NEEDS ANALYSIS FOR THE DEVELOPMENT OF A CHEMISTRY PROJECT LEARNING GUIDE WEBSITE TO ENHANCE SCIENCE LITERACY

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Abstract

This study aims to analyze student needs for the development of a website-based Learning Guide using a Project-Based Learning (PjBL) approach in chemistry education to support science literacy. The research is part of the initial phase in the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation), focusing on the needs analysis stage. The participants were 17 undergraduate students from the Chemistry Education Program at FKIP–Universitas Terbuka (UT) enrolled in the Basic Chemistry course. Data were collected through an online questionnaire and analyzed using both descriptive quantitative and qualitative approaches. The results indicate that although nearly half of the respondents had never experienced PjBL before, most acknowledged its benefits in enhancing conceptual understanding, collaborative skills, and problem-solving abilities. Identified challenges include the lack of step-by-step guidance, limited project time, and coordination difficulties in group settings. Students expressed a strong preference for interactive website features, such as structured guides, video content, discussion forums, assessment rubrics, and digital logbooks. These findings underscore the need for a contextual and inclusive website design that supports both independent and collaborative project-based learning. The results of this needs analysis serve as a foundation for developing a website-based Learning Guide that fosters science literacy among chemistry education students, particularly in a distance learning environment.

Keywords: Project-Based Learning, Science Literacy, Website Learning

1 INTRODUCTION

The development of digital technology has provided great opportunities in educational transformation, especially in technology-based learning that is able to increase student involvement. However, reality shows that chemistry learning, especially at the university level, still faces various challenges. One of the main challenges is the low science literacy of students. Science literacy includes the ability to understand scientific concepts in depth, analyze data, and relate it to real-life contexts (Riduan et al., 2021). This low science literacy often limits students in solving problems related to global issues, especially those involving

chemistry (Effendi et al., 2021). This shows that there is a gap between the expectations to create competent students in the 21st century and the reality on the ground.

One of the learning models that is recognized as effective in improving science literacy is Project-Based Learning (PjBL). PjBL allows students to learn through projects that are relevant to the real world, thus being able to develop critical thinking, problem-solving, and collaboration skills (Zhou, 2023). Unfortunately, the implementation of PjBL in chemistry learning in higher education still encounters various obstacles such as the lack of structured guidance to help students understand and carry out the project-based learning process independently. By integrating the PjBL model with the Learning Guide, students can be guided through the stages of the project, from planning to evaluating results. This Learning Guide is designed to be a practical guide that supports students in understanding project assignments, developing problem-solving strategies, and improving overall science literacy.

The majority of college students need additional guidance to help them connect chemical concepts with practical applications in the real world (Irwan & Aznam, 2021). This condition confirms the importance of providing a Learning Guide that is integrated with digital learning platforms such as interactive websites. With this approach, students will not only be helped in carrying out their projects, but also will be encouraged to better understand chemical concepts in depth and contextual.

In addition, the main problem identified is the low level of science literacy which hinders students' ability to understand chemical concepts in depth and apply them in real life. Students often have difficulty relating theory to practice, which ultimately reduces their confidence in real-world learning. Additionally, project-based learning, while recognized to have many benefits, is often not supported by well-structured learning guides. This makes it difficult for students to understand the stages of project work independently. This shortcoming is further exacerbated by the lack of use of digital technology integrated with project-based learning models, which can actually help students in carrying out their projects more effectively. Another problem identified is the lack of student access to interactive resources that support independent and collaborative learning. In fact, interactive resources such as digital modules, discussion forums, and multimedia-based guides can be a catalyst to increase student engagement and understanding of chemistry learning materials (Rahmawati et al., 2022).

To ensure that this research can be conducted in a focused and in-depth manner, the scope of the problem is limited to a few key aspects. This study will analyze the needs of chemistry

education students and lecturers for a Project-Based model that can be integrated with the Learning Guide. This research will also study the process of designing a Learning Guide that is integrated with PjBL on an interactive website. This Learning Guide is designed to improve students' science literacy by using a project-based learning approach that is specific to basic chemistry topics. In addition, this research will also develop an integrated Project-Based Learning Guide design to support the improvement of student understanding, especially in science literacy. This research will not cover other aspects such as module development in non-chemical subjects or the implementation of PjBL outside of the interactive website.

Based on the limitations of the problem that have been determined, the formulation of the problem in this study is as follows: (1) What are the needs of students and lecturers for the PjBL model that is integrated with the Learning Guide in chemistry learning? (2) What is the process of designing a Learning Guide that is integrated with PjBL on an interactive website to improve students' science literacy? (3) What are the obstacles faced in the development of a PjBL-based Learning Guide on basic chemistry topics?

2 METHODOLOGY

This research uses a developmental research approach by adopting the ADDIE development model, which consists of five systematic stages: Analysis, Design, Development, Implementation, and Evaluation. This model was chosen because it has proven to be effective in developing structured and needs-based learning media for users. The main focus in this study lies in the initial stage, namely the analysis stage (Spatioti et al., 2022). This stage is designed to ensure that the media developed, namely the PjBL-Learning Guide, is truly in accordance with the characteristics and needs of students in distance chemistry learning.

The subjects in this study are students of the Chemistry Education Study Program, Faculty of Teacher Training and Education (FKIP), Universitas Terbuka, who are taking a Basic Chemistry course. The students involved were selected purposively by considering their active status in lectures and exposure to distance learning. In addition to students, several lecturers in Basic Chemistry were also involved as informants to obtain a complete picture of the obstacles and support needed in the implementation of a project-based approach in the distance education system.

Data was collected through two main instruments, namely an online questionnaire compiled through Google Form and a semi-structured interview guide. The questionnaire consists of 25 questions that include aspects of learning experience, perception of PjBL, the need for

features in website-based media, and the readiness to access technology. The interview was conducted to dig deeper regarding the expectations of students and lecturers for digital learning media that are contextual and collaborative.

At this stage, data from questionnaires and interviews are used to map the gap between current conditions and the ideal conditions expected in project-based learning. The results of this analysis are used as a basis for compiling the initial design of learning media. The data collected from the questionnaire was analyzed descriptively quantitatively using simple statistical techniques such as frequency, percentage, and average to map general needs. Meanwhile, data from interviews were analyzed using thematic analysis techniques to identify narrative patterns that represent students' expectations, challenges, and deep needs.

3 FINDINGS AND DISCUSSION

3.1 Student Experience with PjBL

Based on the results of the questionnaire filled out by 17 Chemistry Education students of FKIP-UT, it is known that their level of confidence in project-based learning is still quite diverse. From Figure 1, as many as 47.1% of students stated that they had participated in PjBL learning, 47.1% had never, and the rest (5.9%) were not sure whether they had experienced it or not. This shows that although almost half of the respondents have experience with PjBL, the proportion who have not been exposed or are not sure is also quite significant, indicating the need for a stronger understanding and socialization of this learning model.

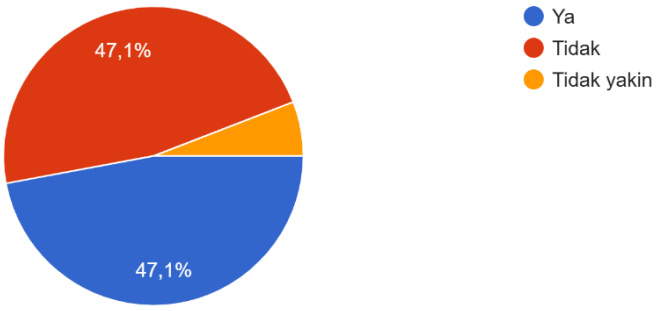

Figure 1. Students' Confidence Levels in the Face of PjBL

Furthermore, students mentioned several courses that have used a project-based approach, including PKM (Teaching Ability Practice), Analytical Chemistry, as well as practicum courses and learning media. However, most of them stated that they had never experienced it in its entirety in various core courses. This is strengthened by the perception of the frequency of the application of PjBL in study programs as seen in Figure 2. The majority of students feel

that the PjBL approach is only applied "occasionally" (41.2%) or "rarely" (23.5%). Only 5.9% of respondents felt that PjBL was "always" used in learning. This data reflects the potential that has not been maximized in the implementation of PjBL, especially to support competency achievement in the context of distance learning.

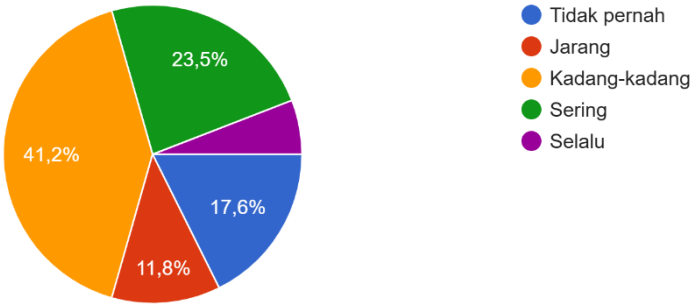

Figure 2. Frequency of Application of PjBL

Regarding the benefits of PjBL, most students consider this approach very beneficial. As many as 76.5% of respondents stated that PjBL improves understanding of concepts and collaborative skills. In addition, 70.6% also assessed that PjBL encourages problem-solving skills and makes the learning process more enjoyable. One of the students even said:

> *"It's quite fun and requires the ability to solve problems. I think PjBL will be happy to do it if the time provided is long enough and the instructions are clear."*

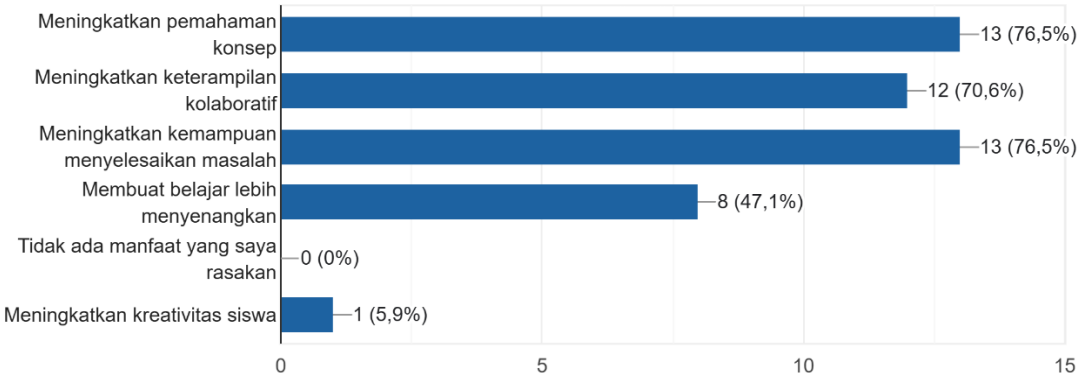

Figure 3. Benefits of PjBL

These findings are in line with previous studies that stated that PjBL contributes to active student engagement, improves higher-level thinking skills, and provides space for meaningful learning (Ospankulova et al., 2025; Zulyusri et al., 2023). However, in distance learning such as at the Open University, a more systematic and accessible guidance structure is needed so that students can carry out projects confidently and independently.

The implication for the design of the Learning Guide website is the need to provide comprehensive information, ranging from the definition of PjBL, the flow of project steps, to concrete examples of the implementation of PjBL in chemistry learning. Thus, students who have never experienced it can still actively participate in online project-based learning.

3.2 Challenges in the Implementation of PjBL

While most students recognize the benefits of PjBL, they also face a number of challenges in its implementation. Based on Figure 4, the most dominant challenge felt by students was the difficulty of working in groups (52.9%), followed by too short implementation time (47.1%), and lack of structured guidance (41.2%). Other factors that are also obstacles are unstable internet connections and limited support from tutors or lecturers.

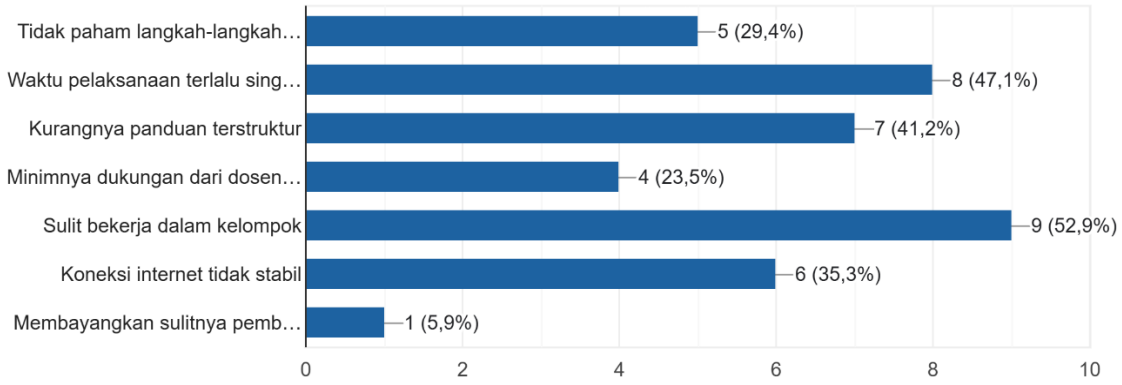

Figure 4. PjBL Challenges for Students

Qualitative responses from students also reinforce this picture. One of the students said:

> *"Because I didn't understand much of the concept/material, the lack of clear procedures or guidelines for me led to having to spend extra time (effort) in completing the task."*

Other respondents also conveyed the constraints of collaboration in distance learning:

> *"It has not been imagined how the project will be done in groups, whether it is done at the same time, or can be accessed by anyone and done without being bound by a schedule."*

These findings affirm the importance of providing structure and flexibility in project design, including communication mechanisms and group coordination. This is in line with the findings of Ernawati et al. (2022) who emphasized that the success of PjBL in distance education depends on the quality of scaffolding, clarity of workflow, and ease of access to digital resources.

The connection to the design of the Learning Guide website is that it should include step-by-step guidance features, flexible collaborative spaces (such as forums or group logbooks), and

a progress-tracking system that supports teamwork without relying on time synchronization. Additionally, the website interface should be designed to be intuitive and inclusive, considering that UT students have a diversity of ages and technology backgrounds.

3.3 Student Needs for Learning Guide Website Features

The findings of the questionnaire show that the majority of students strongly support the development of a website-based Learning Guide, especially if it is equipped with features that facilitate the implementation of projects independently and collaboratively. When asked about the main needs in the learning media, as many as 94.1% of respondents expect a step-by-step guide to project work as well as an introductory/topical video that visually explains the condition of the project. Additionally, features such as project design templates, rating rubrics, and discussion forums also get a high percentage of support, ranging from 76–88%.

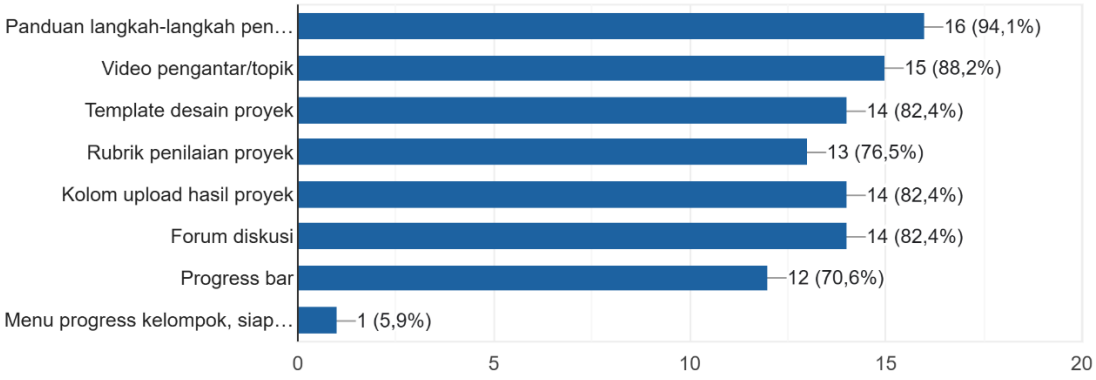

Figure 5. Feature Requirements on the Platform

Interestingly, 82.4% of students also mentioned the importance of having a project result upload column and group progress menu that allows tracking of who has accessed, edited, or added project content. This shows that students not only need complete learning content, but also a collaborative work system that can be run flexibly and in a structured manner.

The students' qualitative responses reinforce this need. One of the respondents wrote:

> *"I think the features that have been mentioned are very good. Maybe if the project assignment is very unfamiliar to students, a good example of project results can be provided so that it can be used as a minimum standard for project work."*

Another respondent added:

> *"I hope that the website developed will continue to make it easier for students to use, because at UT not only young people, but also adults who study. So it must be easily accessible at all age levels."*

In addition, platform preferences also show a clear direction: 70.6% of students choose a combination of all media, namely websites, interactive videos, e-learning, and PDF/printable files. This indicates that accessibility and flexibility are very important in the development of digital Learning Guides.

Some previous literature supports the importance of diversifying digital features in project-based learning. According to Ahmad et al. (2021), interactive media that provide structure, conceptual visualization, and discussion space can increase student engagement and help develop high-level thinking skills.

Therefore, the design of a Learning Guide website is not enough to present materials, but it must also facilitate project workflows, group communication, progress tracking, and reflection. All of these features should be packaged in an integrated, responsive, and user-friendly manner for students from diverse backgrounds.

3.4 Digital Readiness and Science Literacy for Students

To ensure that the Learning Guide website can be accessed and utilized optimally, it is important to understand students' digital readiness. The survey results showed that students' internet access was quite adequate, with the majority of respondents (47.1%) stating that their connection was "quite smooth", and another 35.3% calling it "smooth". Only one respondent (5.9%) reported a "very poor" connection. This shows that in general, FKIP-UT Chemistry Education students have access to online digital platforms, although it is still necessary to consider possible technical constraints in certain areas.

In terms of devices used for online learning, the majority of students use laptops (82.4%) and smartphones (76.5%). This indicates that the website design should be mobile-friendly and support cross-device viewing, especially for interactive features such as discussion forums, progress bars, or project logbooks.

Furthermore, the aspect of student science literacy is a crucial point in this study. Most students (64.7%) admit that they sometimes have difficulty relating science material to everyday life, and only 23.5% say they do not have difficulties, as seen in Figure 6. However, when asked how often they understand science concepts in depth through real projects, 47.1% answered "sometimes" and 47.1% answered "often". This shows that the project-based approach does have a strong potential in improving conceptual understanding and science literacy, as long as it is facilitated appropriately.

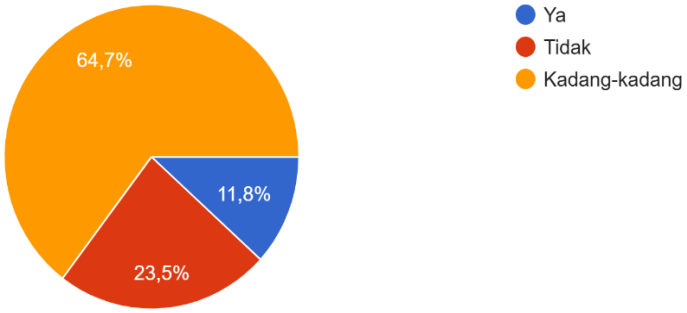

Figure 6. Difficulty in Relating Science Materials

Media that are considered most helpful in understanding science topics include learning videos (88.2%), online simulations (PhET, etc.), and explanations from lecturers or tutors in person. While interactive websites also have an important place with 58.8% of respondents choosing them, this reinforces the urgency of integrating visual and interactive media in digital platforms.

The students' reflective responses also reflected their awareness of the importance of science literacy. One respondent said:

> *"Science projects can be very helpful in improving literacy because they train students to read, understand, and organize information systematically."*

While another wrote:

> *"With the science project, I can understand scientific concepts more deeply, practice critical and analytical thinking, and encourage myself to seek additional information in the work on the project."*

These findings are in line with the literature that states that real-world context-based science projects are capable of developing conceptual understanding and scientific thinking skills (Hastuti et al., 2022). In distance learning, the combination of projects, interactive media, and structural guidance can be a catalyst for students' science literacy.

This is related to the design of the Learning Guide website, which is the importance of presenting project content that is contextual, relevant to real issues (such as water, food, or waste), and supported by interactive media and experiential reflection features. In addition, the platform also needs to be user-friendly with different levels of digital capabilities, including support for usage through smartphones.

4 CONCLUSION

The results of the needs analysis showed that FKIP-UT Chemistry Education students have a positive perception of PjBL, although their experience is still limited. The majority of

respondents acknowledged the benefits of PjBL in improving concept understanding, collaborative skills, and science literacy. They also show a strong interest in the development of project-based digital Learning Guides, especially if they are accompanied by clear guidelines, supporting media, and interactive and collaborative features.

On the other hand, various challenges such as time constraints, lack of structured guidance, and communication difficulties in groups became important notes in the design process. In distance learning at UT, this challenge underscores the importance of a learning platform that not only presents content, but also supports flexible and facilitated project work processes.

Based on these findings, it can be concluded that the development of a Learning Guide website for chemistry projects should be designed systematically and contextually. The website should ideally present a project workflow that is in line with the PjBL syntax, provides media that is easily accessible through various devices, and contains features that encourage interaction, reflection, and monitoring of student progress. With this approach, this platform is expected to be able to become a medium that not only supports the understanding of chemical concepts, but also strengthens students' science literacy in facing real-world challenges.

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