

THE DEVELOPMENT OF INNOVATIVE LEARNING RESOURCES WITH PROJECT TO IMPROVE STUDENT CRITICAL THINKING SKILL ON THE TEACHING OF DISTILLATION

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ARTICLE INFO	ABSTRACT
Received 06 September 2022	National education in Indonesia is designated as one of the national development departments to educate the nation's life. Learning innovation in the learning process in the classroom is needed to improve student achievement. This research has a goal, namely to develop a project-based learning resource innovation in the form of Module in distillation subjects. in order to know its effectiveness to improve critical thinking skills and student learning outcomes. The model used in this research is ADDIE with three cycles in the implementation phase. The results of the development of project-based MFIs have an average according to BSNP standards = 85% with very feasible criteria and an N-gain score of 0.77, the proportion of 77.8% which states that project-based MFIs have high effectiveness. The field trial of the first cycle of the project design obtained the same value with M1 = 50; M2 = 89.37; M3 = 90.48; M4 = score 90.66 M4 > M3 > M2 >M1 which shows an increase in students' abilities in the refining learning process. the results of the pretest and posttest obtained the results of Mpostes = 46.25 and Mpostes = 88.23, so the test results show t count > t table which means H0 is rejected and Ha is accepted. project development results. based on the results of the calculation of the correlation between critical thinking skills and student learning outcomes obtained rxy count = 0.0066 with rxy table = 0.497 so that rxy count < rxy table then H0 is rejected and Ha is accepted with a positive correlation level with the conclusion that there is a relationship between critical thinking ability and student learning outcomes taught by the LKM developed on distillation material.
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Introduction

National education in Indonesia has been set as one of the national development sectors to educate the life of the nation (Sutiani et al., 2017). one of the efforts that can be done to improve students' critical thinking skills is the use of project-based innovative learning

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resources (Safitri, 2022). In project-based chemistry learning, there are practical activities. The commitment to implement competence based curriculum suited to the National Qualifications Framework (in Indonesian Kerangka Kualifikasi Nasional Indonesia, KKNI) requires improvement in the teaching and learning activities toward outcomes based learning in accordance to the learning purposes (Simaremare et al., 2018). Learning innovation in the classroom teaching process really needs to be done to improve student learning achievement (Parulian & Situmorang, 2013).

According to (Novita & Kasrawati, 2019) entitled Improving Student Chemistry Learning Outcomes on the Subject of Colloidal Systems Using Project Based Learning Innovative Chemistry Textbooks states that innovative chemistry books encourage students to study independently and make students study intensively so as to improve student learning outcomes.

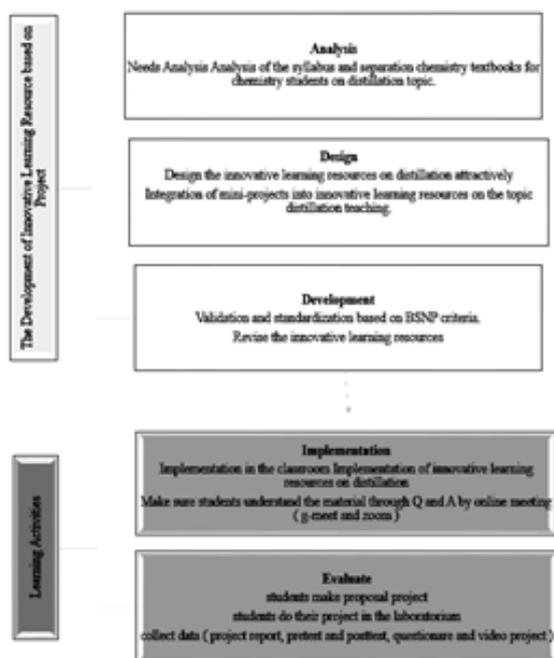
According to (Sutrio et al., 2020), With high critical thinking skills, students will be able to achieve the competency standards set in the curriculum. Research that is relevant to this research is the research conducted by (Situmorang, 2014) in 1011 which states that “Project-based learning is proven to be able to develop students' critical thinking skills. Students have been directly involved in planning, implementation, and reporting. From the description presented, researchers are interested in conducting research with the title “The Development of Innovative Learning Resources with Project to Improve Student Critical Thinking Skill on The Teaching of distillation” With the aim of developing innovative project-based learning resources in the form of LKM in distillation subjects. to determine its effectiveness in improving critical thinking skills and student learning outcomes. The model used in this study is ADDIE with three cycles in the implementation phase.

Method

Researchers conducted research at the Department of Chemistry, Faculty of Mathematics and Natural Sciences, Unimed, specifically using laboratory facilities. Determination of this location is based on relevance to the purpose of this study. Implementation time in July-September 2021 odd semester 2021/2022 Academic Year. Population in this study are: All students majoring in chemistry UNIMED semester V academic year 2021/2022. All chemistry lecturers at the Unimed and All Analytical Separation book of Distillation

This type of research is Research and Development (R & D). This model consists of five steps, namely: (1) analysis, (2) design, (3) development,(4) implementation, and (5) evaluation.

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Hypotesis Testing

Research data processing is done with the excel application. and use the arithmetic formula.

1. Normality Test
2. Homogeneity Test
3. t test Testing

Results and Discussion

A. Analysis Stage

Through the results of this needs analysis, the learning resource developed in this research is a project-based E- Module on the subject of distillation.

B. Design Phase

1. Drafting an MFI

The draft LKM made was adapted to the LKM component, the project-based learning component, the results of the analytical chemistry GBPP analysis, the results of the analysis of learning resources used in the learning process and the learning situation during the COVID-19 pandemic.

2. Compile MFI material content

The content of the MFI material is compiled by collecting appropriate materials from various relevant sources such as books, journals and blogs.

3. Assemble mini project assignments
4. Prepare project assignment assessments

C. Development stage

The first namely product development in the form of project-based MFIs based on the analysis and design that have been carried out in the previous stage. Making the cover of the MFI is done with the help of Microsoft Word, namely insert-shape. The second stage of

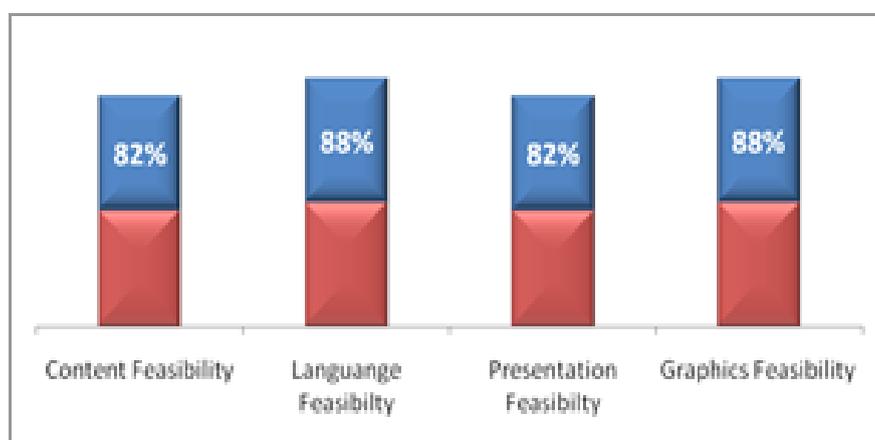
this process is the development of MFIs that focus on the mini-projects that have been designed. The third stage is designing student assignments to create mini projects based on videos that have been presented in the LKM. Final stage of development. After being validated by an expert validator and declared suitable for use in the refining learning process.

D. Distillation teaching mini project

The mini-projects that have been prepared are based on the consideration that (1) the mini-projects are designed in such a way that they can be carried out easily, (2) this project can be implemented by following the project procedures provided in the MFI, (3) this project is designed using natural materials that easily available in the surrounding environment and (4) mini projects that are designed to have alternative tools and materials so that they are easy to carry out.

No	Sub Topic	Project	project title
1	Simple Distillation	Project I	Separation of Alcoholic Tapai
2	Fractional Distillation	Project II	Separation of Ethanol and Methanol
3	Steam Distillation	Project III	Distillation of Bay Leaf

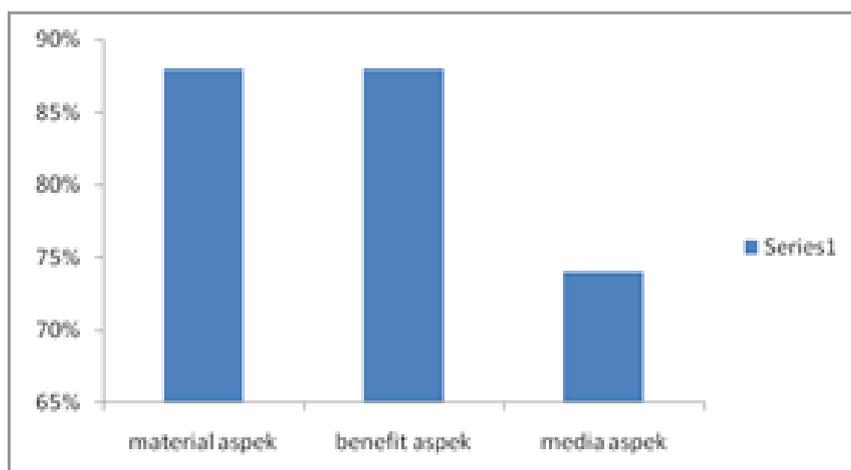
E. Standardization of project-based innovative learning resources



From the diagram, we know that the validation results by the validator, namely lecturers have an average of 82% for the content feasibility aspect, 88% for the language feasibility aspect, 82% for the

presentation feasibility aspect, and 88% for the graphic aspect. With an average overall aspect of 85% which is included in the Eligible criteria. Furthermore, the results of student responses regarding the MFI developed by researchers with the results that the material aspect is 88%, the benefit aspect is 88%, the media aspect is 74% with an average overall aspect of 83% in the decent category. It can be seen in the following diagram 2.

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F. Implementation of project-based innovative learning

The implementation stage is the stage of implementing project-based E- LKM as a result of development into learning activities for the subject of distillation.

Assesment	Rata-Rata
Initial Proposal	50
Final Proposal	89
Psychomotoric	90
Project Report	91,3
Video Project	90

G. Evaluation stage

No	Average		N-gainScore	% N-gain	Criteria
	Pretest	Postes			
1	46.25	88.43	0.77	77.8	Tall

Conclusion

In developing innovative learning resources with project-based improvement of students' critical thinking skills, this research was carried out in several stages, namely the analysis stage, design stage, development stage, implementation stage and evaluation stage. In this study, there are three mini projects that can be developed on distillation materials, namely Separation of Alcohol in Tapai, Separation of Ethanol and Methanol, Distillation of Bay Leaf.

The MFI developed by the researcher meets the BNSP eligibility standards, has an average of 82% for the content feasibility aspect, 88% for the language feasibility aspect, 77% for the presentation feasibility aspect, and 88% for the graphic aspect. With an average overall aspect of 84% which is included in the Eligible criteria. Student responses to the LKM with a mini project developed by researchers received a positive and good response.

In this study, students' critical thinking skills and student learning outcomes were carried

out using project-based learning resources on distillation material. Project-based learning resources can be said to be effective through increasing critical thinking and student learning outcomes, namely the N-gain value of 0.77 which is included in the high category.

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