Development of Mini-Research Based Assesment to Measure Students Competences

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Abstract. The results of previous studies show that mini research learning can improve student competence but there are problems in the assessment process where lecturers have not used appropriate instruments and the instruments used have not comprehensively assessed students' cognitive, affective and psychomotor aspects. Based on these problems, we carry out research on the development of an authentic assessment based on mini research. Methods that use are Research and Development (R&D) with the ADDIE model, analysis, design, development, implementation, and evaluation. The purpose of the research is to produce a mini research-based assessment that can be used by lecturers to conduct authentic assessments to measure student competence comprehensive during the learning process. The results of the expert validation test obtained an average construct validation score of 3.5 (valid), an average content validity score of 3.7 (valid). The results of testing the validity of the instrument using Kaiser-Meyer-Olkin (KMO) on cognitive assessment of 0.79 > 0.5, psychomotor assessment 0.618> 0.5, affective assessment 0.555> 0.5, so it can be concluded that the three types of instruments are valid. The result of the reliability test using Crocbach's alpha was 0.7 in the high category. The results of the first test student's competency assessment showed that 56% of students were at the competent level in cognitive competence, 80% of students were at the competent level in psychomotor competence and 83% of students were at the competent level in affective competence. The mini research- based assessment that was developed is appropriate to be used in the learning process to measure student competences

Keywords: assessment; mini research; competences

1 Introduction

The main task of lecturers in the tridharma of education is to plan learning, carry out learning and carry out learning assessments. These three components are an inseparable unit. [1]The assessment process carried out by the lecturer will provide information and feedback whether the planned learning objectives have been achieved or not. [2] Learning assessment must be carried out comprehensively and integrated in the learning process. Assessments carried out by lecturers must also emphasize the process and learning outcomes, thus enabling lecturers to carry out authentic assessments. [3]

Authentic assessment assesses all student activities before, during, and after the learning process. Authentic assessment includes several aspects that are assessed, such as cognitive, affective, and psychomotor aspects. [4] Authentic assessment is a process of collecting student learning outcomes starting from the cognitive and performance of students during the

UNISET 2021, December 02, Kuningan, Indonesia

DOI 10.4108/eai.2-12-2021.2320241

learning process, learning outcomes and assignments expressed by test and non-test scores given by the teacher / lecturer. [5]

The obstacle in implementing learning that occurs in higher education is the lack of implementation of authentic assessments in assessing students during the learning process. The assessment process that is usually carried out by lecturers is limited to the implementation of UTS, UAS and assignments. Based on the results of observations in one study program, 50% of existing lecturers have carried out an assessment of the learning process, but the instruments used are not appropriate, such as not using rubrics that are in accordance with learning outcomes. There are several problems that may be faced by lecturers in conducting the assessment process. First, the lecturers have not been consistent in conducting comprehensive and integrated assessments. Second, lecturers have difficulty in improvising/developing instruments/measuring tools used in assessing students, especially in the aspects of skills and attitudes. Although in order to ensure the quality of learning, at the end of every semester, the activities of lecturers in the implementation of pre-learning have been monitored and evaluated by the leadership, but this has not focused on the implementation of authentic assessments

The implementation of this authentic assessment should be used by lecturers to assess the learning process carried out by students. So that this authentic assessment in essence must be developed in accordance with the model or learning strategy used. The learning model or strategy must also be in accordance with the concepts and learning objectives to be achieved. [6]

The concepts of lecture material in biology education are generally conceptual and contextual concepts that are suitable for using mini-research-based learning strategies. Mini-research-based learning can develop student competencies in terms of knowledge, skills, and attitudes. An effective assessment must be able to ensure that students have the competencies that have been determined. All lecturers must understand the assessment standards in order to carry out learning assessments based on the same standards. [7]

Based on the background of the problem, we conducted development research to produce a product in the form of an authentic assessment based on mini research to measure student competence. The purpose of this study, the results of this mini-research-based authentic assessment can be used by lecturers to conduct authentic assessments to measure student competence comprehensively during the lecture process. This becomes very important to implement because the results of the products made will support the performance of lecturers in conducting assessments in accordance with the learning assessment standards set by the Higher Education.

2 Methodology

The research method used in this research is Research and Development (R&D). The stages of the research method, namely the ADDIE model; analysis, design, development, implementation, and evaluation developed by Reiser and Mollenda. [8] The data collected include:

a) Content validation,
   The instrument validation test was carried out by experts, one of which was to measure the content validation of mini-research-based assessments. The data obtained were analyzed using the following

formula:
Score = Σ validator answer score
Σ item

b) Construct Validation
In addition to content validation, construct validation of the mini-research-based assessment was also measured using the same formula as content validity. The levels of content and construct validation are described in Table 1.

Table 1. Content and Construct Validation Criteria

Percentage	Criteria
$1 \leq Va < 2$	Invalid
$2 \leq Va < 3$	Sufficiently Valid
$3 \leq Va < 4$	Valid

Analysis of small-scale test data, analyzed to see the validity and reliability of the instrument and to see the ability of students. Data validity was measured using Kaiser-Meyer-Olkin (KMO) and reliability data was measured using Crocbach's alpha.

3 Result and Discussion

The expert validation stage is used to determine the feasibility of an authentic assessment instrument that has been developed. This stage is needed to examine that the resulting product has good validity. The feasibility of an authentic assessment instrument is assessed from two aspects, namely the content aspect and the construct aspect. It is hoped that from the assessment of these two aspects, an authentic assessment instrument is obtained, both in terms of content and in terms of constructs. The results of the study began with the results of the validation of 3 experts in the field of evaluation and learning biology to assess the product of a mini research-based learning assessment. The assessment made consisted of cognitive assessment (higher order thinking skills), psychomotor assessment (experimental and presentation skills) and affective assessment (scientific attitude). The results of expert validation consisting of construct validation and content validation are presented in Table 2

Table 2. Expert Validation Results

No.	Validasi	Rata-rata skor	Keterangan
1	Construct validation	3,	Valid
2	Content validation	3,	Valid

The assessment validity criteria are said to be valid if the range of values is 3-4. Based on table 2, it is explained that construct validation with an average score of 3.5 (valid) and content validity with an average score of 3.7 (valid). The results of construct and content validation are valid, meaning that the assessment can be used at the small-scale trial stage without revision.

The next stage is a small-scale trial on 30 students who are taking biology courses using mini-research lessons equipped with practicum. The results of testing the validity of the instrument using Kaiser- Meyer-Olkin (KMO) on cognitive assessment of $0.79 > 0.5$, psychomotor assessment $0.618 > 0.5$, affective assessment $0.555 > 0.5$, so it can be concluded

that the three types of instruments are valid. The result of the reliability test using Crocbach's alpha was 0.7 in the high category

Table 3. Results of Instrument Validity and Reliability

Instrument	KMO	Validity	Cronbach' Alfa
Cognitive	0,790	KMO> 0.5 = valid	0.764
Affective	0,618	KMO> 0.5 = valid	0.652
Psychomotor	0,655	KMO> 0.5 = valid	0,664

The results of the small-scale trial include 3 competencies, namely cognitive, affective and psychomotor, as follows:

Table 4. Students Competencies

Competence	Average Score		Level	% of competent students
Cognitive	76.34	3.05	Kompeten	56%
Affective	82.61	3.3	kompeten	80%
Psychomotor	81.99	3.27	kompeten	83%
Average	80,3	3,2		

Based on table 4, it is explained that the competency levels of Biology Education students are; as many as 56% of students are at the competent level with an average cognitive score of 76.34, 80% of students are at the competent level with an average affective value of 82.61, and as many as 83% of students are at the competent level with an average the average psychomotor score was 81.99.

In the results of this small trial, the average overall student competency score obtained is 3.2 and the average score is 80.3 or is categorized as competent so that the authentic mini-research-based assessment instrument in the cognitive, affective and psychomotor domains developed is declared very effective. or very good. In the application of an authentic assessment instrument based on a mini- research, there were no obstacles related to its implementation. Student competency assessment using this mini research-based authentic assessment makes it easier for lecturers to assess and describe the competencies that have been achieved by students, because this authentic assessment is equipped with clear assignments and rubrics. The assessment rubric contains dimensions that contain criteria for each competency that must be achieved, as well as the scale/measurement of the acquisition of these competencies. With the dimensions and scales in the rubric, it will be easier for lecturers to assess student competencies.[9] Authentic assessments accompanied by clear assessment rubrics will help lecturers provide an accurate description of each level of competence that must be achieved by students. [10]

The learning that is applied uses mini research which is identical to one type of inquiry, namely free inquiry. Free inquiry is one of the levels in inquiry learning that encourages students to identify a problem, find a solution to the problem through an experiment. [11] In mini-learning, research can lead to active learning in the classroom accompanied by observation activities, designing experiments to communicating the results of the experiments.

Students will produce knowledge that is truly meaningful so that it will improve their ability to master the learning material. [12]

The application of mini-research learning in several Biology courses can facilitate and improve students' KPS and problem solving abilities. [13]Authentic assessment is a form of assessment that requires students to display attitudes, use the knowledge and skills obtained from mini research-based learning in carrying out tasks in real situations. [14]

Based on table 4, it can be seen that the affective competence (attitude) of students has a high value between cognitive and psychomotor competencies. This affective competence / scientific attitude is needed by students because it can increase learning motivation so that the expected learning outcomes can be optimal and are closely related to science learning achievements. The lack of positive attitudes that students have can lead to low learning outcomes. [15] The application of authentic assessments can also improve cognitive abilities, scientific thinking, and creative thinking because authentic assessments encourage students to use scientific knowledge in real contexts instead of making/composing something new and unknown to students. [16] Inquiry-based authentic assessment which is in line with mini research in science learning is expected to help teachers assess students in cognitive, affective and psychomotor aspects as well as train students in applying science knowledge in real life. [17] Improving student learning outcomes because the assessment developed characterizes an inquiry model that is in line with mini research learning that can train active students in the learning process to be challenged to find problems and to be solved by finding solutions to a problem faced in real world contexts. [18]

Through the application of authentic assessment in learning, it can provide opportunities for students to carry out authentic tasks and improve skills and skills that are relevant and useful for their lives. Authentic assignments can shape students to be innovative and creative because they have the opportunity to develop it through learning. [2] Developing skills in carrying out practicals starting from determining problems to making conclusions means also developing investigative and discovery skills which are important for student teacher candidates. [19]

4 Conclusion

In this research, has developed an authentic assessment based on mini research that measures the competence of Biology Education students which include: (1) cognitive competence; (2) affective; (3) psychomotor. This mini research-based authentic assessment was validated by 3 experts and tested on Biology Education lecturers and students. Expert validation and field trials show that the authentic, authentic assessment based on the mini-research that has been developed has met the criteria of being valid, reliable and effective, so that it can be used to measure the competence of Biology Education students which includes cognitive, affective and psychomotor competencies.

References

[1] A. I. N. Marhaeni and L. P. Artini, “ASESMEN AUTENTIK DAN PENDIDIKAN BERMAKNA : IMPLEMENTASI KURIKULUM 2013,” vol. 4, no. 1, pp. 499–511, 2015.

[2] N. Riya Irianti, “The Development of an Authentic Assessment with Project Based Learning to Improve Creative Thinking Skills,” Adv. Soc. Sci. Educ. Humanit. Res. Vol. 274 1st Int. Conf. Creat. Innov. Technol. Educ. (IC-CITE 2018), vol. 274, pp. 244–246, 2018.

[3] S. Ermawati and T. Hidayat, “Penilaian autentik dan relevansinya dengan kualitas hasil pembelajaran (persepsi dosen dan mahasiswa ikip pgri bojonegoro),” vol. 27, no. 1, pp. 92–103, 2017.

[4] N. Dwinda and R. Sumarmin, “Analysis of the Need for the Development of Authentic Assessment Instrument in Biology Learning In Class XI MIA SMA Semester 2,” Int. J. Progress. Sci. Technol. ISSN 2509-0119, no. 2, pp. 467–472, 2018.

[5] V. Kusumawati, S. Mulyani, E. Susilowati, and W. Isnaeni, “Journal of Innovative Science Education Evaluation of Authentic Assessment Implementation on Biology Learning at SMA Negeri in Semarang,” vol. 10, no. 37, pp. 8–16, 2021.

[6] R. Safaroh and N. R. Dewi, “Lembaran Ilmu Kependidikan Pengembangan Asesmen Autentik Berbasis Proyek untuk Mengukur Hasil Belajar,” vol. 46, no. September, pp. 41–50, 2017.

[7] P. D. Yuniawan, “The development of an authentic assessment instrument to measure students skills in learning biology in grade 8 junior high school,” Int. Conf. Math. Sci. Educ. Univ. Pendidik. Indones., vol. 3, pp. 112–117, 2018.

[8] B. Military and H. Molenda, “ADDIE Model DESIGN DEVELOPMENT IMPLEMENTATION,” no. June, pp. 34–36, 2003.

[9] A. F. Hindriana and I. Setiawati, “the Development of Authentic Asessment Rubric for Assesing Undergraduate Students Learning and Performance,” Indones. J. Learn. Instr., vol. 1, no. 1, 2018, doi: 10.25134/ijli.v1i1.1279.

[10] I. Setiawati and A. F. Hindriana, “Pengembangan asesmen kompetensi pedagogik pada mahasiswa calon guru biologi,” JPBIO (Jurnal Pendidik. Biol., vol. 5, no. 1, pp. 1–11, 2020, doi: 10.31932/jpbio.v5i1.531.

[11] M. R. S. Damanik, “Jurnal Pendidikan Ilmu-Ilmu Sosial Pengembangan Penilaian Autentik Berbasis Karakter pada Ranah Keterampilan di Fakultas Ilmu Sosial Universitas Negeri Medan,” J. Pendidik. Ilmu-ilmu Sos., 2017.

[12] C. J. Wenning, “Levels of inquiry: Hierarchies of pedagogical practices and inquiry processes,” J. Phys. Teach. Educ. Online, vol. 2, no. 3, pp. 3–11, 2005, [Online]. Available: http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Levels+of+inquiry:+Hierarchies+of+pedagogical+practices+and+inquiry+processes#0.

[13] R. Widiantie, I. Setiawati, and E. Junaedi, “Analysis of Integrated Science Process Skills and Problem-Solving Abilities Through Mini-Research Learning of Biology Students,” UNISET 2020 Proc. 1st Univ. Kuningan Int. Conf. Soc. Sci. Environ. Technol. UNiSET 2020, 12 December 2020, Kuningan, West Java, Indones., 2021, doi: 10.4108/eai.12-12-2020.2305015.

[14] D. N. Agnafia, H. Fauziah, and S. Susdarwati, “Analisis Sikap Ilmiah Mahasiswa Calon Guru Ipa Pada Mata Kuliah Biologi Dasar I,” Bio-Pedagogi, vol. 8, no. 2, p. 77, 2019, doi: 10.20961/bio-pedagogi.v8i2.34929.

[15] A. V. A. Fidia Fibriana, “Potensi Kitchen Microbiology Untuk Meningkatkan Keterampilan Teknik Hands-on Dalam Pembelajaran Mikrobiologi,” USEJ - Unnes Sci. Educ. J., vol. 5, no. 2, pp. 1210–1216, 2016, doi: 10.15294/usej.v5i2.12591.

[16] S. H. Setya Triamijaya, “Pengembangan Asesmen Autentik Berbasis Inkuiri Pada Materi Klasifikasi Benda,” Unnes Sci. Educ. J., vol. 4, no. 2, 2015, doi: 10.15294/usej.v4i2.7944.

[17] S. Vajoczki, S. Watt, M. Vine, and R. Liao, “Inquiry Learning: Level, Discipline, Class Size, What Matters?,” Int. J. Scholarsh. Teach. Learn., vol. 5, no. 1, 2011, doi: 10.20429/ijsotl.2011.050110.

[18] A. H. Daulae, L. Lazuardi, and M. A. Napitupulu, “Kajian Penerapan Tugas Mini Riset Terhadap Hasil Belajar Mahasiswa Materi Keanekaragaman Hayati,” J. Pelita Pendidik., vol. 6, no. 1, pp. 60–64, 2018, doi: 10.24114/jpp.v6i1.9305.

[19] R. Widiantie, and L. Lismaya, “Pengembanagn Alat Penilaian Berbasis Keterampilan Generik Sain Pada Praktikum Struktur Hewan,” Semnas pendidikan Sain II Fakultas Biologi Universitas Kristen Satyawacana., ISBN; 978-602-61913-0-4..