Development of Learning Instruments based on Scientific Approach to Low Animal Taxonomy Courses for Students of Biology Study Program at *FKIP UISU*

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Abstract: In achieving good learning outcomes, assessment of student learning outcomes should be supported by good assessment of instruments as well. Assessment of student learning outcomes is designed to add information for lecturers, students, and parents of students about the advantages and disadvantages of educational development. Based on the results of the analysis, 3 out of 5 lecturers still find it difficult or even unable to make a good assessment instrument and to see student learning outcomes. Many professors often like to provide a possible assessment on the basis of many factors. The cause of the difficulties in making the assessment instrument is that too many students need to be observed at one time, and it takes a considerable amount of time to develop judgment instruments, and the aspects and attitudes of skills are difficult to observe. This is in accordance with the findings in the field that the lecturers do not assess the student's learning outcomes on an ongoing basis between aspects of attitude, knowledge, and skills. To overcome this, the development of student learning achievement assessment instrument is done on the basis of scientific approach as a reflection of curriculum of *KKNI* or national curriculum.

1 INTRODUCTION

Assessment is one of the eight national education standards. Assessment has several principles in its implementation. Principles of assessment of student learning outcomes are described in the Regulation of the Minister of Education and Culture of the Republic of Indonesia No. 23 of 2016 on Education Appraisal Standards. (Ministry of National Education, 2006). Some of the principles described are valid, objective, comprehensive, and sustainable. Overall, the assessment of students' learning outcomes is expected to include continuity of all aspects of competence, namely attitude (affective), knowledge (cognitive) and skills (psychomotor) which not only measure the results or what is known to the students but also the process or what the student has done during the learning process. Aims are to be made to improve students' understanding based on clear procedures and criteria. (Frey et al: 2012)Assessment of student learning outcomes is important. This assessment can help add information on lecturers, parents, students and students themselves about the advantages and disadvantages of each individual. In the Attachment to the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 104 Year 2015 on Learning in Higher Education, Curriculum of *KKNI* uses scientific approach or science-based approach. Stages in the scientific approach is 5Ms that is, observing, asking, gathering information, reasoning / associating, and communicating. This is suitable with Biology Study Program of Low Veterinary Taxonomy as a subject that requires the ability of thinking and the skills of the process of science in learning it. Low Veterinary Taxonomy is expected to foster curiosity as well as the ability and skills of students in obtaining scientific products. To find out the extent of students' ability, lecturers can make an assessment by making an assessment of learning outcomes based on a scientific approach. However, the results of the survey on the analysis of the needs of the assessment instrument of student learning outcomes in the Low Animal Taxonomy are obtained from two Lecturers of Biology Study Program. Of the two respondents, one expresses difficulties in making an instrument of student learning outcomes. This is consistent with the result

of the statement that only two respondents use the skill aspect as an assessment of learning outcomes. Factors that cause lecturers to have difficulty in making the instrument of student learning outcomes are too many students need to be examined at one time, and it takes time in making the instrument of student learning result assessment and attitude aspect as well as skill aspect. Stages in the assessment of student learning outcomes, are from four respondents. One does not use scientific approach stages and the other two only use a few stages only. Of all the respondents, two lecturers of Biology want an assessment instrument of student learning outcomes of attitude aspects with self-assessment techniques to be developed. The gap between student learning outcomes based on what is written in government regulations and ministerial regulations with what is happening at campus, requires the development of a valid and reliable learning assessment instrument. Because the assessment of learning outcomes must be continuous between aspects of attitude, knowledge, and skills. The researcher develops the students' learning achievement instrument based on the scientific approach on the study of Low Animal Taxonomy.

2 METHODOLOGY

The instrument development procedure is based on research and development (ADDIS). Steps of the ADDIE model are Analysis, Design, Development, Implementation, and Evaluation. The ADDIE model is the simplest model but covers overall development. Here is an ADDIE model scheme.
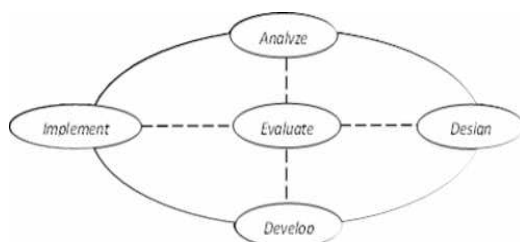

Image Schema Model of ADDIE

Research is still underway at the design stage. After conducting need analysis and literature study, the researcher makes the instrument of student learning achievement of three domains. For the affective domain, the researcher creates a self-assessment sheet based on eighteen values of the nation's character by adapting the scientific approach and

Core Competency 1 and Core Competence 2. For the cognitive domain, the researcher makes a structured description based on factual, conceptual, procedural, and metacognitive knowledge on matter of heat. For the psychomotor domain, the researcher makes a assessment sheet based on the scientific stage of the scientific approach that is 5M, observing, asking, gathering information, reasoning / associating, and communicating. (Enger and Yager, 2000)

One instrument that can measure the ability of good knowledge of students and the skills to carry out activities authentically and scientifically is an instrument in the form of items of activity that must be done directly by students. Instrument is equipped with assessment rubrics in accordance with the components of scientific activity and assessment guidelines. Assessment during the learning process based on the 2013 curriculum is not separated from the learning process and carried out applying the scientific approach. Therefore the assessment of achievement of the three domain of competence, is also necessary done on students' abilities to carry out scientific activities through the process learning with a scientific approach. To measure the competency of students in terms of knowledge and skills, tools are needed for measurement to describe the scientific activities. Instrument prepared by the lecturer to measure students' competency in general is in the form of objective tests to measure the ability of students in the mastery of material tested only. Skills for conducting scientific activities cannot be measured through objective questions developed. Therefore measuring instrument is necessary to know the knowledge of students, and to measure the skills of students in doing scientific activities authentically.

Authentic assessment is seen as the most suitable model, complete, and objective, and has been used in various countries and fields. Lowery (2003), explains that school teachers in Texas intensively are trained to have skills in composing and applying authentic assessment instruments in learning. Various types of instruments have been developed by researchers, educators and education practitioners.

3 RESULT

The result of the research consists of a self-assessment sheet with check list, an assessment instrument in the form of structured questions, and a practical assessment sheet. Here is a grid of assessment instruments developed by researchers.

Table 3.1: Grid of the Assessment Instrument for Students' Learning of Affective Range.

Rated Aspect	Indicator	Affective stage					Amount
		A1	A2	A3	A4	A5	
Religion	Students perform actions based on religious teachings embraced					2,17	2
Curiosity	Students perfect the knowledge they have				4,7,8		3
Honesty	Students show the work					13, 20	2
Responsibility	Students complete the task		5,18				2
Discipline	Students fulfil their duties with coherence		3,6				2
Hard Work	Students do their job seriously					9,19	2
Tolerance	Students hear the opinions of others	1,10,11,12					4
Enviromental Care	Students initiate environmental awareness				14,15,16		3
	Amount	4	4	3	3	6	20

The following aspects are assessed on the lattice of student learning outcomes in the cognitive domain :

1. Factual:
has the following indicators:
a. students mention one of Avertebrate phylum and its species example
b. students mention the tools used to observe species from protozoan phyla
c. students explain the process of vegetative propagation from one of the invertebrate phylum

2. Conceptual:
has the following indicators:
a. students explain the species life cycle of invertebrate phyla

b. students explain the negative impact that aquatic species can inflict on humans
c. students can explain the basic sequence of classification levels of taxon
d. students explain the special features of each phylum of invertebrates
e. students explain the function or usefulness of every phylum for human life
f. students describe the characteristics of each class of every invertebrate phyla

3. Procedural:
has the following indicators:
a. students sort the procedure of field practice work
b. students sort the process of observing the sample species of each phylum in the laboratory.

4. Metacognitive:
has the following indicators:
Students complete a chassis study and pour it into a paper report prepared by each group.

In the process of assessing student learning outcomes in the cognitive domain the assessment process Bloom's Taxonomy C1 to C6 is used. Instrument has 20 item test questions and is divided into:
C1 : 5 items
C2 : 1 item
C3 : 6 items
C4 : 5 items
C5 : 2 items
C6 : 1 item
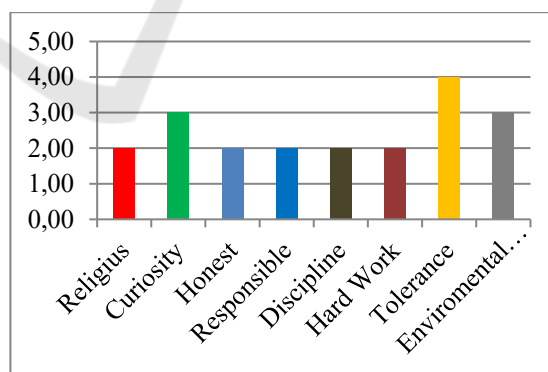
Student learning outcome assessment instruments are still in the development stage towards validation and reliability tests. In the lattice of assessment instrument Learning Outcomes of Affective Domain students have several aspects, namely:
1. Religion with indicators that students take actions based on the teachings of their religion.
2. Curiosity with indicators that students perfect

their knowledge 3. Honesty with indicators that students show the work based on what is done 4. Responsibility, students complete tasks that should be done 5. Discipline, students fulfil the task coherently 6. Hard Work, students do their work seriously 7. Tolerance, students hear other people's opinions 8. Caring for the Environment, students initiate concern for the environment. As an example of one aspect of the scientific stage in the Psychomotor realm instrument is the stage of gathering information. At this stage we can use the assessed aspects as follows: a) Instruments / tools used to collect data. b) Validity of information collected. c) processing linkages between various types of facts or concepts or theories. From these 3 aspects we can take a number of indicators, namely 1) students can use the right tools in making measurements, 2) students operate the tool repeatedly to get valid results 3) students construct the interrelationship between collected taxonomy of invertebrates

4 ANALYSIS

From the result of the Wilcoxon Signed Ranks Test, it is analyzed that the alpha value of both groups are less than 0.05. The Test Statistics shows that the alpha value at Asymp.Sig. (2-tailed) of group A (social class) is .001, and the alpha value of group B (physics class) is .000. This result means that the hypothesis is rejected. In other words, there is significant difference of the students' score before and after the short course. Based on the score before and after the short course of both groups, it is analyzed that the score of the students in group A (social class) increases up to 31.5 %, and the score of the students in group B (physical class) also increases up to 28.2 %. The assessment instrument that is made is intended for the students of Biology Education Study Program of Low Animals Taxonomy. Instrument development is done by Research and Development method of ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). This research results in an assessment instrument of learning result of student's attitude aspect, in the form of self assessment sheet with check list based on basic competence 1.1 one instrument of student learning result of knowledge aspect in the form of structured description test based on basic competence 2.1, and one instrument of student learning result assessment aspect practical engineering test skills with checklists based on basic competencies 3.2.

5 CONCLUSION

Development of a Scientific Approach Based Assessment Instrument on the Material of Low Animal Taxonomy using the ADDIE model includes 5 processes, namely Analysis, Design, Development, Implementation, and Evaluation. These five stages must be sequentially carried out continuously in the instrument development process in the Low Animal Taxonomy course. The Low Animal Taxonomy course itself consists of 9 phyla where this course is one of the courses in Biology Study Program that meets the requirements to be chosen as a scientific approach media. This course is chosen because it fulfils the requirements for the criteria for the 3 aspects of assessment: attitude, normative, and skill assessment. The results of the development of an instrument are one instrument assesses student learning outcomes in the form of structured description based on basic competencies in the class, and an instrument for evaluating student learning outcomes in technical practice tests in the laboratory. From the results of the assessment and development, 8 aspects of the points are assessed and instruments are obtained amounted to 20 points per indicator.

RECOMMENDATION

With the development of assessment instruments based on 3 aspects Affective, Cognitive, and Psychomotor, it is expected that each lecturer will be able to develop an assessment instrument based on the ability of each lecturer. Adjusting to the courses can enable them to more easily analyze the learning outcomes obtained by students. Indicators of each aspect must be considered, as well as the questions used in the instrument must be in accordance with the taxonomy of blooms C1 to C6. and levels A1 to A5. Instrument validation is also needed to ensure that the instruments used can be measured for their validity and reliability.

Types of data used in this research development are quantitative and qualitative. Quantitative data are obtained from the score from questionnaire responses from teachers, and test data validity and reliability. Qualitative data are obtained from responses and suggestions provided by validation experts and teachers as practitioners. Development research is equipped with the use of research instruments. Instruments are in the form of a validation sheet by the team material expert and product design and questionnaire of teacher's responses to assessment instruments based on the

scientific payload approach in animal and plant sub-themes in home environment. In the limited test data obtained from the teacher's response is a score. Questionnaire score is analyzed by first making interval table. Interval distance is calculated by use of the following formula (Ridwan, 2010): interval = (highest score - lowest score) / number of interval and classes after obtaining interval distance. The classification is determined for the following teacher's responses:

9.77 - 12.00: very decent
7.51 - 9.76: feasible
5.26 - 7.50: quite decent
3.00 - 5.25: not feasible

In addition to the teacher's response, data on the limited test are also obtained from student learning outcomes used to determine validity and reliability. Validity and reliability are obtained by using the product-moment correlation formula (Arikunto, 1999). In the trial of students, the ability of students to carry out scientific activities can be analyzed using percentage calculation techniques using the formula:

Average value = (score obtained / maximum score) x 100 (Arikunto:2016)

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