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Design For Developing A Project Based Learning Model Assisted By The Smartedu Application to Build Knowledge Collaboration In Science Learning

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Abstract. 21st century skills are one of the cores in curriculum development that is currently developing. One of the curriculum developments currently occurring is the outcome-based education (OBE) curriculum. The curriculum indicates that learning is not only tied to the content of the concepts studied, but more than that it must be able to produce impacts that can be useful for solving problems in the environment. The indicator components of 21st century skills are closely related to the meaning of this OBE. Technological literacy, collaboration, critical thinking, problem solving and creative thinking are skills that must be developed based on this curriculum. A person's ability to access technology-based technology and the importance of collaboration in learning activities are unavoidable learning demands. Outcome achievements in learning can be obtained by having a product produced in learning. This is in accordance with the essence of science learning, where the essence of this learning includes processes, attitudes and products. The project based learning (PJBL) model development design assisted by the Smartedu application is an alternative solution developed to overcome these obstacles. Projects produced in learning activities can be packaged in the PJBL model combined with the advantages of smart edu applications. This application was developed with various features that enable synergy in learning so that knowledge collaboration can be formed.

Keywords: Project based learning, app smartedu, 21st century skills, collaboration, OBE.

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INTRODUCTION

The development of knowledge is growing rapidly in accordance with technological advances, this results in the importance of superior human resources and being able to compete in the global world (Giacomazzi,, M. 2024). 21st century skills are core competencies that must be possessed in this century, in general these skills are divided into three categories, namely basic literacy, competence and character qualities (Boston Consulting Group, 2015; Giacomazzi,, M. 2024). The competencies referred to in 21st century skills include critical thinking skills, creative thinking skills, communicative skills and collaborative skills (Griffin.at al, 2014; Boston Consulting Group, 2015; Zulkarnaen, et al, 2019). Communication is one of the important skills, individuals must be able to express their ideas clearly, collaborate with others, and engage in constructive dialogue (Al Ali, R, 2024).

21st century skills prepare students to adapt to a rapidly changing world, ensuring they continue to learn and have problem-solving skills (Kain, C, et.al. 2024). Prospective elementary school teacher students, who will later become teachers and educators for the next generation of the nation, must have this ability in order to teach these skills to students from an early age, one of which is collaboration skills. Collaboration skills must be built to develop insight, students can develop their knowledge in lectures, and they can learn about

problems in the environment through the teacher's experience in the field (Zulkarnaen et al, 2019). The importance of collaboration in learning is related to the understanding of human social and cognitive development since infancy (Vygotsky, 1978; Baker, 2015), analysis of joint problem solving (Roschelle & Teasley, 1995; Baker, 2015), analysis of collective work (Schmidt, 1994; Baker, 2015), the study of certain psychological processes such as collaborative remembering (Edwards & Middleton, 1986; Baker, 2015), and efforts to understand what distinguishes humans from other primates (Hamann, et al., 2011; Baker, 2015).

Competency development of prospective teacher students is in accordance with current curriculum development trends, such as Outcome-Based Education (OBE) based curriculum. OBE is a performance-oriented approach by utilizing students' abilities to produce learning outcomes that can be useful, so that learning becomes more meaningful and supports students' success in the future (Shaheen, S, 2019). Competency development is centered on students, thus they must be equipped with various competencies including skills, knowledge and attitudes (Japee, 2021). The foundation of the OBE-based curriculum adopts a reverse thinking process, analysis and environmental needs as the focus of its development (Yantao He and Sijia Liu, 2024). The implications of implementing learning outcomes are oriented towards real-world applications with team-based performance (Yantao He and Sijia Liu, 2024).

Learning outcomes are the focus of the objectives in the OBE curriculum (Wardah et al, 2024). This can be formed if students are able to analyze and be critical in thinking about the problems they face. The critical thinking skills referred to are the ability to recognize and solve problems, construct coherent arguments, and make decisions based on deep and logical thinking (Trilling, B & Fadel, 2009). Real problems centered on teachers' experiences in the field are the focus of lecture activities (Zulkarnaen et al, 2020). Synergy from the environment as the focus of developing problems in learning can be formed if students can establish good communication. Communication skills can be built if each individual is accustomed to interacting well with other individuals (Malik, A & Ubaidillah M, 2021).

Project-based learning (PJBL) assisted by the smartedu application is used as one of the learning innovations in this study. PjBL is student-centered learning where students learn actively in developing their skills to solve a problem (Krauss, 2013; Larmer et al., 2015). The focus of this model is to provide a deep understanding of the concepts being studied (Krauss, 2013; Larmer et al., 2015)). PjBL involves authentic and contextual projects, which are often related to real problems or challenges in the world around students. This project helps students see the relevance between what they learn and real life (Saimon, M et al, 2023). Real problems can be obtained in the field. Synergy between universities and school environments can be formed through the smartedu application. Smart edu is an application development

with various features that enable collaboration of knowledge between the university environment and the school environment (Zulkarnanen, 2020). This application has a feature that can connect teachers in the field to the lectures being carried out. Problems are obtained in the field through teachers and discussed in a lecture, the results of which are then returned to the field (Zulkarnaen, 2019). With this, knowledge collaboration can be formed.

METHODOLOGY

This study aims to develop a project based learning (PjBL) model design assisted by the smartedu application so that the research method used is the research and development method. The ADDIE development model is a type of development model used. This model is very effective in facilitating development, design, and training with high standards so that it can be properly identified with design principles and followed by its systematic application (Dick & Carey, 2004). The ADDIE development model can integrate student needs evaluation, design/design and development, in addition, this model can also significantly produce specific measurements. The ADDIE development model consists of five stages, namely analysis, design, development, implementation, and evaluation (Dick & Carey, 2004). The general description of each stage of the model can be seen in Figure 1 below.

Figure 1. Stages of the ADDIE Development Model

Based on Figure 1, the ADDIE model is divided into five stages where each stage is interrelated with each other to form a flow. Welty (2007) describes the ADDIE development model flow developed in the study according to Table 1 below.

Table 1. ADDIE Model Phase Regarding the Development Of Pjbl Model Designs Assisted By Smart Edu Applications

ADDIE model phase	Description of activities
Analysis phase	- Identification of characteristics of project-based learning (PjBL) models - Analysis of characteristics of smartedu applications

	- Data collection related to the analysis of the relationship between PjBL models and the use of smartedu applications - Analysis of the suitability of PjBL model characteristics with smartedu applications
Design phase	- Making a PjBL model design developed using the smartedu application - Planning and submitting a prototype of the developed model innovation - Developing syntax based on the characteristics of the PjBL model assisted by the smartedu application
Development phase	- Validity test of the PjBL model assisted by the smartedu application - Judgment of the suitability of each model syntax with the characteristics of the smartedu application
Implementation phase	- Limited scale test related to the use of the PjBL model assisted by the smart edu application - Analysis of the suitability of the syntax of the developed model with limited application - Analysis of student responses to the developed model - Test the effectiveness of using the developed model
Evaluation phase	- Data collection and processing - Evaluation of the data generated - Reflection of the tested model

This paper is limited to the development phase, so that what is discussed is limited to the development of the model design and the results of expert validation of the PjBL model assisted by the smartedu application.

RESULTS AND DISCUSSION

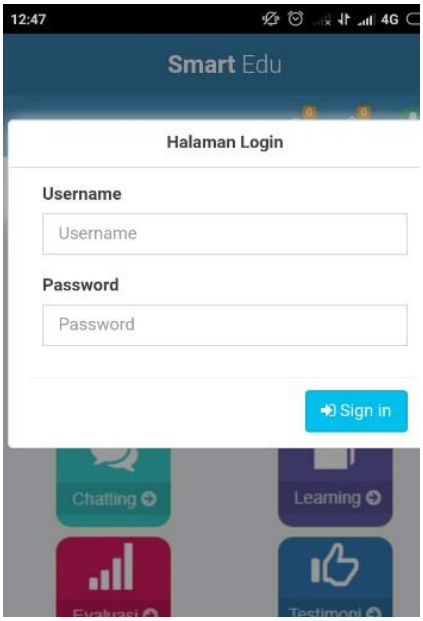
Analysis of Project-Based Learning Models and Characteristics of The Smartedu Application

Project-based learning (PjBL) is a learning model that emphasizes giving assignments in the form of projects that require students to experience an investigation process so that students are able to develop their knowledge, skills, and attitudes as a basis for teacher assessment (Thomas, 2000). PjBL has seven main standards as fundamental principles in its technical implementation, one of which is the authentic principle (Larmer et al, 2015). The Authentic Principle implies learning that is connected to the real world. The authentic principle in question includes three things, namely 1. Authentic in the project. Projects designed by students are based on what they experience in the real world. 2. Authentic in the activities and equipment used in the project. During the project, students carry out activities that are similar

to the real life they experience. 3. Authentic in the impact of project results. The project results are expected to have an impact on the environment (Larmer et al, 2015).

The authentic principle of PjBL indicates not only real problems but must be able to imply results that can have a positive impact on real life. in this case the researcher integrated PjBL with the smartedu application. The smartedu application is an android smartphone-based application, developed with various features that allow each user involved in it to collaborate and coordinate in sharing knowledge so that it can form a learning community (Zulkarnaen, et al. 2019). Through the smartedu application, problems in the field as the main topic of the PjBL project can be well connected without going to the field directly. The features developed in the smartedu application (Zulkaraen et al, 2019) can be implied in PjBL can be seen in table 2.

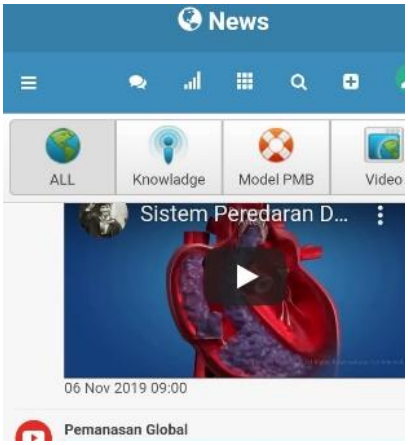
Table 2. features of the smartedu application that can be integrated with the PjBL model

Smart Edu Learning Program Display	Description of Use
	smartedu is developed in the form of a website and android application that can be accessed via an android smartphone. When smart edu is downloaded, an icon will appear on the smartphone screen as an interface that can facilitate access to this program. When we enter this application, the first display that will appear on the smartphone screen is an index related to the username and password previously registered by the admin. The settings in the user are fully set by the admin for ease of testing the application being developed. Users in the development of this application are divided into three users with different characteristics from each other according to their functions. The three users include users for students who can be accessed by students as learners, users for lecturers who function as admins in setting up and managing the programs being developed. As well as users for teachers as environmental roles that contribute to lectures and as liaisons from internal to external environments outside the university.

On the left toolbar display there are navigation icons for each feature developed in this program. This navigation consists of three main feature groups, namely home, main menu, and testimony, where each feature group consists of other supporting features. As in the main menu feature group which consists of chat, problem, news, learning and evaluation features. The function of navigation in the development of this program is to make it easier for users to access the features developed in this application. With this navigation, it is hoped that each user can be guided in entering each feature that will be accessed

The chat feature is one of the core features developed in application development. This feature is divided into 3 user groups with different characteristics according to their functions. The three user groups are student users, lecturer users and teacher users. Technically, the three user groups have functions that are indicated by access restrictions managed by the admin according to their roles. Lecturer users can access all user groups, student users can access teacher and student user groups, the purpose is for learning and raising and deepening cases that occur in the field. While for teacher users can only access the teacher group, with the aim that each teacher can coordinate with other users in raising problems that occur in the field. For the student feature, it can only be accessed by students and lecturers because in this feature the internal learning process takes place. Related to problems as the core in learning can be obtained in the teacher group and can be accessed by all users. With this chat facility, a coordination system between teachers as external roles in
learning with students and lecturers in the internal environment can be formed.

The problem feature is intended to raise issues that occur in the field. All users can access this feature, through this feature problems can be submitted. Teachers can submit problems that occur in the field. This feature is equipped with a comment column with the aim of commenting briefly on the problems submitted. If the user has the capacity to answer or raise a problem, then the user can fill in his opinion in the problem or comment column in this feature.



News is one of the features developed in this application. This feature functions to provide information related to the description of knowledge or alternative solutions to the problems submitted. This feature can be accessed by all users. Teachers can open this feature to increase insight and obtain answers to problems that occur in the field. Thus, problems raised from the field will be returned to the field in the form of alternative solutions so that knowledge collaboration can be formed. In addition to this, with the existence of knowledge information that can be freely accessed by teachers, teachers in the field can increase their insight.

Syntax Analysis of Project-Based Learning Models Assisted By The Smartedu Application

The syntax of project-based learning generally consists of three main stages, namely planning, implementation, and reporting (Stoller, 2006). The three main stages of project-based learning produce eight learning activities as follows.

1 Planning consists of five activities, namely choosing a project topic, pre-communicative activities, asking important questions, designing a project plan, and creating a project timeline.
2 Implementation consists of one activity, namely finishing the project.
3 Reporting There are two activities in this stage, namely assessing project results and evaluating the project.

The description related to the stages of this model can be seen in Figure 2.

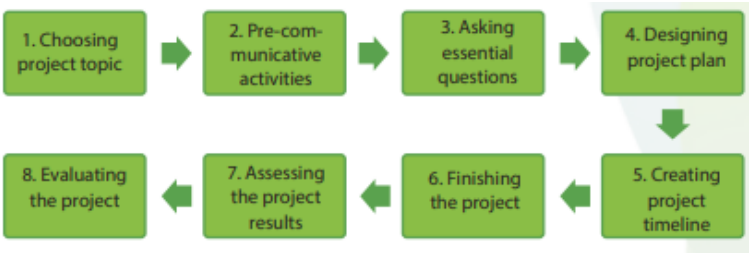


Figure 2. Project-based learning model syntax

At this planing stage, the use of the smart edu application includes several features, including the chat feature and the problem feature. The problem feature can be accessed by all users, this feature functions to submit problems as study material that will be studied in lectures. Teachers can access this feature and submit problems that occur in the field. Real problems in the field are used as topics in making projects. The problem feature is equipped with a comment column to provide a direct response to the problems submitted. Figure 3 shows the communication profile of teachers, students, and lecturers from the problem feature that was developed.

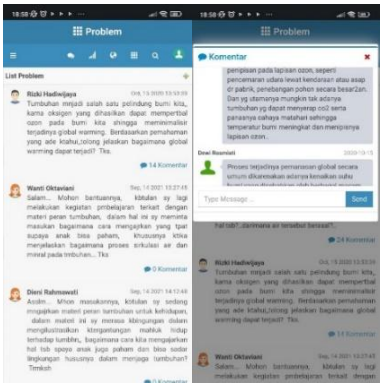


Figure 3. Student - teacher communication profile in the smart edu application

Limited communication between various users can be done on the problem feature. However, for a more in-depth discussion, the smartedu application provides a chat feature. The chat feature is developed into three user groups, namely teacher groups, lecturers, and students. The teacher group can be accessed by all users, in this case students, lecturers or teachers are given the freedom to carry out more in-depth discussion activities related to the problems submitted. Communication that gives birth to knowledge collaboration can be built in this feature. The communication profile of each user on the chat feature can be seen in Figure 4.

Figure 4. Communication Profile Between Users in the Chatting Feature of the Smart Edu Application

In this chat feature, activities such as project guidance so that it does not deviate from the predetermined time schedule can be carried out by lecturers for their students.

In the implementation stage, students can access the Evaluation feature on the smartedu application. In this feature, there is a project menu that functions to report the results of products that have been worked on by students. The image of this feature can be seen in Figure 5.

Figure 5. Evaluation feature consisting of the project menu

Meanwhile, at the reporting stage, the product results that have been uploaded in the project menu will be assessed and if they are worthy of being published, the lecturer will connect them to the News feature, so that the product results which are alternative solutions to problems in the field can be returned to the field where teachers can access them. Thus, knowledge collaboration can be formed, the description of the News feature can be seen in Figure 6.

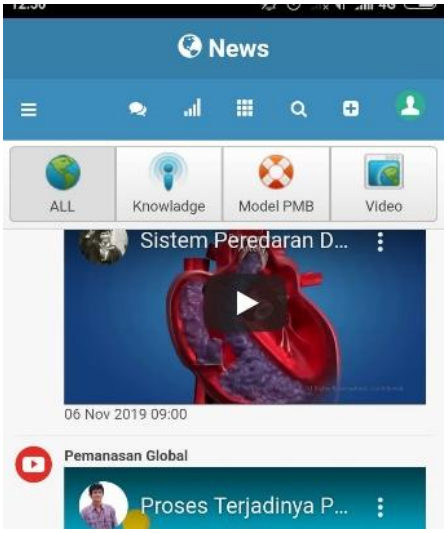


Figure 6. News feature where teachers in the field can access the products produced

Based on this, knowledge collaboration can be formed in PjBL by using the smartedu application, where teachers submit problems that are used as a reference for learning at the university, students and lecturers carry out learning activities to solve problems that occur in the field, then the solutions as a result of learning activities are re-entered into the application that can be accessed by teachers in the field (Zulkarnaen, et al., 2020).

CONCLUSION

The design of the development of a project-based learning model integrated with the smartedu application indicates a learning that utilizes technology to obtain real problems in the field that are raised in a lecture. The problem is used as the main topic in the development of the project carried out, after students produce a product as an alternative solution offered, the solution in the form of a product from the project is distributed back to the field through the features built into the smartedu application. Thus, there is a collaboration of knowledge between the university as a center for research and development with schools as environmental implications that produce a problem that must be solved where the results of the development of lectures at the university in the form of solutions are returned to the school environment.

The solution in the form of a project is the result of problem-solving addressed in lectures. Problems in the field are raised as lecture themes and turned into projects to develop alternative solutions. Lecturers guide and direct students in solving these issues. For example, if teachers in the field face difficulties in teaching a science concept due to limitations in providing instructional media, this issue can serve as a foundation in lectures, which are then developed into alternative solutions in the form of projects for students.

The project is developed based on thorough analysis and creativity while considering aspects of effectiveness and efficiency, making it highly feasible for application in the field. The project

results, as solutions to field problems, are then returned to the field through the SmartEdu application, allowing teachers to implement them again in their teaching practices.

Thus, a synergy of knowledge is formed through this application, where teachers play a significant role in identifying problems in the field, which then serve as the foundation for lectures. On the other hand, the projects produced from these lectures become alternative solutions that can be assessed and later applied in the field by teachers through the SmartEdu application.

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