Need analysis in the development of PjBL-based assessment instruments for coastal mathematic and science education students

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Abstract. Mathematics and science education in coastal areas pose unique challenges that require appropriate teaching approaches. Project-Based Learning (PjBL) has emerged as a learning model that can enhance student engagement and the application of concepts in real-world contexts. Therefore, this research aims to conduct a needs analysis for the development of PjBL-based assessment instruments for mathematics and science education students in coastal areas. This needs analysis research was an early stage of development research consisting of stages 1) analysis, 2) design, and 3) development. This descriptive study used a questionnaire technique to collect data in the form of lecturer responses to the PjBL assessment instrument needs. Data analysis was carried out using simple statistics, namely percentages and also qualitatively. Based on the research results, it was found that lecturers still had difficulties in developing PjBL assessments. Difficulties felt by lecturers were difficulties in preparing the PjBL stages, determining descriptions of the assessment rubrics, details of project implementation by off-campus students, conformity of assessments with projects made, determining criteria/aspects and scores. All lecturers agree/strongly agree that the development of assessment instruments in PjBL is carried out for Mathematics Education, Chemistry Education and Biology Education.

1 Introduction

The education curriculum in all educational units in Indonesia, including higher education, recommends Project Based Learning (PjBL) as a learning model. PjBL is an inquiry-based learning model that engages students in knowledge construction by asking them to complete meaningful projects and develop real-world products [1]. PjBL's goals are oriented toward involving students in terms of knowledge, attitude, and behavior in working on authentic projects and product development [2]. The criteria for achieving learning objectives need to be determined so that learning objectives are achieved properly. According to Krajcik and Shin [3] PjBL goals are achieved if students: have driving questions, focus on learning objectives, participate in educational activities, collaborate among students, use scaffolding technology, and create real artifacts. The criteria for achieving these learning

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objectives form the basis for developing PjBL-based assessment instruments. The development of assessment instruments based on PjBL is pertinent as PjBL has proven effective in improving student engagement, the application of concepts, and critical thinking skills [4]. Students in coastal areas often face unique challenges related to their environment. The developed assessment instruments should reflect their geographical and social contexts to ensure the relevance of learning [5].

UMRAH is university in coastal area. MIPA Education Study Program at UMRAH consists of Mathematics Education, Biology Education, and Chemistry Education. So far, PjBL has been applied and more intensely applied to the Independent Learning Campus Merdeka (MBKM) program, but not much has been developed for the assessment instruments. Whereas PjBL-based assessment instruments really need to be developed to measure the achievement of PjBL. The research can highlight the specific needs of mathematics and science education students in coastal areas. Assessment instruments should take these aspects into account for accurate and in-depth evaluation [6]. This study can explore its relevance to national and international education standards, ensuring that the developed assessment instruments align with the set learning objectives [7].

2 Methods

This research was conducted in July 2023 with 17 lecturers as research subjects. The research conducted was descriptive research with the aim of analyzing the need for PjBL assessment instruments. This needs analysis research is an early stage in product research and development, namely an PjBL assessment instruments. The research and development stages carried out are a modification of the ADDIE development stages, consisting of 3 stages, namely 1) analysis, 2) design, and 3) development. The analysis was carried out to find out the lecturer's response regarding the need for PjBL assessment instruments. Needs analysis was also carried out by Jalal et al. in developing an authentic assessment instrument based on scientific literacy [8].

The data in this study are lecturer responses related to the need for PjBL assessment instruments which were collected using a semi-open questionnaire instrument in the form of a google form. The questionnaire instrument for the needs assessment given to lecturers explores the identity of the lecturer, namely related to name, the PjBL-based courses taught, and contains the questions presented in Table 1.

Table 1. Questions in google form

No.	Questions
1.	What percentage of the courses do you teach using PjBL each semester?
2.	How many PjBL implementation meetings do you plan in one (1) course?
3.	The form of assessment is in the form of:
4.	Instruments used:
5.	Type of assessment applied:
6.	In your opinion, what aspects should be included in project appraisal?
7.	Can the same assessment instrument be used for different project activities? Why?
8.	Please upload the assessment documents that you have used.
9.	Did you experience difficulties in developing the PjBL assessment instrument?
10.	Please explain the difficulties you experienced in developing and/or conducting PjBL assessments?

Questionnaires for lecturers were distributed via the lecturer's Whatsapp group and also sent via Whatsapp chat privately to colleagues who teach in the Mathematics Education Study Program, Chemistry Education Study Program, and Biology Education Study Program. Lecturer response data is processed by Google form.

3 Results and Discussion

Place Based on the results of the questionnaire, the data is presented in the form of an image as follows:

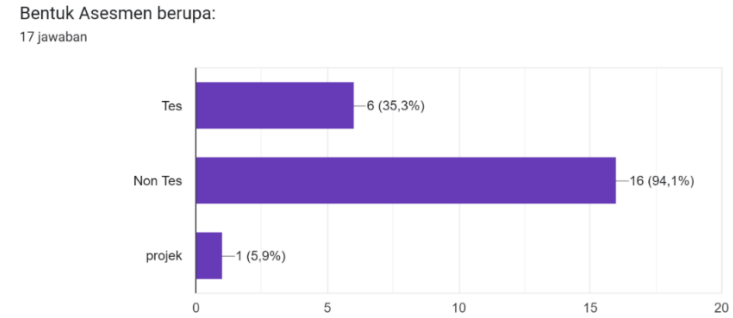

Fig. 1. Various kinds of PjBL assessments

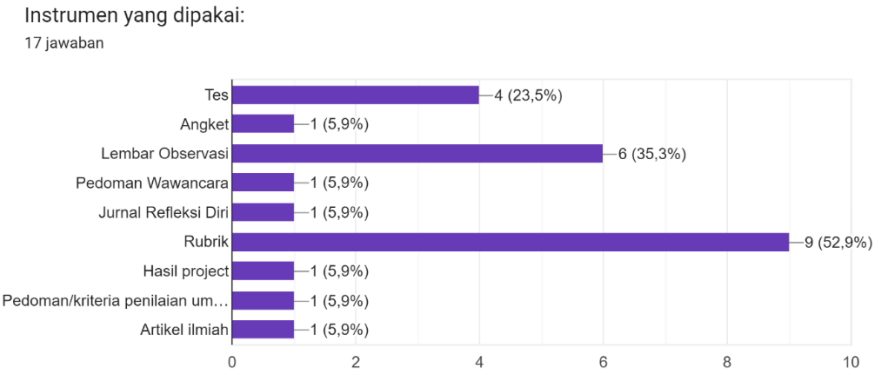

Fig. 2. Various kinds of PjBL assessments instrument

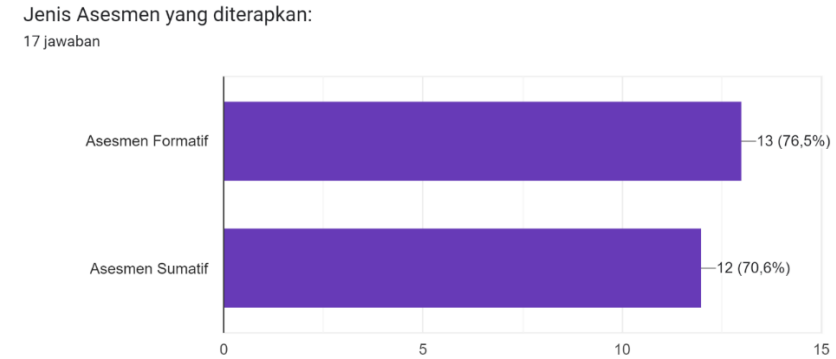

Fig. 3. Various kinds of PjBL assessments instrument

Fig. 4. Lecturers' opinions regarding whether it is difficult to develop PjBL assessments

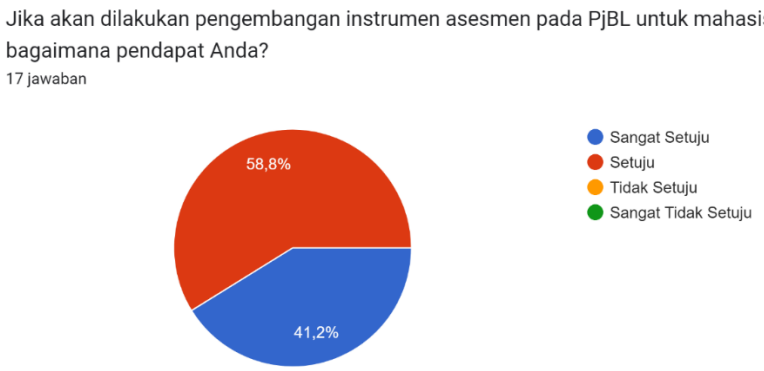

Fig. 5. Lecturers' opinions regarding the development of PJBL assessments

Table 2. The difficulty of lecturers developing aspects of PjBL assessments

No.	Aspects in the PjBL assessment	Total of Lecturer
1	Implementation/ monitoring/ implementation/ technical	11
2	Results	10
3	Planning	7
4	Scheduling, essential questions, affective/attitude, cognitive/knowledge, psychomotor/skills	2
5	exposure and updating of ideas, and continuity between theory and facts in the field	1

PjBL-based courses include Biology: Plant Anatomy, biological research, coastal resource conservation, environmental science, plant physiology anatomy, biology and science curriculum studies, animal taxonomy. Mathematics: linear programming, Field and spatial analytic geometry, Maritime Ethnomathematics and PMRI, Statistical Methods, Mathematics Education seminar, inferential statistics. There is no chemistry because there are non-educational chemistry lecturers to fill in. Education: Strategy, planning, evaluation, and learning media, Educational profession, development of teaching materials, eduprenuership, study and learning.

PjBL is the most recommended learning model for independent learning, both at the school and tertiary levels because various competencies can develop by carrying out each stage of the model. The competencies referred to include creativity & scientific attitudes [9], students' understanding of chemistry, cognitive, affective, and psychomotor [10], and critical

thinking skills [11]. PjBL assessments that are often carried out by educators in Indonesia are assessments related to these competencies. There is no assessment that can be used for PjBL in general, including formative and summative assessments.

Formative and summative assessments have been carried out by MIPA Education Lecturers. The MIPA Education lecturers referred to in this discussion are the lecturers in the Mathematics Education Study Program, Biology Education, and Chemistry Education Study Programs. However, only 2 lecturers sent samples of their assessment documents. The first provides a PjBL assessment portion of 50% of the total course grade, namely 25% on project progress including planning and procedures, and 25% on project work results which include appearance and performance, innovation and creativity, as well as functions and utilities. Creativity is an aspect that is often measured in PjBL as was done by Kurniawan [12]. While the second lecturer assesses the project based on the value of research instruments, articles, and video reports. Creativity can also be measured at the planning, implementation and reporting stages (Sari & Angreni, 2018). Based on the two lecturers, it can be seen that the assessment in PjBL must contain formative assessments and summative assessments. Formative assessment in PjBL functions to maximize student achievement [14].

The PjBL syntax that is often used by educators in Indonesia is providing essential questions, designing projects, compiling schedules, monitoring project implementation, testing results, and evaluating [15],[16], [17]. There are still lecturers in Mathematics and Natural Sciences Education who are unsure about how to implement PjBL correctly, so the PjBL syntax can be used as a reference in implementing PjBL but an assessment is needed to ensure students are actually carrying out the project. Doubts about implementing PjBL are usually due to the absence of a formative assessment being carried out, so the assessment tends to be only summative, namely the assessment of the final product. Even though not all projects produce products, there are also projects that produce problem solving ideas, this depends on the characteristics of the competencies facilitated by the course.

Courses in FKIP MIPA Education consist of non-educational courses and educational courses. The learning model applied at FKIP is problem based learning and PjBL. Pure courses implemented using the PjBL model in the Biology Education Study Program include Plant Anatomy, biological research, coastal resource conservation, environmental science, plant physiology anatomy, biology and science curriculum studies, animal taxonomy. While the pure courses implemented by PjBL in the Mathematics Education Study Program include linear programming, field and spatial analytic geometry, Maritime Ethnomathematics and PMRI, Statistical Methods, Mathematics Education seminars, inferential statistics. Because there was only one Chemistry Education lecturer who filled out the needs analysis questionnaire and the lecturer had an educational background, information was not obtained on pure courses conducted with PjBL. While the educational courses in the MIPA Education Study Program are generally the same. Educational subjects implemented using PjBL include strategy, planning, evaluation, and learning media. Research by Wicaksana & Sanjaya [9] and also carried out in study and learning courses. Educational profession, development of teaching materials, eduprenuership, study and learning. As many as 65% of lecturers admit that in each semester the average percentage of courses taught using PjBL is 20-50%. This is the largest percentage of the total 17 lecturer respondents. Nearly 50% of lecturers hold PjBL implementation meetings as many as 3-5 meetings in one subject.

The same PjBL assessment instrument can be used for different project activities. As many as 10 lecturers agreed on this for reasons including because the assessment indicators were the same, the stages for each project were the same, depending on the type of instrument, but not yet specific, because if what was being measured was different then the indicators would also follow what was to be measured, for example, wanting to measure skills, science processes, measuring problem-solving skills and so on, all have to be adapted. Research by Wicaksana & Sanjaya [9] and Sari&Angreni [13] both measure creativity in PjBL.

Meanwhile, lecturers are of the opinion that the same PjBL assessment instrument cannot be used for different project activities depending on the type of project undertaken, the content is different, because each project has different objectives and achievements so that the assessment is adjusted to the objectives and achievements of project activities, assessment formative must be in accordance with the fashion steps, different projects have different specifications and the products produced are also different, different project specifications, different projects must have different instruments.

Educators still experience difficulties in developing PjBL assessment instruments. The biggest difficulties experienced by lecturers in developing and/or implementing PjBL assessments are time constraints, in addition to difficulties in preparing PjBL stages, determining descriptions of the assessment rubrics, details of project implementation by students off campus, suitability of assessments with projects made, determining criteria / aspects and scores, assessments are sometimes just spontaneous without neat documentation, especially formative assessments, difficulties in designing the form of the project itself so that it deserves to be given an assessment weight of 50%, when assessing attitudes in the PjBL implementation process in the field, because they do not always participate in activities directly, Determine aspects and describe indicators of each aspect.

MIPA Education Lecturers hope that there will be standardized assessments and accommodate PjBL assessments with a variety of diverse approaches, varied assessment techniques. Hopefully, with the development of Pjbl assessments it will facilitate the assessment of lectures with projects. It is best if this instrument can be used by anyone according to the field, can accommodate a variety of the resulting product can be an overview of other courses/can be used in various projects. The form of assessment is developed so that it can provide the right assessment with the appropriate weight. Hopefully, with PjBL students can develop their academic potential in real life, so as to provide benefits for oneself and the surrounding environment, the instruments developed must be in accordance with learning outcomes. The development of assessment instruments for PjBL was also carried out by Trimawati, Tjandrakirana, & Raharjo with a needs analysis so that students can develop critical and creative thinking skills [18]. They also suggested that the PjBL assessment be determined in every implementation of the PjBL not to use the same assessment periodically, but must be up to date. PjBL assessment needs to be disseminated more frequently, especially for education students and lecturers. So that you are no longer confused in the implementation in the field. All lecturers agree/strongly agree that the PjBL assessment instrument is developed for students in Mathematics Education, Chemistry Education, and Biology Education.

Based on the description above, it can be concluded that it is necessary to develop a PjBL assessment that can be used for different projects, it's just that some indicators need to be adjusted to the material content of each field of study. The assessment that will be developed is a formative and summative assessment. So far, formative assessment has not received much attention, lecturers tend to do it spontaneously. Though the assessment needs to be well planned. The formative assessment that will be developed is in accordance with the PjBL syntax which includes providing essential questions, designing projects, preparing schedules, monitoring project implementation, testing results, and evaluating. A summative assessment needs to be developed for the final product/outcome. The PjBL assessment that is developed needs to be identified from the dimensions of the realm of learning outcomes [10], [2], type of assessment (formative and summative) [14] and PjBL syntax.

4 Conclusion

Based on the research results, it was found that lecturers still had difficulties in developing PjBL assessments. difficulties felt by lecturers were difficulties in preparing the

PjBL stages, determining descriptions of the assessment rubrics, details of project implementation by off-campus students, conformity of assessments with projects made, determining criteria/aspects and scores. This article can provide insights into the latest developments in project-based learning assessment instruments, offering a solid foundation for research specifically on coastal student.

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