment instruments based on scientific literacy with content cognitive assessment, affective assessment, psychomotor assessment, lesson plan, portfolio assessment, and presentation product and was judged by expert judgment consist aspect: construction, validity, language, scientific literacy and completeness used expert assessment sheets. The data obtained was analyzed with qualitative and quantitative. Based on the results of the portfolio assessment instruments based on scientific literacy on the concept of the archaebacteria and eubacteria obtained was 87,8% with category very good and feasible to use.

Keywords: Portfolio, Scientific Literacy, Archaebacteria, Eubacteria

INTRODUCTION

The success of a learning process can be seen from the achievement of the learning objectives that have been set. The learning objectives can be known to be achieved by conducting an assessment. According to Arifin (2009), assessment is a step that must be taken by teachers to determine the effectiveness of learning. In learning activities, teachers often skip assessments during the learning process, while those that support the final results obtained by students can be influenced by the process that students follow during learning. The learning process of students is one of the important aspects in the assessment. Muslich (2011) reveals that the assessment is not only to find out student learning outcomes, but also to find out how the learning process takes place.

Assessment in the curriculum 2013 has several criteria, one of which is authentic assessment. Authentic assessment is an assessment carried out comprehensively to assess cognitive aspects, skills, and attitudes. There are several forms of authentic assessment, namely work assessment, project assessment, and portfolio assessment (Kusaeri, 2014). One

form of assessment instrument that is commonly used in the learning process and is one form of authentic assessment is portfolio assessment. Portfolio can be interpreted as a collection of student work that is arranged systematically and organized as a result of the learning efforts that have been carried out within a certain period of time (Sanjaya, 2008). Suardana (2007) explains that portfolio assessment can assess the learning process of students as a whole, both in cognitive, affective, and psychomotor aspects. This is in accordance with the characteristics of the assessment in the curriculum 2013 which requires an assessment of these three aspects.

Based on observations in several high schools in Serang City, it is known that this type of portfolio assessment is still very rarely used by teachers because most teachers do not understand the implementation of the portfolio assessment technique. The type of assessment that is mostly done in schools in general is in the form of standardized tests. According to Marhaeni (2006), standardized tests are not able to display the ability of students as a whole. One type of standardized test that is widely used is the written test. This written test emphasizes more on assessment at the level of memorizing and understanding the material rather than students' knowledge of processes, procedures, and ways of thinking. Whereas the assessment of biology learning does not only require mastery in terms of material but also mastery in terms of skills, scientific attitudes, and applications of biology in everyday life. Thus, to obtain a good assessment in learning, an assessment instrument is needed that can comprehensively measure the skills, concepts and attitudes of students. The assessment carried out must be able to measure students' ability to solve problems, communicate, conduct investigations and be creative in accordance with the demands of biology learning which requires students to develop science process skills, inductive thinking, scientific attitudes, communication skills, all of which are integrated in the basic skills of scientific work. (Supandi, 2019).

Biology learning which is included in science education emphasizes providing direct experience to develop competence so that students are able to explore and understand the natural surroundings scientifically. Based on this goal, science education should focus on students' scientific literacy as stated by the National Research Council (1996). Scientific literacy is defined by OECD (Organization for Economic Co-operation and Development) as the ability to use scientific knowledge to make conclusions and solve problems about nature and nature's interactions with humans (Nbina and Obomanu, 2010). The scientific literacy ability of students in aspects of science knowledge and competence can be optimized through the application of scientific activity-based learning (Wulandari *et al*., 2016).

One method of learning science that involves scientific activities is practicum. In the practicum there are steps of the scientific method in building the concept of knowledge and science process skills which are part of the aspect of scientific literacy competence. This is in line with portfolio assessment, which can measure the learning process and can be used to assess performance. As stated by Arifin (2009), portfolio assessment is an approach in assessing student performance or is used to assess performance. Astuti et al. (2012) revealed that the development of scientific literacy-based assessment instruments is very necessary because it is able to assess student learning processes and outcomes and encourage students to understand the nature of science comprehensively.

Thus, it is hoped that with this scientific literacy-based portfolio assessment instrument the ability of students to understand science concepts and their development in natural events and the ability to apply concepts to solve problems in everyday life can be measured properly.

In this study, a portfolio assessment instrument based on scientific literacy will be developed on the concepts of Archaebacteria and eubacteria. Archaebacteria-eubacteria is a concept that requires students to apply theory through practical activities. Based on observations, the assessment made on this material is usually in the form of a standardized test that only memorizes, while in the indicators students are required to be able to apply the classification principle to classify archaebacteria and eubacteria based on characteristics and shapes through careful and systematic observation. Learning this concept requires scientific literacy, so this concept was chosen for the implementation of making scientific literacy-based portfolio assessment instruments for class X at the high school level.

METHOD

This study used research and development methods (R&D). The product developed in this study is a scientific literacy-based portfolio assessment instrument on Archaebacteria and Eubacteria material for high school class X. The design of this study refers to the development model according to Sugiyono (2012), but this study was modified and only until the Expert validation stage. The stages in the research carried out in this study include, potential problems and data collection, product planning and product development.

RESULT AND DISCUSSION

The preparation of scientific literacy-based portfolio assessment instruments includes three stages, namely the potential problem stage and data collection is the stage of finding potential or problems that occur in real life and collecting information/data by conducting needs analysis, material analysis and curriculum analysis. The results of this stage are in the

form of information on learning activities and assessment techniques needed by students in accordance with the current curriculum. The product planning stage is the stage of designing and compiling a product based on the results of data analysis at the information collection stage. The result of this stage is a product prototype (initial product). The development stage is the stage of conducting an initial product assessment carried out by a team of experts. And after the assessment is carried out, the product revision stage is carried out. This stage is carried out based on suggestions and input from a team of experts. The description of the stages of data collection, product planning and product development is as follows:

1. Stage of Potential Problems and Data Collection

This stage is the earliest stage of the development stage by design according to Sugiyono (2012). This stage aims to determine the limitations of the research conducted by the researcher. At this stage, several activities are carried out, namely determining potential problems, needs analysis, curriculum analysis, and material analysis. The stages of potential problems and data collection in detail are described as follows:

a. Problem Potential

This stage aims to find the potential or problem to be studied. Starting from looking at the curriculum 2013 which made changes to several characteristics of assessment in learning, one of which was authentic assessment which required teachers not only to assess cognitive aspects, but also to comprehensively assess attitudes and skills. Then the next stage is a needs analysis to find out the actual conditions that occur in the field.

b. Needs Analysis

Needs analysis aims to obtain information about existing conditions as a comparison material or basic material for the developed instrument product. The information obtained from this needs analysis is in the form of information on learning activities and assessment techniques needed by students in accordance with the current curriculum. Needs analysis was conducted by distributing questionnaires to five high schools in Serang City, namely School A, School B, School C, School D and School E.

One of the information from the results of distributing the questionnaire is the type of assessment that is mostly done in schools in general is a standardized test in the form of a written test. According to Marhaeni (2006) standardized tests are not able to display students' abilities as a whole. This written test emphasizes more on assessment at the level of memorizing and understanding the material rather than students' knowledge of processes, procedures, and ways of thinking. Whereas the assessment of biology learning does not only

require mastery in terms of material but also mastery in terms of skills, scientific attitudes, and applications of biology in everyday life so that other assessment instruments are needed that can measure students' skills, concepts and attitudes comprehensively in accordance with the demands of biology learning that does not only emphasize in terms of material.

c. Curriculum Analysis

Curriculum analysis was carried out to identify the core competencies and basic competencies of the archaebacteria and eubacteria material demanded by the 2013 curriculum. The basic competencies for the cognitive rinciple to classify archaebacteria and eubacteria based on characteristics and shapes through aspects of the material are contained on basic competence 3.5 applying the classification p careful observation and systematic and psychomotor aspects on basic competence 4.5 Presenting data on the characteristics and roles of archaebacteria and eubacteria in life based on the results of literature studies in the form of a written report. The results of the analysis of Core Competencies and Basic Competencies are translated into several learning indicators.

d. Material Analysis

Material analysis aims to determine the depth and breadth of learning materials that will be presented in the product based on the indicators formulated in the curriculum analysis. The results of this analysis are in the form of material contained in the product which includes the characteristics of Archaebacteria and Eubacteria, Classification of Archaebacteria and Eubacteria, Methods of reproduction of Eubacteria, Role of Archaebacteria & Eubacteria.

2. Product Planning Stage

The planning stage is the second stage of this research. At this stage, the design and preparation of a scientific literacy-based portfolio assessment instrument is carried out. The design begins by compiling the initial design of the scientific literacy-based portfolio assessment instrument by determining the outline of the content and product description referring to the results of the previous stage, namely the data collection stage, which includes adjustments to basic competencies and indicators, as well as adjustments to product content with predetermined boundaries determined at the data collection stage.

The planning stage is carried out with various activities, namely the preparation of product feasibility assessment instruments and preparation of initial product assessment instruments based on scientific literacy. The preparation of the product uses the steps of developing portfolio assessment according to Nurgiyantoro (2011), namely: (1) determining

standards, (2) determining authentic assignments, (3) making indicator criteria, and (4) making rubrics.

3. Product Development Stage

The scientific literacy-based portfolio assessment instrument that has been designed and compiled at the planning stage, then proceeds to the development stage. At the development stage, an expert assessment is carried out to determine the feasibility of the product. The expert assessment was carried out by five experts consisting of two lecturers of biology education and three teachers. The results of the expert assessment are then used as the basis for making improvements (revisions). The value obtained from the product assessment by the expert obtained a value of 87.8% with a very feasible category (Figure 1**).**

Some of the aspects assessed include cognitive, affective, psychomotor, lesson plans, portfolio assessment and appearance, while the criteria assessed include instrument construction, validity, language, scientific literacy, and completeness. Assessment of instrument construction is related to instrument writing techniques according to the type of instrument presented. The validity assessment relates to the suitability of the instrument with the material as well as the grids and guidelines made, in terms of language it relates to whether the writing of the instrument is in accordance with the rules of using good and correct Indonesian. Assessment in terms of scientific literacy relates to the suitability of the instrument with scientific literacy indicators, assessment in terms of completeness relates to whether the components of the instrument made are complete or not including grids, instructions for use and scoring guidelines. Appearance assessment is related to the suitability of the cover and design of the content section with the concept used.

The following is an explanation of each aspect of the assessment of the scientific literacy-based portfolio assessment instrument.

1) Display Aspect

The results of the assessment of the appearance of the portfolio assessment instrument product that were presented overall obtained a percentage of 86.85% (Figure 1) with a very decent category. The assessment is based on 2 criteria, namely the cover display and the content display (Figure 2).

2) Cognitive Aspect

The results of the assessment of the quality of the portfolio instruments on the cognitive aspects presented overall obtained a percentage of 88% (Figure 1) with a very

decent category. The assessment is based on 5 criteria, namely construction, validity, language, scientific literacy and completeness (Figure 3).

3) Affective Aspect

The results of the assessment of the quality of portfolio instruments in the overall affective aspect obtained a percentage of 89% (Figure 1) with a very decent category. The assessment is based on 5 criteria, namely construction, validity, language, scientific literacy and completeness (Figure 4).

4) Psychomotor Aspect

The results of the assessment of the feasibility of the portfolio instrument on the psychomotor aspect obtained a percentage of 87% (Figure 1) with a very decent category. The assessment is based on 5 criteria, namely construction, validity, language, scientific literacy and completeness (Figure 5).

5) Learning Implementation Plan

The Learning Implementation Plan has only one assessment indicator, namely the suitability of all portfolio instruments made with the lesson plan. This indicator gets a score of 84%, this value has entered the very feasible category.

6) Portfolio Assessment

The portfolio assessment for the recap of each meeting got an average score of 88% with a very decent category. This portfolio assessment has four indicators, namely there are instructions for filling out the instrument, there are indicators of competency learning, the assessment instrument is clear and there is a commentary column for teachers and parents.

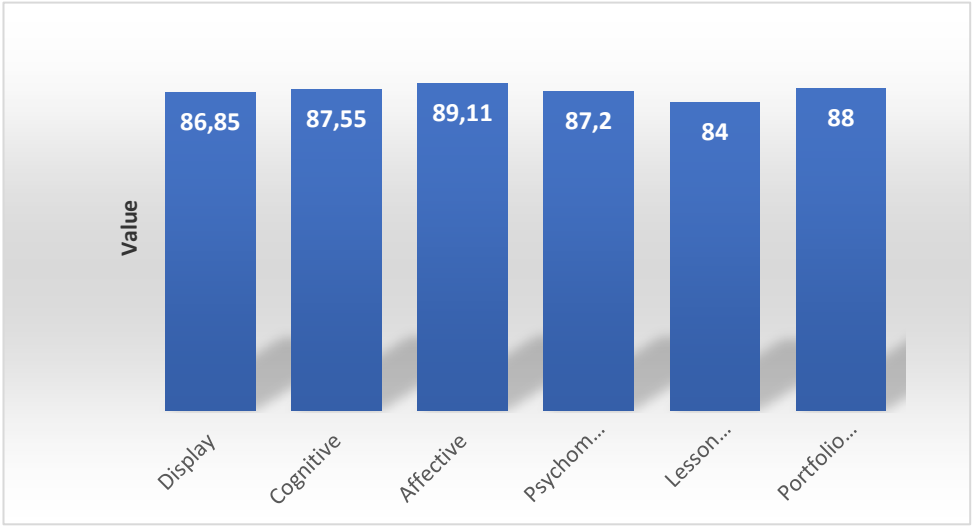

Figure 1. Eligibility of Portfolio Assessment Instruments
Scientific Literacy

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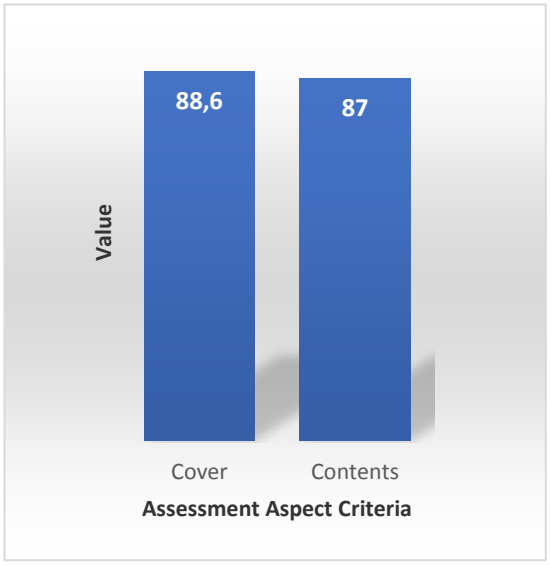

Figure 2. Display Aspect Assessment

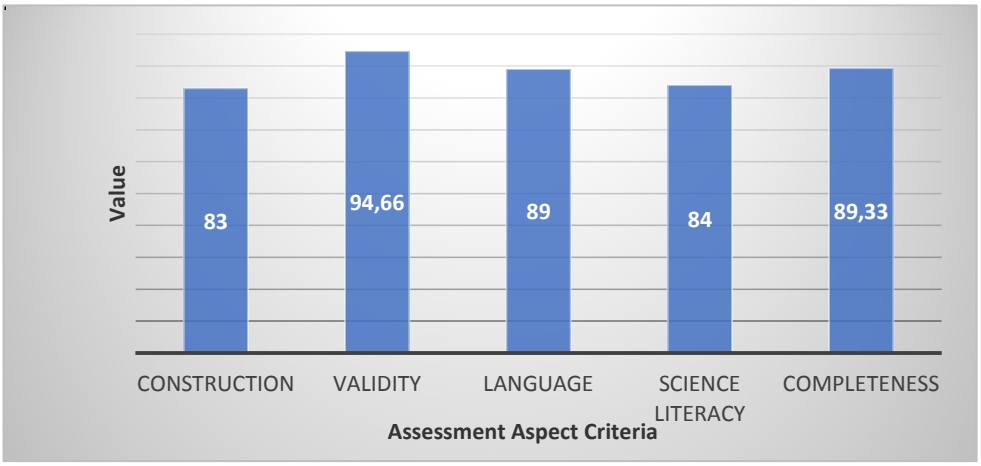

Figure 3. Cognitive Aspect Assessment

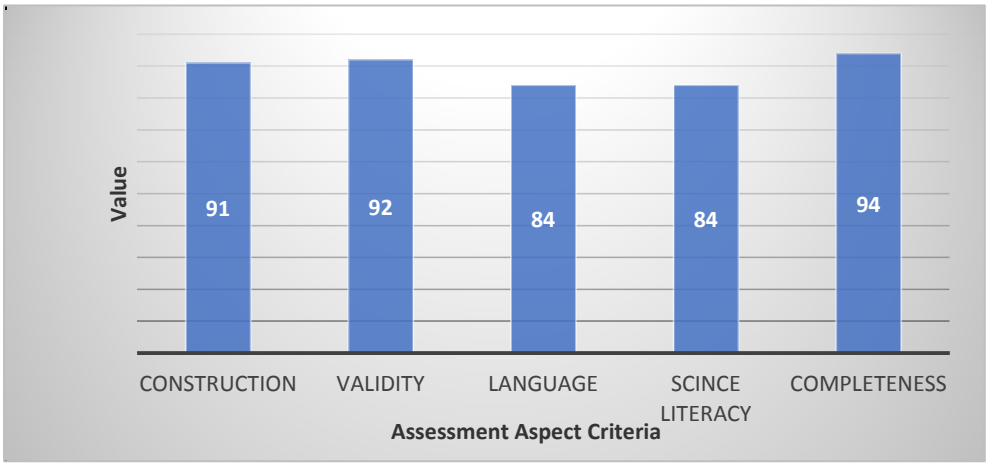

Figure 4. Affective Aspect Assessment

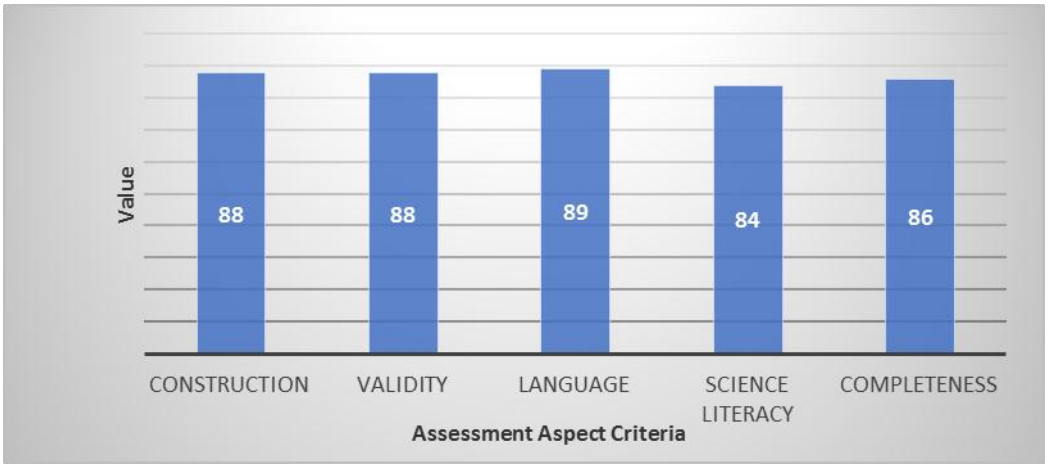

Figure 5. Psychomotor Aspect Assessment

CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that: The research product developed in the form of a scientific literacy-based portfolio assessment instrument is structured through three stages, namely (1) data collection, which includes needs analysis, curriculum analysis and material analysis; (2) product planning which includes initial product design and preparation of assessment instruments; and (3) product development which includes expert validation and product revision. The results of the feasibility test of the portfolio assessment instrument based on the expert test overall obtained a score of 87.8% and entered into the very feasible category. The aspect of assessing the feasibility of the portfolio assessment instrument consists of six aspects, namely the aspect of appearance with a value of 86.85%, cognitive aspect with a value of 87.5%, affective with a value of 89.11%, psychomotor with a value of 87.2%, lesson plan with a value of 84 % and portfolio valuation with a value of 88%.

After conducting this research, the researcher recommends that biology teachers can use more varied instruments or measuring instruments to measure students' abilities comprehensively, one of which is that the instruments developed in this study can be used. However, there are a few things that can be suggested: 1) Adding scientific literacy content to each assessment instrument both on cognitive, affective and psychomotor so that the content of this portfolio assessment instrument contains more aspects of scientific literacy; 2) Improving the appearance of the portfolio assessment instrument developed by increasing the visual display in the form of images to make the instrument more attractive; 3) For other researchers who will continue this research to the next stage, it is necessary to first revise the questions that have been developed; and 4) The product portfolio assessment instrument

developed only on the concepts of Archaebacteria and eubacteria, it is necessary to develop further on other concepts.

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