

PERFORMANCE ASSESSMENT INSTRUMENT DEVELOPMENT IN BIOLOGY PRACTICUMS AT SENIOR HIGH SCHOOL

Muhammad Al Muhajir

Universitas Pejuang Republik Indonesia
ajir.biologi@gmail.com

ABSTRACT

This study is research and development (R & D) which aims to develop an instrument used to assess student performance in practical activities. The development of performance assessment instruments refers to the 4-D development model developed by Thiagarajan which consists of four stages of development consisting of define, design, develop and disseminate. Based on the results of validation from experts and the results of input and responses from biology teachers, it shows the performance assessment instruments are classified as valid, practical and efficient and can be applied in assessing student performance in biology practicum activities.

Keywords: Development of instruments, performance assessment, biology practicum

INTRODUCTION

Improving the quality of education services was one of the priority agendas of the national education development in 2015-2019 as mandated in Presidential Decree No. 2 of 2015 on the National Medium-Term Development Plan 2015-2019. Besides the reliable availability of the curriculum, one of the most fundamental aspects of ensuring the quality of education services is to provide a comprehensive assessment system in accordance with the national standards which have been set.

The government issued a policy on Curriculum 2013 which was implemented in stages starting from the 2013/2014 school year. The 2013 curriculum implements activity-based learning, which is expected to produce productive, creative, innovative, and affective Indonesian people through integrated enhance of attitudes, knowledge, and skills. This has implications for the implementation of assessments that include assessing attitudes, knowledge, and skills, carried out using a variety of ways, including observations, project assessment, performance assessment, and portfolios.

Generally, teachers at the senior high school are still lacking and do not recognize the use of performance assessments in the implementation of practicum in class. This is due to the nonexistence of patents practicum performance assessment forms, even the deficiency of socialization regarding the embodiment of performance assessment in assessing students, especially from the school staff.

To find out the process of student learning effects in class, the teacher generally only refers to cognitive assessment, while the recommended form of assessment based on the 2013 curriculum, not only uses cognitive assessment but also attitude and psychomotor assessment must be included in assessing students.

Practicum activities doing by students must be assessed by the teacher using performance assessment instruments. This is intended for students' psychomotor abilities can be clearly measured not solely to their cognitive abilities. Based on the facts in the field, the teacher only gives a practicum assessment to the extent of observation without any clear and systematic assessment indicators of the activities performed by students at the practicum, so, the students' psychomotor assessment is pseudo. Cognitive, affective and psychomotor assessments need to be synergized for students' competencies and attitudes can be measured clearly. Because not all learning processes carried out in class, especially in the laboratory, are undominated only by the student's cognitive abilities but, psychomotor and

affective abilities are also unspared in the learning process. Therefore, to assess student activities, especially when practicing biology, it is necessary to develop an instrument in the performance assessments form then the teacher's assessment is factual. The performance assessment instrument developed will assess student performance practically objectively because some indicators will be assessed from each student activity that has been summarized in a structured and systematic assessment instrument.

FORMULATION OF THE PROBLEM

Based on the background, the formulation of research problems is:

1. How does the performance assessment development process in the practicum of biology?
2. How is the implementation of performance assessment in the practicum of biology?

PURPOSE

Based on the formulation of the problem aforementioned, the purpose of this research is:

1. To determine the performance assessment development process in the practicum of biology.
2. To find out the implementation of performance assessment in the practicum of biology.

STUDY LITERATURE

Learning device development represents a series of processes or activities carried out to produce a learning device based on the existing development theory. According to van den Akker (in Nurdin 2007), describing development research based on two objectives, i.e. (1) development to get a product prototype (2) formulation of methodological recommendations to design and evaluate the prototype. A valid product or program is if it is imaging the soul of knowledge (state of the art knowledge). This is what we announce content validity; meanwhile, the components of the product must be consistent with each other (construct validity). Furthermore, a practical product is if the product can be managed and implemented in real terms. In addition, an effective product is if it produces the equivalent results as the purpose (Nurdin, 2007).

Assessment and evaluation are an attempt to collect data that is then processed for policymaking in an educational program. In teaching and learning activities, the teacher makes an assessment by collecting facts and student learning documents to make improvements to the learning plan (Sani, 2014). Assessment of learning outcomes depends on the objectives to be achieved in the learning process. Learning objectives are based on the classification of learning outcomes that include cognitive, affective and psychomotor aspects (Majid, 2014). The purpose of the assessment is to ensure the accountability of the learning process. For students, the assessment aims as student feedback to improve their learning and increase student motivation. For teachers, this assessment aims as feedback for teachers on the learning they do.

According to Sudaryono (2013), the assessment has several principles, i.e.:

a. Validity

Validity means assessing what should be assessed using appropriate tools to measure competence.

b. Reliability

Reliability is related to consistency (constancy) of the results of the assessment. Reliable assessment (steady.) allows reliable comparison and guarantees consistency.

c. Comprehensive

The assessment must be performed thoroughly covering all domains contained in each basic competency. Assessment must operate a variety of

ways and tools to assess the various competencies of students so that a competency profile is described.

d. Continuous

The assessment is carried out in a planned, gradual and continuous manner to obtain a picture of the achievement of student competencies within a certain period of time.

e. Objective

Assessments must be made objectively. For this reason, the assessment must be fair, planned and apply clear criteria and scoring

f. Educative

The process and results of the assessment can be used as a basis to motivate and improve the learning process for teachers, improve the quality of learning and foster students to grow and develop optimally.

In line with the above, Eko (2014) has classified the characteristics and principles of assessment of learning outcomes. In his book, he said that the assessment of students' learning in the 2013 curriculum exhibited five characteristics, namely: complete learning, authentic, continuous, based on reference criteria and using varied assessment techniques. As for the assessment of learning outcomes at primary and secondary education levels are based on the principles: valid (valid), reliable, objective, fair, integrated, open, comprehensive and continuous, systematic, accountable and educative.

Practicum is learning where students conduct experiments by experiencing something themselves. Practicum has its own advantages with other learning methods, namely: students directly gain experience and skills in conducting practicum, increase student participation both individually and in groups, students learn to think through the principles of scientific methods or learn to practice work procedures based on scientific methods (Djamarah, 2011). Learning with practicum is very effective to reach all knowledge domains simultaneously, including training makes the theory can be applied to real problems (cognitive), training planning activities independently (affective), and training in use of certain instruments (psychomotor) (Rahayuningsih, 2005). One of the advantages of practicum (laboratory) learning is that students can practice in trial and error, can repeat the same activities or actions until they are truly skilled (Sumiati, 2013).

METHODOLOGY

This research type is research and development (R & D). The development of this instrument produced the ultimate product in the form of performance assessment instruments for biology labs. The development of the assessment used in this research is referring to the 4-D development model developed by Thiagarajan, which consists of four stages of development i.e. define, design, develop, and disseminate.

The stages of developing a performance assessment are as follows:

1. Defining Phase (*Define*)

a. This activity aims to establish the problems that will be the basis for developing practical performance assessments, including solutions to problems encountered through relevant learning theory.

b. Analysis of students

This activity is carried out by paying attention to the characteristics, abilities, and experiences of students, both individually and in groups which include characteristics such as; academic ability, background knowledge, psychological development, and student learning experience.

c. Analysis of concepts/material

Concept analysis is carried out with the aim of identifying materials, in accordance with CS and BC in the k13 curriculum.

d. Formulation of learning objectives

This activity was carried out based on the results of the analysis carried out in the previous three steps. Learning objectives are developed from the

formulation of indicators of achievement of competency standards (CS) and basic competencies (BC).

2. Designing Phase (*Design*)

The design phase is intended to produce a biology practicum performance assessment. The activities carried out at this stage are as follows:

a. Format selection.

Format selection is intended so that the format adopted is in accordance with the standards of content and process standards that have been set. The choice of format is also designed to synergize between the practicum performance assessment that will be developed and the content standards set by the National Education Standards Agency (BSNP) to achieve the learning objectives in these case practicum activities.

3. Development Phase (*Develop*)

This development phase aims to produce a practical performance assessment that is valid and can be implemented.

4. Disseminating Phase (*Disseminate*)

At this stage, assessment of practicum performance is distributed exclusively to a few classes that carry out practicum of biology.

Based on the above development stages, the activity plan can be seen from the chart below:

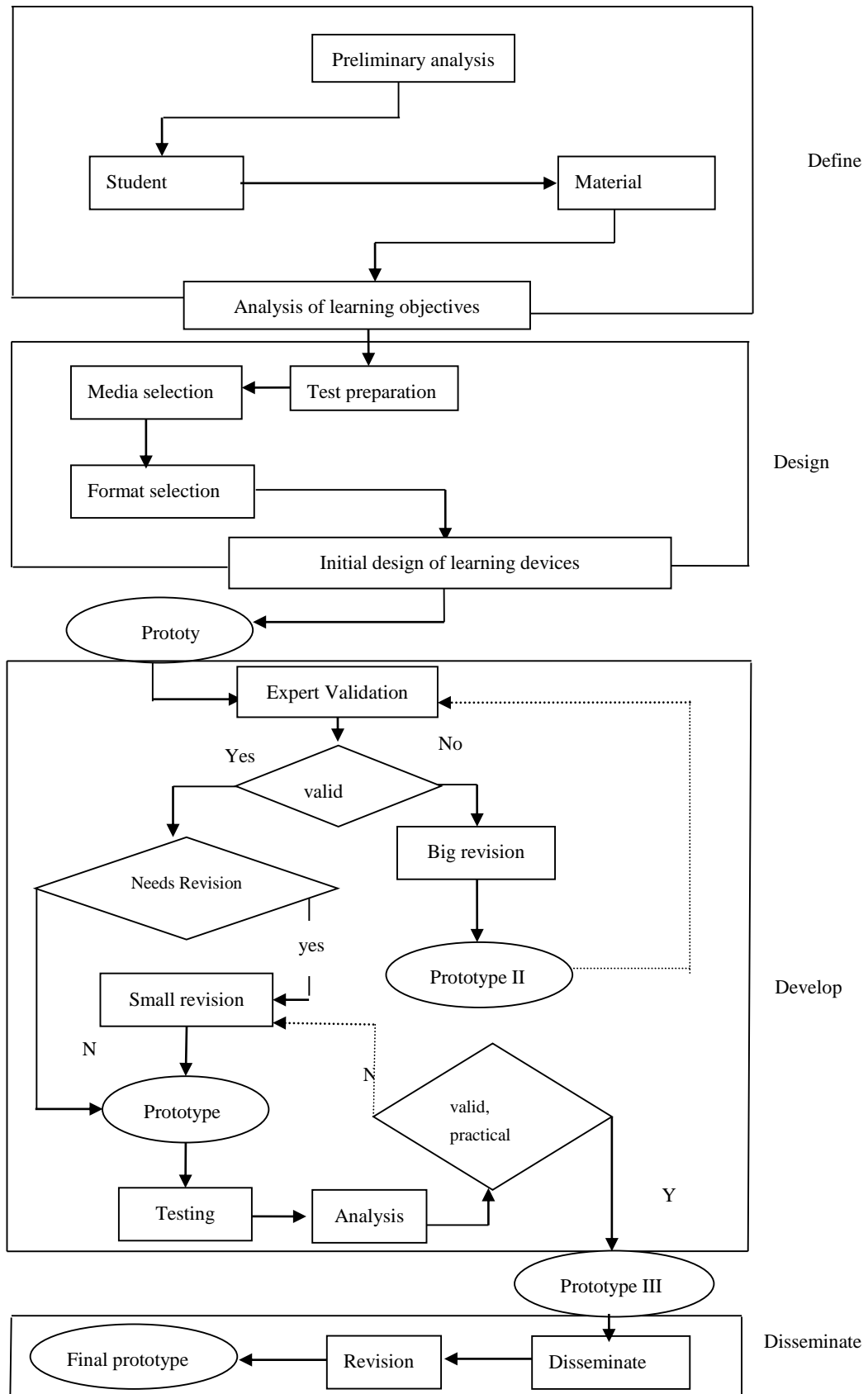


Figure 3.1 Thiagarajan Learning Device Development Model (4-D)
 (Source: Thiagarajan semmel & semmel 1974 in Sahid, 2009)

RESULT

The results of this study were obtained at each phase of the development of performance assessments described as follows:

A. Defining Phase (Define)

1. Initial analysis

In connection with the real conditions, information is obtained: 1) learning is only dominated by the teacher and only tests students' cognitive abilities; 2) teachers only assess students' cognitive abilities; 3) teachers have not been able to assess students' psychomotor in practical activities because they do not yet have systematic assessment instruments.

2. Analysis of students

Student analysis is carried out to find out the students' psychomotor abilities in practicum implementation, and the results obtained by students have not performed practicum perfectly considering there is no teacher assessment on the student psychomotor competence.

3. Concept analysis

Concept analysis refers to competency standards (CS) and basic competencies (BC) based on content standards developed by the National Education Standards Agency (BSNP).

4. Specifications of learning objectives

Specifications of learning objectives are carried out to formulate learning objectives and competencies, especially competencies.

B. Designing Phase (Design)

The design phase is carried out to identify practicum activities that will be carried out that the performance assessment that will be developed is in accordance with the assessment indicators that will be made.

C. Development Phase (Develop)

The development phase is carried out after going through the design stage. At this stage, various revisions of input from experts have been carried out. These results include the structure of performance assessment and indicators needed in accordance with the basic competencies desired in the practicum.

Following are the results of the revision of the practicum performance assessment

No.	Assessment aspects	Scale				
		1	2	3	4	5
1	Use of a microscope					
	a. Check the completeness of the microscope, and record the loan book.					
	b. Holding the microscope by hand holding the microscope arm and the other hand holds the microscope					
	c. Put the microscope on a table in a horizontal position and reach the observer body					
	d. Turn on the microscope lamp					
	e. Set the diaphragm that the incoming light when observing objects is optimal.					
	f. Rotate the objective lens in the position farthest from the preparation table by turning the macrometer.					
	g. Put the observed object by clipping the glass on the preparation table.					
	h. Choose the biggest magnification.					
	i. Rotate the macrometer until the objective lens is directly above the preparation by looking through the ocular lens with a distance of 0.5 cm.					
	j. Rotate the micrometer to clarify observations on objects.					
	k. Identify objects implementing the lowest magnification to the highest magnification.					

Result of revision

No.	Assessment aspects	Scale					Revision
1	Use of a microscope						
	a. Check the completeness of the microscope, and record the loan book.						
	b. Holding the microscope by hand holding the microscope arm and the other hand holds the microscope						
	c. Put the microscope on a table in a horizontal position and reach the observer body						
	d. Turn on the microscope lamp						
	e. Set the diaphragm that the incoming light when observing objects is optimal.						
	f. Rotate the macrometer that objective lens in the position farthest from the objective table						✓
	g. Put the observed object by clipping the preparation glass on the preparation table.						✓
	h. Choose the biggest magnification. (removed)						✓
	i. Rotate the macrometer until the objective lens is directly above the preparation by looking through the ocular lens with a distance of 0.5 cm.						
	j. Rotate the micrometer to clarify observations on objects.						
	k. Identify objects implementing the lowest magnification to the highest magnification.						
	l. Clean the microscope that has been used by using a flannel material (added)						

DISCUSSION

Based on the results of limited trials conducted at school, the performance assessment has met the criteria of validity, practicality, and effectiveness. The following are the results of the study and the obstacles found during the study.

Defining Phase (Define)

Based on the results of field observations, basically, the teacher has carried out practicum activities well and simultaneously. This can be seen from the high percentage of practicum activities carried out reaching almost 40% of the theories given in class. But one of the obstacles is that most teachers who carry out practicum especially biology practicum do not have clear and systematic guidelines and performance assessment indicators. Assessment of practice performance is only limited to direct observations made by the teacher, while not a few indicators can be assessed in performance, especially in carrying out a practicum activity. To anticipate the less systematic form of assessment, a special instrument is required that will be used as a performance assessment in laboratory activities. One of the impacts caused by the existence of a structured and systematic performance assessment instrument is by increasing psychomotor in this case student motivation and student accuracy in practical activities. Students assume that with the performance assessment, all students will carry out practicum activities in accordance with the direction and instructions of the teacher and practicum guides they have that practicum activity ultimately leads to increased psychomotor abilities of students.

Designing Phase (Design)

At this phase, performance assessment instruments that will be made are inseparable from the formulation of learning objectives that have been analyzed previously. The specifications of these learning objectives are based on basic competencies (BC) contained in the content standards and minimum passing criteria (MPC) that must be achieved by each student in each basic competency (BC). In addition, the indicators of performance assessment instrument indicators are

adjusted and refer to the practicum material that will be implemented and the standard of psychomotor abilities of students that must be mastered in a practicum.

No.	Assessed Aspect	Assessment Result			Criteria Average \bar{K}_i	Expla nation
		Validator 1	Validator 2	Validator 3		
1	Format					
	a. Clarity of performance indicators	5	4	4	4,33	V
	b. Clear numbering system	5	4	5	4,67	VV
	c. Match between content and the number of columns available	4	3	5	4,00	V
	d. Spatial/layout settings	5	5	4	4,67	VV
		Average of Aspect \bar{K}_i			4,41	V
2	Language					
	a. The use of language is in terms of Indonesian language rules	4	3	5	4,00	V
	b. Clarity of instructions,	4	4	5	4,33	V
	c. The simplicity of sentence structure.	4	4	5	4,33	V
	d. The language used is clearly to the activity to be assessed	4	4	5	4,33	V
		Average of Aspect \bar{K}_i			4,24	V
3	Content					
	a. Compliance with CS and BS	5	5	5	5,00	VV
	b. Suitability of assessment indicators with practicum implementation	5	4	5	4,67	VV
	c. Clarity of indicators with practicum activities	5	3	4	4,00	V
	d. Structured and systematic performance assessment procedures and procedures	5	4	5	4,67	VV
	e. Availability of observation pages	5	4	4	4,33	V
	f. Availability of assessment column	5	4	4	4,33	V
		Average of Aspect \bar{K}_i			4,5	VV
	TOTAL AVERAGE of ASPECT \bar{X}				4,38	V

Development phase (Develop)

At this phase, instruments that have been examined by several experts will be revised according to the input and revisions that have been revised by experts before re-validation. The revisions considered format, content, language, and performance indicators to be assessed. Besides, aspects of practicality and

effectiveness are also assessed by experts to find out the extent of practicality and effectiveness of instruments that have been developed.

Instrument validation by experts is presented in the table below:

Table 1. Validation of practicum performance assessment instruments

$4,5 \leq x \leq 5,0$	Very Valid
$3,5 \leq x < 4,5$	Valid
$2,5 \leq x < 3,5$	Enough Valid
$1,5 \leq x < 2,5$	Less Valid
$x < 1,5$	Invalid

Based on the above table, the value or average aspect is given by experts is 4.38 or includes a valid category with minor revisions in each aspect. One of the revisions made is the aspect of language, namely by using direct command language. Thus, the instrument developed is suitable for testing in schools.

In addition, other factors assessed in this instrument are practicality and effectiveness. The performance assessment instrument is ready if it meets two criteria, i.e. (1) the performance assessment instrument developed can be applied according to the judgment of experts and practitioners; (2) performance assessment instruments developed can be applied in real terms in the field. The practicality indicator is the result of observing the use of performance assessment instruments in the practicum of biology activities in the laboratory, included in the category of at least partially implemented. Performance assessment instruments are said to be effective, if they meet two criteria, namely (1) performance assessment instruments developed effectively according to experts and practitioners; (2) instrument performance assessment practicum developed can provide results in line with expectations. Indicators of effectiveness are: (1) achievement of students' psychomotor mastery in practical activities (2) student activities and motivation in practicum activities are increasing (3) teacher's ability to assess student performance more systematically.

Disseminating Phase (Disseminate)

This step of the performance assessment instrument is distributed to a limited extent at only one school and is used when carrying out biology practicum activities. This activity is intended to determine the extent of practicality and effectiveness of the performance assessment instruments that have been developed. The practicality and effectiveness test are carried out in a biology laboratory when carrying out practicum observing plant roots. This activity is to measure student performance in terms of the ability to operate a microscope to observe the structure of plant roots.

After the trial, the biology teacher's response to the instrument performance assessment in terms of instrument clarity. Clarity of instruments in the form of letters, font sizes, and layout of the contents of the performance assessment instruments. In addition, the language used in filling out the performance assessment instructions is clear without the need to analyze it again. On the other hand, the teacher's response to the contents of the performance assessment instruments, especially the assessment indicators, was reasonably good. According to the performance assessment, indicators are in accordance with the desired student competencies in terms of student psychomotor. Based on some input from experts and practitioners, especially biology teachers, to obtain a quality performance assessment instrument, a revision was made and the third prototype of the performance assessment instrument was produced. This prototype will be distributed to several schools to carry out practical performance assessment especially in biology subjects.

CONCLUSION

Based on the results of the validation data analysis obtained from the validation results of the three validators, it was discovered that the performance

assessment instruments that had been developed had met the valid criteria. Besides, from the results of the analysis of the limited trials of the instruments that have been carried out, then generally the instruments developed in the form of performance assessment instruments have satisfied the criteria, are practical and effective. This is based on some responses from the teacher that an average practicality rating of 86% and effectiveness around 88%.

REFERENCES

- Abdullah, Sani Ridwan. 2014. *Pembelajaran saintifik untuk kurikulum 2013*. Jakarta: Bumi Aksara.
- Asra,Sumiati.(2013). *Metode Pembelajaran*, Bandung : Wacana Prima.
- Djamarah, Syaiful Bahri. 2011. *Psikologi Belajar*. Jakarta: Rineka Cipta.
- Huda, Miftahul. 2013. *Cooperative learning*. Yogyakarta: Pustaka Belajar
- Majid, Abdul. 2013. *Strategi Pembelajaran*. Bandung: PT Remaja Rosdakarya.
- Nurdin. 2007. *Model Pembelajaran Matematika yang Menumbuhkembangkan Metakognitif untuk Menguasai Bahan Ajar. (Dissertation)*. Unpublished. Surabaya: Surabaya State University.
- Rahayuningsih, Edia dan Djoko Dwiyanto, 2005, *Pembelajaran di Laboratorium*, Yogyakarta: Gajah Mada Education Development Center
- Sudaryono, dkk. 2013. *Pengembangan Instrumen Penelitian Pendidikan*. Yogyakarta: Graha Ilmu.
- Sugiyono. 2013. *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta
- Tim Redaksi Kamus Besar Bahasa Indonesia. 2008. *Kamus Besar Bahasa Indonesia*. Jakarta: Language Center