



Development of Authentic Assessment Instruments Through High-Level Botanical Practicums to Improve Science Process Skills

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Abstract: The Authentic Assessment Instrument is part of the achievement indicator in obtaining information to measure aspects of student knowledge in the learning process. The measurement process carried out for students in the assessment instrument both individually and in groups consists of three affective, psychomotor and cognitive aspects. Ethnobiological studies are part of the understanding of people's culture regarding the knowledge of plants. Science process skills activities are the implementation of an action carried out by students in practicum learning. The basis of the research objectives is to develop an assessment instrument on a high-level botanical practicum learning tool in measuring students' science process skills and measuring feasibility tests and limited tests of assessment instruments in the implementation of science process skills practicum learning activities. The implementation of the method in the research is a development method. The results of this study consist of three aspects of assessment from expert validation, namely aspects of content validity, presentation aspects and language aspects are declared feasible. Meanwhile, the student's response to the assessment instrument was stated to be good to use as a measuring tool in the assessment of students to carry out a high-level botanical practicum.

Keywords: Assessment Instruments; High-Level Botany; Science Process Skills

Introduction

This. Science process skills consisting of several cognitive aspects contain two aspects of cognitive skills (cognitive) and sensorimotor skills (sensorimotor) these are contextual skills in underpinning basic knowledge in mastering science process skills (Santih, 2014). The implementation of basic skills includes measurement, observation, classification, inference, communication and prediction while integrated skills activities include variable control activities, formulating hypotheses, formulating problems, and interpreting data. Basic skills or basic skills and process skills or processing skills are part of science process skills (Viki, 2014).

Science process skills are a form of skill that contains aspects of cognitive skills that are intellectual skills (Supahar, 2017). Science process skills are skills that focus on students to be able to understand a

concept, to know independently and to develop facts, concepts and values (Indriani & Mercuariani, 2019). Science process skills are expected to improve the skills possessed by students (Bachtiar & Dukomalamo, 2019). According to Zaki (2013) there are two types of science process skills, namely basic science process skills and integrated science process skills.

The skill of the science process that carries out learning activities there is an Action. Science process skills activities are part of the preparation of the assessment that conducts experiments, communicates, hypothesizes, interprets, observes, and plans experiments. Performance assessment instrument as a measuring tool to carry out practicum learning that performs science process skills. The application of performance assessment can also make an improvement in growing the quality of learning that occurs in the implementation process of Usmeldi, 2016). Therefore,

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apply an assessment assessment that is measured appropriately and gets the results of an expected assessment (Fadillah, 2017). The application process of performance assessment can improve a teacher's competence and can improve students' ability to carry out the learning activity process (Windyarani et al, 2017). To carry out a performance assessment, it is recommended that you must be able to pay attention to several aspects an indicator of achieving student abilities that can be reached according to using a rating scale (Basri et al, 2017).

Performance assessment is an alternative assessment by assessing multidimensionally when students perform tasks, this assessment is authentic (Stiggin & Chappuis, 2012). Performance appraisal is intended to measure students' cognitive and psychomotor levels in more depth than traditional assessments and spur students in solving authentic or real problems (Koh, Tan, & Ng, 2011). Harris et al. (2009) gave cognitive tests in oral and written form and interviews and obtained the results that students who did practicum in the laboratory had better answers than students who did not participate in learning in the laboratory. This is in accordance with the statement (Dresner, et al., 2014) that learning in the lab significantly improves students' ability to answer questions at higher cognitive levels and improves knowledge retention over time.

The daily life of students is carried out an assessment that is integrated in the performance assessment (Nurfutriani et al, 2018). Meanwhile, the implementation of the assessment carried out by the teacher in measuring the activities of students in providing knowledge and abilities that have not been achieved in accordance with the performance assessment assessment (Setiyana et al, 2018). Furthermore, learning and learning activities that are in fostering teacher creativity as a performance assessment for students (Mulyani et al, 2017). Performance appraisals that provide a valid and reliable measure of learning outcomes during and after a student's course of study, and when the student graduates then works. At the end of student learning, the assessment should provide evidence of how competent the student is in learning outcomes in aspects of knowledge, skills, and dispositions in life outside the academy (Shavelson, 2018).

An important component in the implementation of education is assessment or assessment (Depiani, 2019). Performance assessment in botanical practicum is based on science process skills which include skills in using tools and materials, observing skills, classifying skills, predicting skills and communication skills (Rustaman, 2007). Meanwhile, according to Funk in (Dimiyati & Mudjiono, 2006) there are six indicators of the science process, namely skills in using tools and materials,

observing skills, classifying skills, predicting skills, communication skills and drawing conclusions skills. The form of assessment that has been determined by the government includes an authentic assessment or assessment (Kusumastuti, 2020). One is that performance appraisal encourages students to synthesize their knowledge and apply their skills to unusual circumstances because they are most likely beyond the limits of their abilities (Palm, 2008). The characteristics of the performance test are twofold, namely; 1) participants in creating a product or engaging in an activity (deed) such as conducting experiments, practices and so on, 2) the product of a performance test is more important than the deed or performance (Basri, 2017).

Efforts to realize the provision of authentic assessments to students, in this case, measurements are needed in the form of assessment instruments to obtain assessment results for students. The implementation of practicum in high-level botany courses uses strategic

instruments in the assessment for students arranged as needed. The implementation of the practicum of high-level botany courses can find out the types of ethnobotanical naming among plants that have certain ethnic groups related to knowledge of plants used by the community.

Related to the description above, that students carry out practicum the need for performance assessment is very necessary for all students to be more active in practicum activities. In this case, the purpose of the research was born that explains the development of authentic assessment instruments on high-level botanical practicum learning tools based on ethnobiology in measuring student science process skills and measuring feasibility tests and limited assessment instruments on the implementation of science process skills practicum learning activities.

Method

Types of Methods

Research This type of research is carried out using the Research and Development (R&D) method. The process of implementing this activity is in the form of an assessment instrument product in measuring science process skills in ethnobiology-based high-level botanical practicum learning for the perfection of the products that have been made (Sugiono, 2012). The improvement of the product can use the development method with several stages, namely the initial stage of product design preparation or it is said to be a preliminary study, the second stage is the stage of the process of making an assessment product in the form of an Authentic Assessment Instrument. While the third stage is the stage of product assessment that has been used for

students in the process of learning activities from predetermined instruments.

Stages of Research

The implementation of the activities of this stage of the procedure adopts development research (Thiagarajan et al, 1974) namely (1) establishing courses; (2) preliminary research; (3) analysis; (4) design making; (5) initial product development; (6) due diligence; (7) limited test.

Data Collection Techniques

As for what is the data collection technique for the development of assessment instruments: (1) a validation sheet for the validity aspects of the content; (2) validation sheets of presentation aspects; (3) language aspect validation sheet.

Data Analysis Techniques

The concept of data analysis techniques carried out in this research activity by validating products from feasibility tests and limited tests of assessment instruments in science process skills activities in the implementation of high-level botanical practicum.

Result and Discussion

This research is a research on the development of a High-Level Botanical Practicum Assessment Instrument to Improve the Science Process Skills of Students of the Biology Education Study Program, Faculty of Teacher Training and Education, Samudra University. This study aims to assess high-level botanical practicum assessment instruments that meet valid, practical, and effective criteria that use a 4D development model through 4 stages of define, design, develop and disseminate. Each stage of learning tool development activities carried out along with the analysis of the data obtained, can be described as follows:

Defining Stage (define)

This activity is carried out to identify problems arising in the biology practicum. The Biology Education Study Program has several practicums in the laboratory, one of which is a High-Level Botanical practicum. Higher Botanical is a practicum that is carried out on a fourth semester with a total of 1 credit.

Higher Botanical has 9 practicum titles. Practicum 1 with the title Leaf (*Folium*), practicum 2 with the title Root (*Radix*) Stem (*Caulis*), practicum 3 with the title Flower (*flos*), Fruit (*Fructus*), and Seeds (*Cement*), practicum 4 with the title *Pinophyta (Gymnosperme)*, practicum 5 with the title Division *Magnoliophyta Classis Magnoliopsida* Part I, practicum 6 with the title *Magnoliophyta Classis Magnoliopsida* Part II, practicum 7 with the title *Magnoliophyta Classis Magnoliopsida* Part III, practicum 8 with the title *Magnoliophyta Classis*

Magnoliopsida Part IV, practicum 9 with the title *Magnoliophyta Division Classis Liliopsida*.

Instrument Analysis Stage

At this stage, theoretical studies and other research are also carried out related to the development of the assessment instruments developed. The development of assessment instruments that have been carried out in the High-Level Botanical Practicum course measures student science process skills.

Design Stage

The activities carried out after the analysis stage are the design stage. This stage is an activity that connects the initial assessment stage with the next stage, aiming to design a prototype of a practicum assessment instrument.

Development Stage (develop)

At this stage, the design of the practicum assessment instrument is then made and developed to obtain a prototype I. Practicum assessment instrument that have been made and developed will be assessed by experts/validators by conducting product feasibility tests and limited unions given to students, even though the stages of development are as follows:

1. *Validation Results of Aunthetic Assessment Instrument Experts Through High-Level Botanical Practicum*

At this stage, a product feasibility test is carried out in the form of an assessment instrument in the implementation of a high-level botanical practicum carried out by expert validation which consists of three aspects, namely the validity aspect, the presentation aspect and the language aspect as follows.

1) *Aspects of the Validity of the Contents of the Aunthetic Assessment Instrument through a High Level of Botanical Practicum*

The results of the assessment of the quality of the assessment instrument through a high level of botanical practicum, in the aspect of content validity obtained a percentage of 87.7%% with very valid cariteria. In this case, it can be seen in Table 1.

Table 1. Expert Validation of Content Validity

Instrument Item	Answer %	Criterion
Statements according to the aspects (variables) measured	87.5%	Very Valid
Clearly formulated statement	100%	Very Valid
The expected answer is obvious	75.0%	Valid
Average%	87.5%	Very Valid

The validity of the contents of this instrument aims to measure the extent to which the items in this

instrument include the content, namely whether the assessment items in the instrument developed have reflected the indicators of the assessment aspects / variables to be assessed in the study. The performance assessment instruments developed are assessed and given suggestions and inputs for improvement by experts (Sudrajat et al, 2011).

2) *Aspects of Presenting Aunthetic Assessment Instruments Through High-Level Botanical Practicum*

The Presentation Aspect is shown to find out that the instrument developed can complement the technical requirements in the proper presentation with the appropriate and accurate instrument. The results of the assessment of the quality of the assessment instrument through a high level of botanical practicum in the presentation aspect obtained a percentage of 93.7% with very valid criteria. This indicates that the assessment instrument for the development results of practicum is considered valid for the presentation aspect, the results of the study can be described in Table 2.

Table 2. Validity of Presentation Aspects

Instrument Items	Answer %	Criterion
Instruments are presented systematically	100%	Very Valid
Instruments can measure psychomotor	87.5%	Very Valid
Instruments according to student conditions	100%	Very Valid
Each instrument has an indicator	87.5%	Very Valid
Operational verbs used according to the psychomotor ability to be measured	100%	Very Valid
The presentation of the instrument is clear and easy to understand	87.5%	Very Valid
Average %	93.7%	Very Valid

Based on Table 2 above, the results of the study stated that the instrument was designed in a measurable and systematic manner with reference to the criteria for assessing KPS aspects and KPS indicators, the instrument already has an appropriate assessment rubric. The assessment rubric contains student assessment criteria, KPS indicators and student work procedures in determining the level of achievement of student KPS competencies. To determine the high and low performance in question, you can use a scale tool in the form of a rubric to provide scores for each predetermined criterion (Ngadip, 2016). The performance assessment instrument developed is also equipped with guidelines that function as a reference in determining the scores obtained by students in accordance with the formula or assessment procedures set (Sumaryanta, 2015).

3) *Language Aspects of Aunthetic Assessment Instruments Through High-Level Botanical Practicum*

Aspects of language are shown to know the validity and suitability of the language used in the developed product. The language aspect resulted in an average percentage value of 91.6% which falls under the very valid criteria. Although the aunthetic assessment instrument through the high-level botanical practicum described can already be used as an assessment equipment, there are some suggestions for input from experts to perfect the aunthetic assessment instrument through a high-level botanical practicum to measure the KPS developed. The results obtained are found in Table 3.

Table 3. Validity of Language Aspects

Instrument Items	Answer %	Criterion
Use enhanced spelling-appropriate language	87.5%	Very Valid
The language used is communicative	87.5%	Very Valid
The sentences used are clear and easy to understand	100%	Very Valid
Each instrument has an indicator	87.5%	Very Valid
Average %	91.6%	Very Valid

The level of validity of the instrument can be obtained from the results of the assessment on the validation questionnaire sheet which consists of four aspects based on (Erick, Rayandra, & Bambang, 2015) that have been modified, namely aspects of content validity, construction aspects, conformity aspects, and language aspects. The input and suggestions given are consistency in the use of language. The validity of the equipment from the point of view of language must meet 3 aspects, namely communicative language that is appropriate with the level of education, using standard Indonesian and not using local languages or taboos (Matondang, 2010). This is in accordance with the language aspects of the performance assessment practicum for measuring instruments (KPS) developed.

Thus, it can be concluded that the test of the assessment instrument through a high-level botanical practicum conducted from two expert validation persons consisting of three aspects of content validity, presentation aspects and language aspects with an overall average percentage obtained of 90.9% it can be stated that the assessment instrument through a high-level botanical practicum is worthy of use as an assessment of the ability of science process (KPS) skills of students. at the time of the high level of botanical practicum.

2. *Limited trial results*

At this stage, a product practicality test is carried out in the form of an assessment instrument in the

implementation of a high-level botanical practicum conducted by students of the Biology Education Study Program, Faculty of Teacher Training and Education, Samudra University. In this case, it can be proven by the exposure of the research results below.

1) *Aspects of the Validity of the Contents of the Aunthetic Assessment Instrument through a High Level of Botanical Practicum*

In the aspect of the validity of the contents of the assessment instrument through a high level of botanical practicum which has a very high category of 85.7%. It can be stated that the assessment instrument is well used to measure students' science process skills (KPS) in the implementation of practicum. To see the evidence from the aspect of validity is seen in the following Table 4.

Table 4. Limited Test of Validity Aspects

Statement	Answer %	Criterion
The practicum performance assessment instrument has measured skill competency indicators	83.3%	High
Practicum performance assessment instruments have been prepared based on the order of achievement of skill competency indicators	86.6%	Very High
The practicum performance assessment instrument is made on the basis of a grid formulated	86.6%	Very High
The instrument is equipped with a skill competency assessment rubric	86.6%	Very High
Average %	85.7%	Very High

It can be stated that the assessment instrument is well used to measure students' science process skills (KPS) in the implementation of practicum. The results showed that the percentage of aspects of content suitability, construction aspects, and readability aspects to the practicum performance assessment instruments developed was 82.76%, 82%, and 83%, respectively. It can be concluded that the product developed has excellent criteria (Sahputra et al, 2015).

2) *Aspects of Presenting Aunthetic Assessment Instruments Through High-Level Botanical Practicum*

In the presentation aspect of the aunthetic assessment instrument through a high-level botanical practicum with a percentage value of 88.3% is critiqued very high, it can be concluded that the aunthetic assessment instrument is good for use in measuring students' ability to carry out practicum. An explanation of the data results obtained can be seen in Table 5.

Table 5. Limited Test aspects of presentation

Statement	Answer %	Criterion
The instructions for filling in the performance appraisal are clear	90.0%	Very High
The scope /criteria of performance appraisal are in accordance with the steps of the experiment carried out	83.3%	Tall
The table used for filling in the values is already good.	93.3%	Very High
Rubrics designed to be in accordance with the performance appraisal criteria	86.6%	Very High
Average %	88.3%	Very High

Related to Table 5 above relates to the results of the research of Lestari et al, (2015) which explains the percentage of teacher responses to aspects of product use, construction, and readability of products developed successively is 92.00%, 93.33% and 95.11%. The response of such teachers falls under the criteria of excellent.

3) *Language Aspects of Aunthetic Assessment Instruments Through High-Level Botanical Practicum*

The language test questionnaire on the aunthetic assessment instrument through a high-level botanical practicum is now useful to find out the language used in understanding the aunthetic assessment instrument used to measure students' science process skills (KPS) in practicum implementation with a percentage of 88.3% very high critique value. It can be concluded that the practicality test questionnaire is well used to measure student abilities, this is proven in Table 6.

Table 6. Limited Test aspects of Language

Statement	Answer %	Criterion
The language presented uses simple and communicative language so that it is easy to understand.	93.3%	Very High
The language used is in accordance with the rules of writing the Indonesian	86.6%	Very High
The language spoken does not use the language applicable in the local area	90%	Very High
The sentences used do not use words that can be interpreted double (ambiguous)	93.3%	Very High
Average %	90.8%	Very High

This is in accordance with the opinion of Amalia et al, (2015) which states that the practicum performance assessment instrument developed is declared valid and feasible to use. The teacher's response to the readability aspect. Science process skills are needed when students

do practicum. Students should be familiar with the nature of science, about how scientific knowledge is constructed and validated, the work and methodology of scientists, and how the processes underlying the evolution of scientific knowledge (Yacoubian & BouJaoude, 2010). The skills possessed by students can be improved with direct experience in investigation and experimental activities (Rusmiyati & Yulianto, 2009).

Conclusion

Based on the results of research and discussion, it can be concluded that this assessment instrument is specifically designed using aspects of assessment consisting of three aspects of content validity, presentation aspects and language aspects of assessment instruments through a high level of botanical practicum, namely

The average result of the percentage that has been given an assessment from expert validation of the assessment instrument is suitable for use in measuring students' science process (KPS) skills in carrying out high-level botanical practicum. The results obtained by students' responses to the assessment instrument products consisting of three aspects of content validity, presentation aspects and language aspects are declared good, to be used as an assessment instrument in measuring student success assessments to carry out paractical learning.

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