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DESIGN A SIMPLE DISTILLATION PROJECT-BASED ON CHEMICAL LITERACY ON THE TOPIC OF THE ALCOHOL PHASE F

Meylinda Anggraini and Eka Yusmaita*
Chemistry Education Department, Faculty of Mathematics and Science, Universitas Negeri Padang, Padang, Indonesia
*Email: ekayusmaita@fmipa.unp.ac.id

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Abstract: This study aims to design a simple distillation project on chemical literacy on alcohol phase f. This research was designed using the Plomp development model, which consists of 3 stages: the preliminary research stage, the development stage or prototyping, and the assessment stage. In this study, the authors limit the research to the development stage prototype, which produces prototype III. This project was designed using the project-based learning model with a combination of the anatomy of the project-based learning model) and project-based learning syntax, which contains aspects of chemical literacy. The development of this simple distillation project on chemical literacy on the topic of alcohol phase f is expected to assist teachers in overcoming obstacles in making learning media. It can be used as one of the learning media that can help students in learning, especially on alcohol. Testing the content validity and construct validity was carried out by five validators (Padang State University lectures and teachers of senior high school). The data obtained from the validator was then analyzed using Aiken's V formula. The results of data analysis in this study showed that the average results of Aiken's V on content validity were 0.89, and construct validity was 0.90, which is included in the valid category.

Keywords: *Project-Based Learning, Simple Distillation, Chemical Literacy, Alcohol*

INTRODUCTION

The independent curriculum is one of Indonesia's new policies in the world of education. The medeka curriculum is expected to transform education so that it can create students who are superior and have a Pancasila student profile and can compete in the world of education [1]. It is in line with the characteristics of the independent curriculum, namely project-based learning, soft skill, and character development according to the profile of Pancasila students, learning on essential materials, and a more flexible curriculum structure [2]. The application of project-based learning can support learning recovery due to learning loss as character development, according to the profile of Pancasila students [3]. The Pancasila student profile is an effort to improve the quality of education in Indonesia through character building which provides a balance between technological and human advances [4]. In implementing the project, strengthening the profile of Pancasila students can be linked to the community's local wisdom to build curiosity, inquiry, and exploration abilities in students. Thus, students better understand the material being taught because it reflects the values in the life of the local community [5].

Indonesia has abundant natural resource potential, including sugarcane [6]. Sugarcane is a plant that can be processed into commercial sugar products [7]. One of the highland sugarcane production centers in West Sumatra is Nagari Lawang, Matur District, Agam Regency. Nagari Lawang is also a center for the brown sugar cane industry known as Saka Lawang [8]. The process of producing saka sugar is through traditional milling. The waste of sugarcane milling from saka sugar production around the granary must be properly resolved. The remaining waste from milling sugar cane is called dregs or bagasse [9]. Bagasse contains a lignocellulosic substrate which can be used as an ingredient for making bioethanol because it contains high sugar content [10]. Thus, processing bagasse to reduce waste can be used as a simple distillation project based on chemical literacy by linking it to alcohol [11].

Alcohol material is classified as a material that is difficult to understand. Complex material makes teachers usually use the lecture method more often and rarely do project learning. Students learning skills and outcomes can be increased by using project-based learning [12]. Through project-based learning using the Project Based Learning (PjBL) learning model, it is hoped that students can increase their understanding of chemical literacy about this alcohol material [13]. Teachers and students need literacy to understand chemistry concepts broadly and abstractly. Teachers are expected to be able to make students think critically and have the ability to apply chemical concepts to everyday life. Students can be helped if they learn by seeing the chemistry they feel daily [14].

Based on a preliminary study by interviewing one of the chemistry subject teachers at senior high school SMAN 1 Matur regarding the local wisdom of Saka Lawang sugar cane, it was found that chemistry learning had never been carried out by visiting Micro, Small, and Medium Enterprises (MSMEs) in the area around the school, there was no waste treatment. Sugarcane and there is no project-based learning for

processing bagasse waste. Whereas based on the results of the questionnaire distributed to 41 students, the results obtained were 73.17% of students stated that chemistry learning material was material that was difficult to understand. 51.22% of students stated that students felt bored when learning chemistry. 100% of students stated that there had never been a visit to SMEs around the school on chemistry learning material and had never carried out learning by processing bagasse waste from the manufacture of brown cane sugar. According to the results of an interview with a Micro, Small, and Medium Enterprises (UMKM) owner who produces cane brown sugar in Nagari Lawang, there is no proper processing of bagasse waste. Bagasse is usually only burned as fuel for the brown sugar cane production process.

Based on the description above, there is a need for important learning tools to support alcohol learning activities in the implementation of the phase F independent curriculum.

RESEARCH METHODS

This type of research is research and development (R&D) with a plump development model. The Plomp development model consists of three stages: preliminary research, development or prototyping phase, and assessment phase [15]. In making a simple distillation project design based on chemical literacy on the topic of alcohol phase F, it was only carried out until the validity test (prototype III). The subjects of this study were three chemistry lecturers from the Faculty of Mathematics and Natural Sciences, Padang State University, and chemistry teachers from SMAN 1 Matur.

The instruments used in this study were content validation questionnaires and construct validation. The aspects assessed in the content validity test include an introduction, task, resources, process, guidance and scaffolding, cooperative/collaborative learning, and reflection [16]. While the aspects assessed in the construct validity test include content, linguistics, presentation, and graphical components. The data obtained from the validity test results were analyzed using Aiken's V scale with the following formula.

$$V = \frac{\sum s}{n(c-1)}$$
$$s = (r - l_0$$

Information :
S = The score set by the validator minus the lowest score in
the category used
r = The score of the validator's choice category
I_O = Lowest score in the scoring category
n = Number of validators
c = Number of categories chosen by the validator

Furthermore, the value of each component is analyzed using qualitative methods to determine the validity level of the project design developed using the Aiken's V formula, namely with a reference value of 0.8, thus a product being developed can be said to be valid if the Aiken's V value obtained must be greater or equal to 0.8 [17].

RESULTS AND DISCUSSION

Need Analysis

The results of a questionnaire filled out by teachers and students showed that there were obstacles or difficulties experienced by teachers and students in learning, such as students still having difficulty understanding chemical material, the project-based learning model not being applied to alcohol material, and no wisdom-based learning. Locally, no bagasse waste processing results from cane brown sugar production in Nagari Lawang. Based on this, a simple distillation project design based on chemical literacy was carried out on phase f alcohol.

Context Analysis

The results of the context analysis that has been carried out include an analysis of the independent curriculum and an analysis of learning outcomes. Based on the independent curriculum, analysis is carried out in the form of an analysis of learning outcomes which are translated into learning objectives.

Table 1. Results of Analysis of Learning Outcomes

Learning Outcomes	Learning objectives
Students can understand organic chemistry, including its application in everyday life.	Determine the types of alcohol compounds (primary, secondary, and tertiary) based on their functional groups.
	Determine the structure and name of alcohol based on IUPAC and Trivial nomenclature rules for organic compounds.
	We are designing and conducting experiments and making scientific reports related to the manufacture of bioethanol on alcohol material.

Literature Review

Researchers carried out literature collection through various relevant sources related to the research. The design of a simple distillation project based on chemical literacy on the topic of alcohol was designed using the anatomy of project-based learning

referenced from Grant [16], which includes: 1) introduction containing content or context for the background of the project to be carried out by students, 2) task which contains accompanying questions to guide students to understand what competencies will be achieved and display the content being studied, 3) resources include reading sources, 4) process contains the process or steps in completing the project, 5) guidance and scaffolding containing guidance from the teacher and feedback from students, 6) cooperative/collaborative learning includes student activities in working together in carrying out the projects being carried out and 7) reflection contains feedback between the teacher and students.

The project design is also designed using the project-based learning syntax, which includes aspects of chemical literacy. The project-based learning syntax is referred to from The George Lucas Educational Foundation in Afriana[18], namely starting with the essential question, designing a plan for the project, creating a schedule, monitoring the student and the progress of the project, assessing the outcome, evaluate the experience. Meanwhile, aspects of chemical literacy are referred to by Shwartz [19], namely 1) content aspects, 2) context aspects, 3) high-level learning skills, and 4) affective aspects.

Conceptual Framework or Theoretical Development

Based on needs analysis, context analysis, and literature study, a simple distillation project design based on chemical literacy was developed on the topic of alcohol with a product design process based on the anatomy of project-based learning by Michael Grant [16] and project-based learning syntax proposed by Lucas [20], according to Yael Schwartz [19], which contains aspects of chemical literacy. The conceptual framework for making this research product is described as follows.

1. Prototyping Stage

Prototype I

The first stage is designing a simple distillation project based on chemical literacy on alcohol. At this stage are covers, learning outcomes, instructions for use, project activity sheets, and project assessment sheets. The cover includes the title, user goals, supporting images, and the author's name. The learning achievements of phase f contain the learning objectives to be achieved by students. Instructions consist of using teachers and students to help teachers and students use the guidelines and carry out projects. The project activity sheet contains material determined based on the learning objectives to be achieved.

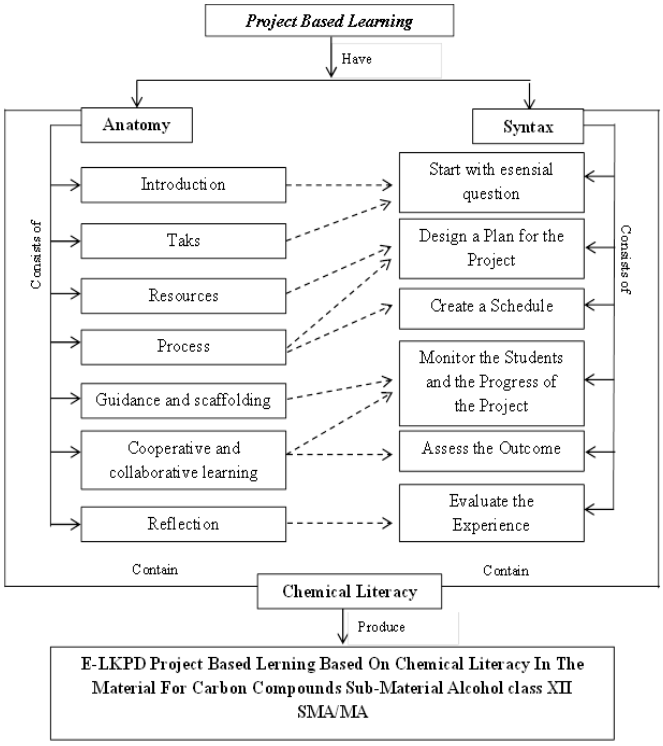

Figure 1. Combination of anatomy, project-based learning syntax, and chemical literacy.

The project design is structured based on the anatomy of project-based learning, namely introduction, task, resources, process, guidance and scaffolding, cooperative/collaborative learning, reflection, and project-based learning syntax, namely starting with the essential question, design a plan for the project, create schedules, monitor the student and the progress of the project, assess the outcome, evaluate the experience which includes four aspects of chemical literacy, namely aspects of content, context, HOLS, and effective.

Aspects of the content and aspects of the context are found in the introduction stage, which contains the project-based learning syntax starting with essential questions. Start with essential questions, namely fundamental questions related to the material given to students as follows.

Figure 2 shows that the content aspect of chemical literacy leads to chemical material as scientific knowledge and ideas in which there are general and basic chemical ideas [19]. In the e-worksheets, the content aspect has been developed in the introduction stage, with a project-based learning syntax starting with an essential question.

Context aspects of chemical literacy are personal, local/national, and global issues in the form of current or existing issues that require an understanding of science and technology [19]. In the e-worksheets, the context aspect has been developed at the introduction stage, in which there is a project-based learning syntax, namely starting with an essential question.

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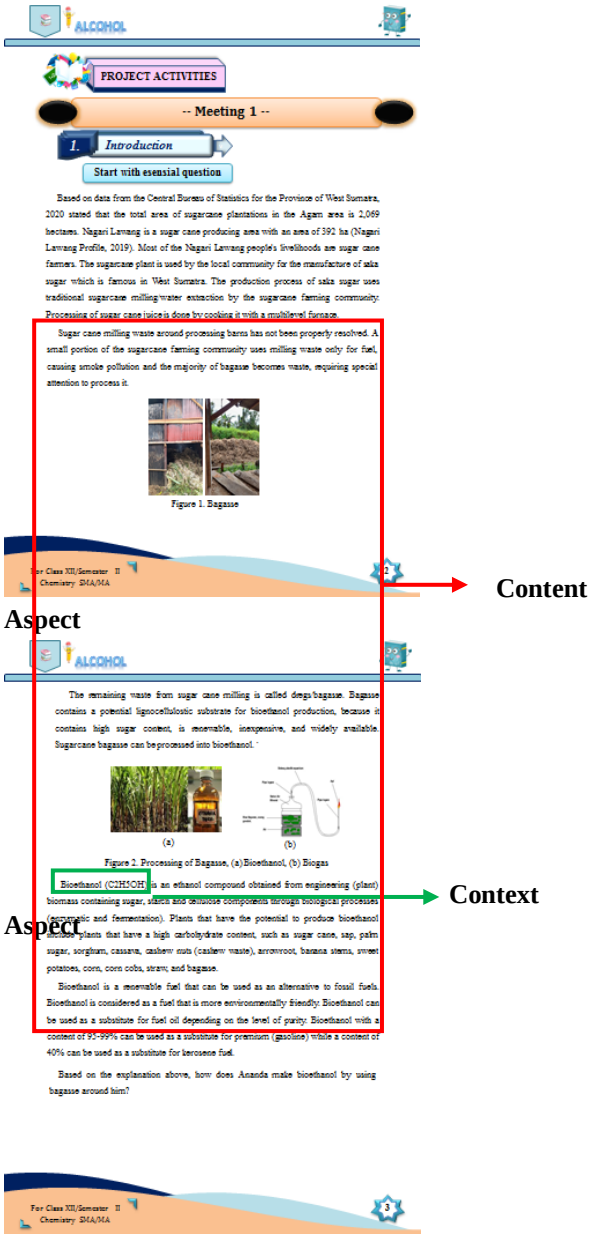

Figure 2. Aspects of Content and Context

The next aspect of chemical literacy is the HOLS and affective aspects contained in the task stage, which also contains the project-based learning syntax, starting with the following essential question.

Figure 3 shows that the HOLS aspect of chemical literacy is an aspect that presents high-level learning skills [19]. The HOLS aspect can encourage students to develop self-skills in high-level learning. In the e-worksheets that have developed the HOLS aspect, a task stage contains project-based learning syntax, starting with an essential question.

The affective aspect of chemical literacy is an attitude that shows interest in science and awareness of the environment [19]. In the e-worksheets that developed the HOLS aspect, a task stage contains project-based learning syntax, starting with an essential question.

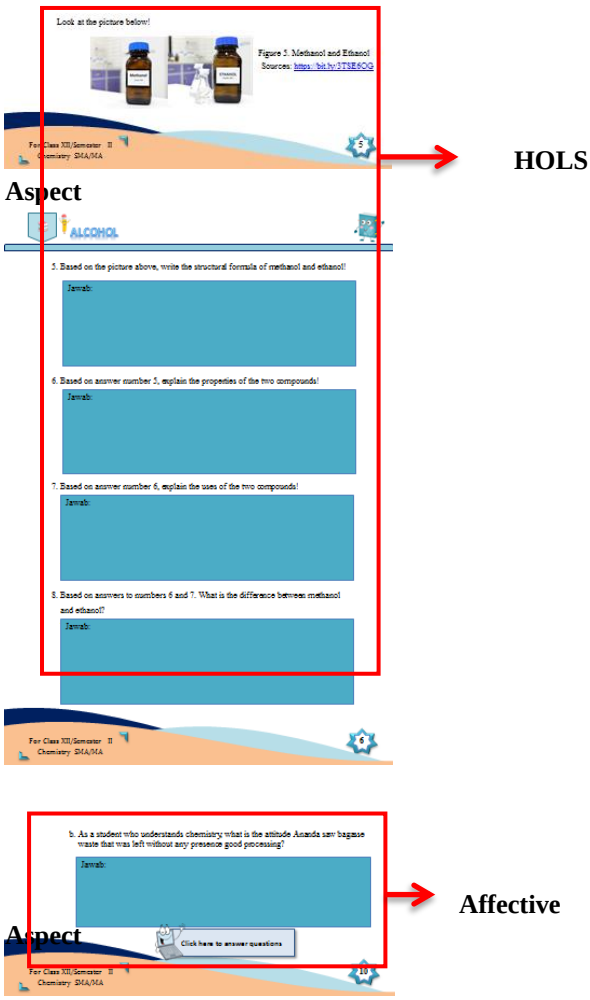

Figure 3. HOLS Aspect and Affective Aspect

Prototype II

At this stage, an independent evaluation is carried out for yourself (self-evaluation). Self-evaluation is carried out using a checklist system for several important sections that must be included in the project guide. If parts are lacking, it is necessary to revise them so that the results of prototype II are obtained.

Prototype III

Prototype II, which has been produced, is then reviewed by several experts (expert review) by five validators and individual evaluation (one-to-one evaluation) to obtain a valid product.

First, the Expert review was carried out by five validators consisting of three Chemistry lecturers at FMIPA UNP and two chemistry teachers at SMAN 1 Matur. In this assessment, tests were carried out on aspects of the assessment of content and context validation. Aspects of content validity can be seen in the following table 2.

Table 2. Results of Content Validity Data Analysis per Anatomy

No	Anatomy	V Value	Category
1	Introduction	0.90	Valid
2	Task	0.88	Valid
3	Resources	0.85	Valid
4	Process	0.90	Valid
5	Guidance & Scaffolding	0.95	Valid
6	Collaborative Learning	0.90	Valid
7	Reflection	0.95	Valid
Average		0.89	Valid

Based on the table above, the results show that the average value of the content validity of the simple distillation project design based on chemical literacy on the topic f phase alcohol that has been developed is 0.89, which is included in the valid category. Furthermore, aspects of construct validity can be seen in table 3.

Table 3. Results of Construct Validity Data Analysis

No	Component	V Value	Category
1	Content Components	0,94	Valid
2	Language Component	0,90	Valid
3	Serving Components	0,93	Valid
4	Graphical Components	0,86	Valid
Average		0,90	Valid

Table 3 shows that each item in the chemical literacy-based simple distillation project design on alcohol phase f has a valid category with a value of 0.90.

Second, one-to-one evaluation (individual evaluation), namely at this stage, is carried out by selecting three students from different ability levels (high, medium, and low) to fill out a one-to-one evaluation questionnaire that the researcher has provided. Based on the answers to questions given by students, the project design received a positive response where the language used is clear, the instructions provided are easy to understand, leading questions can help in understanding the material, the cover design is attractive and has many colors, the instructions in the project steps are easy to understand, the discourse in the introduction section can help in designing the project. No errors in writing; someone found an error in the layout. Based on the existing suggestions, a revision was made to improve the project design that had been made so that a valid prototype III result was obtained.

CONCLUSION

The simple distillation project design based on chemical literacy on alcohol phase f is valid. The validity test was carried out using Aiken's V formula with a content validity result of 0.89 with a valid category and a construct validity result of 0.90 with a valid category. The design simple distillation project design based on chemical literacy on the topic of alcohol phase f can help students understand chemistry learning through things that are around them, especially alcohol material, by utilizing bagasse waste so that it can reduce environmental pollution.

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4. Student SMAN 1 Matur

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