Design Innovative Learning Models Based Project to Improve Student's Competence In Higher Education : Case Studies In Faculty of Information Technology USN Kolaka Indonesia

Nur Fajriah Muchlis
Universitas Negeri Malang, Indonesia, https://orcid.org/0000-0002-1002-6226

Punaji Setyosari
Universitas Negeri Malang, Indonesia, https://orcid.org/0000-0003-0187-9785

Dedi Kuswandi
Universitas Negeri Malang, Indonesia, https://orcid.org/0000-0003-1005-6641

Saida Ulfa
Universitas Negeri Malang, Indonesia, https://orcid.org/0000-0002-2302-7172

Henry Praherdhiono
Universitas Negeri Malang, Indonesia, , https://orcid.org/0000-0002-5922-7491

Abstract: In recent years, the Computer Science and Information Technology programs have experienced growth and achieved immense popularity, increasing the demand for graduates who will become skilled workers. The educational outcomes-based curriculum (OBE) targets that learning must pay attention to one of the Key Performance Indicators (IKU) achievements: competence. This study applies GRASPS to the PjBL learning model, which forms the basis for preparing projects that will be implemented in learning so as not to deviate from the characteristics of PjBL. An essential part of GRASPS is placing students in real-world scenarios where they will produce products that describe learning content and what they need to produce in real-world situations. The GRASPS elements are goals, roles, audiences, situations, products, and standards. The syntax of the innovative learning model that will be implemented is divided into three stages. The first stage is preparation, where the lecturer makes the syllabus, materials, and framework according to Basic competencies (KD). The second stage is learning, which includes activities to determine topics, plan activities, investigate, and solve. In the final stage, namely the evaluation stage, because GRASPS is an authentic assessment, this learning evaluation must be carried out with various instruments, including written tests, product assessments, and performance assessments. Performance assessment is carried out continuously based on evidence of student learning outcomes at each meeting, both from student presentations regarding the progress of their projects and from the results of discussions in each group, as well as notes from researchers regarding student activities during learning.

Keywords: Project Based Learning, Innovative Learning Model, Student Competence, GRASPS

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Introduction

In recent years, Computer Science and Information Technology fields have experienced tremendous growth and achieved immense popularity, increasing the demand for graduates to enter the skilled workforce. It is projected to grow 22 percent from 2020 to 2030 (Bureau of Labor Statistics, 2022). Due to its popularity, the number of students enrolling in Computer Science and Information Technology (CS and IT) courses is steadily increasing worldwide (Skalka & Drlik, 2020). Crucial fields such as big data and data science require CS and IT graduates to demonstrate mastery in data acquisition, data management, and data inference skills (Mithun & Luo, 2020). Data management and programming skills are considered most needed for success in the workplace (Veerasamy et al., 2019). Therefore, several introductory programming courses are essential milestones in CS and IT education because they reflect students' abilities to solve problems and design appropriate solutions (Skalka & Drlik, 2020).

The outcome-based education (OBE) curriculum targets learning to pay attention to one of the Key Performance Indicators (IKU) achievements. The IKU in question is a collaborative and participating class. Learning designed based on the achievement of the seventh IKU can certainly produce graduates with various skills that can prepare them to compete in both the business world and the industrial world (DUDI) (Kemdikbud, 2020).

One of the majors in the computer field is Information systems, a unique study program because it combines several scientific fields, namely Computer Science, management, and Business. This major is required to have graduate competencies or skills equivalent to learning outcomes in the Informatics and Computer Science family, namely being able to know the specialisation of designing and developing applications for information systems or websites, programmers or web programmers, designing e-business and database administration, visualising data, finding patterns from the results of data analysis, and developing business plans based on the latest technology (APTIKOM, 2016). With this achievement, Bachelor of Information Systems graduates have sufficient expertise or skills in the field they are studying, namely the field of Computer informatics, which makes one of the graduates' competencies a planning creator.

As a lecturer in Information Systems, I often feel concerned about the quality of graduates that have been produced. It turns out that when many students have just graduated, they feel that they are still lacking in real-world application and find it difficult to work independently to find solutions to problems encountered in the

world of work. So far, have the method of delivery and content of learning materials and the applied curriculum been able to lead students to become the expected graduates or not? If not, look for solutions to the weaknesses and what must be done to make graduates meet the expected quality.

Mobile Learning

Mobile learning, or M-learning, is a type of e-learning that distributes learning content and supporting materials via wireless communication devices. Changes in terminology mark the transitional revolution from e-learning to m-learning. For example, the dominant terms in e-learning are multimedia, interactive, hyperlink, media-rich environment, and others. In contrast to m-learning, terms such as spontaneous, intimate, situated, connected, informal, lightweight, private, personal, etc., characterise contexts (Cabanban & Christianne, 2013).

M-learning is unlike traditional e-learning; the resources (computing resources) in the mobile learning environment are minimal. Mobile devices used as learning media have several limitations, such as power supply, storage capacity, processor, display screen, and input and output facilities. Another thing is that mobile devices have various platforms and server platforms that are used as learning resources. This fact causes mobile learning systems to be specifically developed and optimised in such a way as to be compatible with a variety of devices and limited resources and have high interoperability (Riyanto et al., 2006).

Functions and Benefits of Mobile Learning

There are three functions of mobile learning in learning activities in the classroom (classroom instruction), namely, as a supplement (additional), which is optional (optional), complementary (complement), or a substitute (substitution).

Supplements (additional)

Mobile learning functions as a supplement; students can choose whether to use mobile learning material. In this case, students are not obligated or required to access mobile learning materials. Even though it is optional, students who use it will undoubtedly have additional knowledge or insight.

Complement (complimentary)

Mobile learning functions as a complement (complementary); the material is programmed to complement the learning material that students receive in class. Here, mobile learning material is programmed to become reinforcement or remedial for students participating in conventional learning activities.

Substitution (substitute)

Several universities in developed countries provide several alternative models of learning activities for students. The goal is that students can flexibly manage their lecture activities according to their time and daily activities. Students can choose from three alternative models of learning activities: Fully face-to-face (conventional), partly face-to-face and partly through the internet, and entirely through the internet.

Mobile Intelligent Cloud Learning System

Mobile Intelligent Cloud Learning System (MIC-Learning) is a development of mobile learning. With this application, students are directed to understand the material and solve problems so they can put forward creative ideas through virtual learning. This is possible because the MIC-learning system application carries out a mobile control system for learning values by adding material and several interactive enrichment interactions that are expected to increase understanding regarding multimedia products by constructing students' knowledge into real life.

According to the analysis phase carried out previously, sources that can be obtained free of charge from video provider sites on the internet will be used to provide learning materials. Initially, the learning resources chosen were Vimeo, YouTube, Dailymotion, and Showme. However, after observing, Vimeo cannot be accessed from the internet network in Indonesia due to blocking reasons. Therefore, the learning resources used are YouTube, Dailymotion, Showme, and Google Drive.

The architectural design of learning resources follows the architectural design of the cloud, but some parts are modified to meet the system's development needs. The cloud architecture in this image retrieves learning content from several sources using the Video Learning Resource Material API search engine, wraps it up, distributes it to a Mobile Learning Management system, and stores it in a cloud database so that users from MLS can find learning materials by utilising videos. Learning Resource Materials

Method

Project Based Learning

The project-based learning (PjBL) model is a learning model that has been widely developed in developed countries such as the United States. Translated into Indonesian, PjBL means project-based learning. PjBL is a learning model that starts with fundamental questions that require teachers to develop guiding questions (a guiding question) so that, in this case, each student can eventually answer guiding questions (Hartini, 2017; Sularmi et al., 2018). Project-based learning starts with problem-solving that needs to be done so that students can create contextual and practical works (Makrufi et al., 2018). PjBL can create student motivation and interest in learning (Handayani et al., 2019). The project-based learning process is a form of student learning that contributes to shared outcomes, so it has elements of experiential learning with active reflection and conscious involvement (Kokotsaki et al., 2016).

PjBL can develop students' problem-solving abilities, including the ability to think creatively (Arisanti, 2017). Learning models built based on project activities can challenge students in everyday life (Triana et al., 2020). Project-based learning can provide engaging experiences (Muwahiddah et al., 2019). Students will practice planning, carry out activities according to plan, and display or report the results of these activities, which are the core of project-based learning (Giwanti et al., 2019). Students in project-based learning must gain new knowledge and understanding based on direct experience working on projects through various presentations (Elvina et al., 2015; Wijanarko et al., 2017).

Roopnarine and Johnson in Arisanti (2017) reveal that the purpose of the PjBL model is to provide various kinds of learning experiences to foster participation in the process of responding to each other's ideas, organise different efforts and contributions from members and all subgroups, resolve disputes, and reach an understanding of how solving problems and completing assignments enhance student learning by creating a suitable environment (J.Afriana et al., 2016; Sularmi et al., 2018).

PjBL is a learning model that can foster students' creative thinking abilities (Kristiani et al., 2017). A structured learning experience is based on the belief that learning occurs when individuals are tasked with investigating the problems that occur (Wajdi, 2017). PjBL is a student-centred learning model that provides meaningful learning experiences to create new, relevant learning (Hidayat, 2019; Suhendar, 2017).

PjBL must start with the following stages: presenting problems, making plans, compiling schedules, monitoring project development, conducting assessments, and evaluating (Nahdliyati et al., 2016). Based on the statement above, it can be concluded that the PjBL learning model is a learning model that requires students to make projects that produce some products.

GRASPS Models

GRASPS in the PjBL learning model is used as a basis for constructing projects that will later be applied to learning so that it does not deviate from the characteristics of PjBL. An essential part of GRASPS is placing students in real-world scenarios where they produce products that describe the learning content and what they need to produce them in real-world situations (Carlson & Marshall, 2009). The Elements in GRASPS are:

A goal, is a goal or action that students will carry out in a scenario.
Role, namely the role of students in the scenario.
The audience, namely the environment, will later relate to the role of students in the scenario.
Situation, namely the challenges and details of the atmosphere or series of activities carried out in the scenario.
Product, namely the result of activities during learning or while running scenarios.
Standards, how this task will be assessed, the product's criteria, and the indicators of its success.

GRASPS is also an Authentic Assessment method taken from the idea of Wiggins and McTighe called "backward planning" or "backward design" (Carlson & Marshall, 2009). Not many have researched the GRAPS method. Gustina (2012) argues that applying PjBL with the GRAPS approach (Goal, Role, Audience, Situation, Product, Standards) can improve student learning outcomes.

Project-Based Learning Design with the GRASP Method

In this study, the GRASPS elements are described in a project-based learning design as follows:

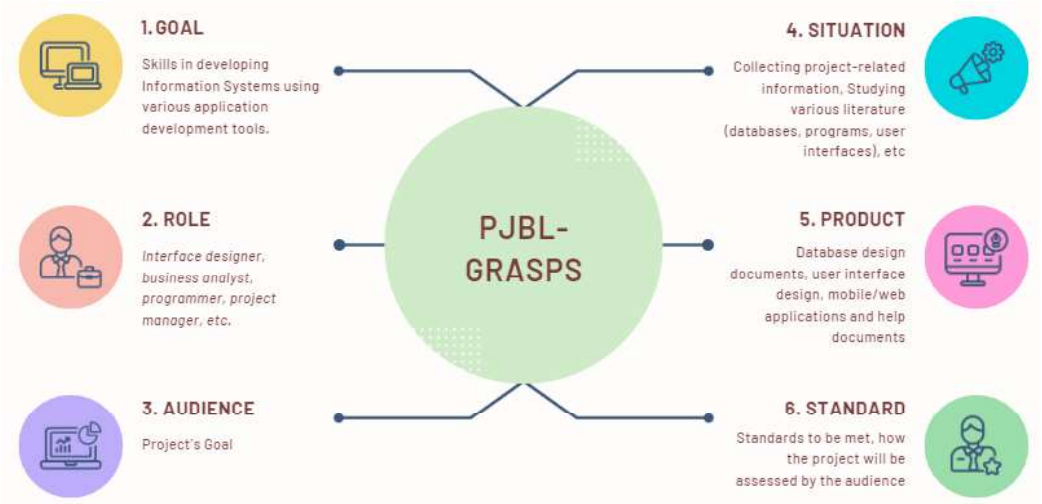

Figure 1. Project-based learning design with the GRASPS method

The goal, to provide students with skills on how to develop information systems by developing various design documents and using various application development tools.

Roles. Students will act as application developers who work in a team with various specialisations such as interface designers, business analysts, programmers, project managers, or other roles that can be added according to the number of group members.

Audience. For whom did the students solve the stated problem? Who should be convinced by students about the solution and the possible success of the proposed solution to the problem (the audience is not limited to students or lecturers but can be simulated as in real life)?

Situation/Set of Activities. Students collect information on the needs of information systems to be developed from resource persons (users), study various literature, make database designs, application/program flowcharts, and interface designs (user interfaces), then present them to users for approval, carry out programming the application using an IDE (Integrated Development Environment), create documentation and technical support, conduct trials on users, and distribute applications.

Product/Results. Database design documents, program flowcharts, user interface designs, desktop and web applications, and documentation for technical support (help documents). After designing the project, the next step is to make detailed learning implementation plans (RPP) documents, action plans, or, as some call them, unit plans, which include learning objectives, competency standards, activity details, teaching tools and materials, worksheets, evaluation methods, and so on.

Standards. The standard that must be met is how the audience will assess the work. Later, this project scenario will be executed in parallel in three existing courses, so it is necessary to create synchronisation between the content delivered at each stage or meeting with students.

To support and provide innovation in this learning activity, a mobile learning-based system with functions like a Learning Management System (LMS) will be developed. An analysis of the web-based e-learning system is carried out to find out the main features of the e-learning system. These features are reviewed and adjusted to be implemented as m-learning applications. The components involved in the m-learning system include Android devices, PC users, web services, and database servers. Figure 2 shows an overview of the mLearning system on the Android platform. The Android device acts as a user interface tool for this application, sends data requests and receives data sent by web services, and is a medium for displaying information sent by the system to users. A database using spreadsheets on Google Drive is used to store student data, teaching materials, quizzes, and grades. PC users are used as an application tool to manage the data contained in the database through the administrator. In this case, it is used to manage and manipulate data used in m-learning applications on the Android platform students and lecturers use. Web service to manage data traffic between client and server. Receives input variables from the user and arranges these variables into parameters that form a query, calls the function by sending the parameters for compiling the query, receives the results of the query execution carried out into the database model and manages the process of presenting the information sent to the client on view component. The last part is the database server, which stores all information about the data used in running the application. Another role of the database server is to receive query-forming parameters sent by the web service, execute the query that has been formed, and send back the query results to the web service.

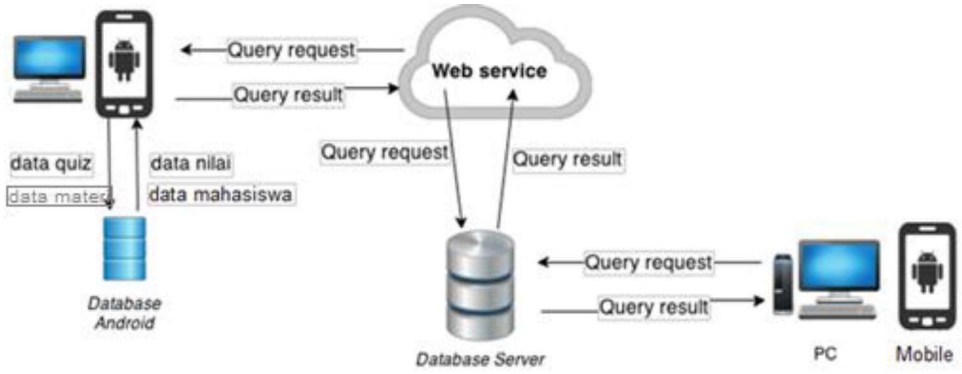

Figure 2. Overview of the MIC-Learning Application to be Used

Results and Discussion

Design Mobile Learning: Integrated Project-Based Innovative Learning

Learning is essentially a system consisting of many interrelated components that influence each other. The learning process is one component of the system. The process aims to provide a learning experience so students can optimally achieve their learning goals. The essence of the learning process is not only transferring knowledge but also optimising students' abilities as independent learners and reconstructing knowledge based on the learning experience gained. The results of observations on students' abilities in the Software Engineering (RPL) course show that student understanding is still low, which is indicated by their inability to produce works in the form of software products.

Problems related to the RPL Practice learning process, as conveyed require appropriate problem-solving solutions. Improvement can begin with the preparation of learning tools supported by appropriate evaluation facilities through lesson study (LS) activities to improve the quality of learning. With increasing the quality of the learning process, it is hoped that it will have a direct impact on increasing students' metacognition abilities and understanding of concepts. Thus, learning planning as outlined in RPS and SAP as technical instructions for implementing lectures will make it easier for lecturers to carry out learning while helping students become independent learners.

The RPS and SAP that have been arranged need to be equipped with teaching materials in modules and digital-based assessment instruments. Teaching materials adapted to learning conditions are supported by facilities that are also very much needed. Preparing material according to the hierarchical level of difficulty is an essential priority as a basis for development, including preventing students from misunderstanding concepts. This is an important part to pay attention to because a thorough understanding of the concept will increase the ability to carry out their duties.

The concept of self-learning using learning media in digital modules and supported by assessment features teaches students to think through the planning process, carry it out, and repeat it as an evaluation step for all these learning activities. Kung et al. (2005) stated that developing metacognitive abilities is an essential step in knowing one's potential. Mittlefehldt & Grotzer (2003) showed that the development of metacognitive abilities will have an impact on increasing students' understanding of concepts. Using e-portfolios with tiered assignments requires students to actively learn by finding multiple sources, honing their thinking skills, and understanding images and videos. Thus, students become accustomed to concentrating and evaluating learning activities so that, overall, they improve their learning outcomes.

Activities of Learning device development with evaluation components in the form of MIC-Learning are carried out by adopting Lesson Study (LS) through the plan, do, and see stages. LS-systematic activities that emphasise the collaboration of team members based on collegiality principles to enhance mutual learning have the potential

to improve the learning process on an ongoing basis. Nesusin et al. (2014) showed that the main point of implementing LS is continuous development based on the dynamics of classroom learning changes by emphasizing innovations to solve problems encountered.

Santyasa (2009) states that LS activities increase the professionalism of lecturers in teaching, which will impact improving the quality of learning. Thus, it can be interpreted that LS, which is carried out consciously and continuously, will improve the quality of both lecturers and students. The implementation of LS activities is expected to improve the quality of lecture implementation, which has an impact on increasing metacognition skills, collaboration skills, and students' communication skills and understanding of the concepts, as well as the professionalism of lecturers to develop lesson plans, implement them, and evaluate them.

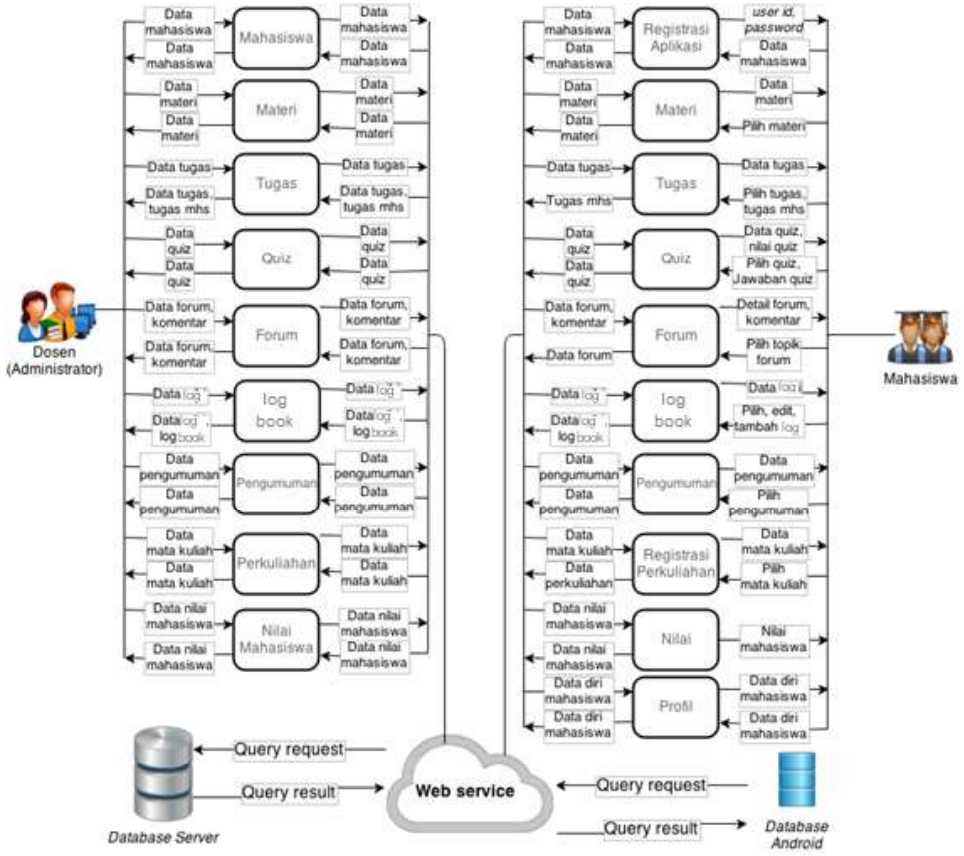

Figure 3. MIC-Learning Architecture on the Mobile Platform

The use of scientific approaches and appropriate learning models such as cooperative, collaborative, and work project models in the Software Engineering (RPL) learning process has consequences and impacts on various activities that strongly support a conducive atmosphere for achieving learning objectives. Activities that are accommodated in a scientific approach, which includes 5M, namely observing, asking, trying, reasoning, and communicating the results of these various activities logically, will be able to increase students' abilities as learners in terms of their ability to communicate, their ability to collaborate, and their metacognition skills,

leading to increased understanding of concepts and achievements. More than that, the activities carried out in scientific learning are believed to make learning more meaningful. Because the competencies or abilities acquired are not simply given by the learner (lecturer), but through several processes and activities carried out by the learner (student), the competencies acquired or mastered will be embedded longer and more vital in students.

The three standard features in MIC-Learning include teaching and learning features, discussion and communication features, and exam and assignment features. The implementation of these features into the MIC-learning application by adjusting the menus contained in the MIC-learning application on the Android platform. The teaching and learning completeness feature is implemented in the course, material, and wiki menus. Discussion and communication features are implemented in the profile update, announcement, lecture information, and forum menu. Examination and assignment features are implemented into quiz menus, assignment menus; student study results menus, and grade menus.

Figure 4. Interface Design of Mobile Intelligent Cloud (MIC) Learning System

The MIC-learning application consists of two versions: the MIC-learning application for lecturers and the MIC-learning application for students. The architecture of the m-learning application on the Android platform can be seen in the outline in Figure 3. There are nine main modules in the MIC-learning application for students and lecturers, including registration modules, material modules, assignment modules, quiz modules, forum modules, value modules, an announcement module, a wiki module, and a lecture module. These modules are implemented into the m-learning application as an application menu.

Conclusion

The product of this research is a learning tool and a description of its influence on communication skills,

collaboration skills, metacognition abilities and students' conceptual understanding as users of the learning tool. In accordance with the target, the resulting learning tools consist of RPS, SAP, learning applications equipped with mobile-based assessment instruments (MIC-learning), usage modules and products or applications resulting from student learning. The product is then revised based on the results of trials and lesson study activities, as well as suggestions and input from experts in their respective fields.

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