



Collaboration of Business Process Modeling Notation and Rational Unified Process in Blended Learning System Development

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Abstract. The blended learning system, or what is known as hybrid learning, is a good learning method to use after the COVID-19 pandemic. This learning is flexible and not only focuses on face-to-face learning in class but can also carry out the learning process anywhere. The use of information technology such as e-learning web applications, conferences, and animated graphic design are the main reasons why this system is attractive to use. The large variety of users with diverse backgrounds means that the blended learning system cannot run effectively and efficiently. The research tries to collaborate between the Business Process Modeling Notation (BPMN) and the Rational Unified Process (RUP) method in developing a blended learning system. The expected result is that the blended learning system will have an e-learning web application that facilitates the learning process and a blended learning system management guide that can be used by users.

Keywords: Blended Learning, Business Process Modelling, RUP

1 PREFACE

There has been a shift in the life patterns of world society during the COVID-19 pandemic since 2020. Restrictions on community activities have caused people to need media to help with social activities such as interacting, communicating, and transacting with one another. Information and communication technology supported by Internet media is one of the technologies used by humans to assist in their social activities. The activities carried out include the fields of health, education, government, and economics.

The transition from the COVID-19 pandemic to a COVID-19 endemic, which was declared the revocation of PPKM status in Indonesia, was conveyed by the President of the Republic of Indonesia, Joko Widodo, on Friday, December 30, 2022. After the revocation of this status, Indonesian people were freer to carry out their daily activities. In the education sector, students and teachers are starting to carry out face-to-face

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learning processes at school. The learning process is not fully carried out face-to-face, but also applies a blended learning system that utilizes information and communication technology [14]. In the blended learning system (or what is now known as hybrid learning), the learning process is carried out online using internet applications, face-to-face in class, and independently [9]. The blended learning system is considered an appropriate learning pattern that makes it easier for students to learn.

The information technology used in the blended learning system makes this learning system good for use after the COVID-19 pandemic. The use of the internet network reaches students who cannot attend class due to distance restrictions but can attend lectures [7]. Web applications such as LMS (Learning Management System) make it easier for students to access course material [9]. Students can also interact face-to-face with lecturers using the Zoom or Google Meet applications. Graphic design and animation technology make it easier for lecturers to explain the material to students.

The blended learning system is not a new concept in the world of education. Learning patterns that are capable of two-way interaction and providing feedback between teachers and students have been implemented in various educational institutions in Indonesia and other countries. Students of the Department of Anatomy, Sharda University, India, use e-learning web applications to make it easier to access lecture material and visualize human anatomy [12]. The Department of Business and Management at the University of Portsmouth, UK, models blended learning [1].

For the use of the blended learning system to run smoothly, an e-learning web application is needed that suits the needs of teachers and students at school. Apart from that, a guidance document is also needed to facilitate the process of implementing the blended learning system. Documentation of guidelines for implementing the blended learning system is very necessary because the users who will use the system vary with different levels of ability and background.

This research develops a blended learning system at the Prima Insani Integrated Islamic School. The blended learning system that will be developed is an e-learning web application used for the learning process between teachers and students and documentation of work procedures for using the e-learning web application. The e-learning web application was developed using the RUP (Rational Unified Process) method. This method is widely used in software development. The advantage of this method is that it is easy to model in the real world and produces quality devices [13].

The documentation contains guidelines for implementing blended learning based on business process modeling. One of the tools used to describe complex and large systems of business processes is Business Process Modeling Notation (BPMN) [11]. By using BPMN, the business processes that occur in the system are easy to understand. Apart from that, BPMN is also able to measure the use of time and resources in the business process. The expected result of this research is to produce a blended learning system consisting of an e-learning web application and a guide that can be used by many users with many backgrounds.

The RUP (rational unified process) software development method is the most widely used method in software development. The advantage of this method is that it is easier to model the real world and produces high-quality software. The weakness of this method is that it only focuses on the quality of the software. In developing a

comprehensive blended learning system, the RUP method does not explain the work procedures for using e-learning applications, so users who have different backgrounds and abilities find it difficult to use the blended learning system. Business Process Modeling Notation (BPMN) provides a detailed explanation of the business processes in the system but does not explain the software development process. The problem that will be solved in this research is "How to collaborate the RUP and BPM methods in developing a comprehensive blended learning system so that the learning process can run effectively and efficiently?" so that users of the blended system can utilize it in the learning process.

2 BASIC THEORY

2.1 BPMN

Business Process Modeling Notation (BPMN) is the new standard for modeling business process flow and web services. Created by Business Process Management Initiative (BPMI), the first goal of BPMN is to provide a notation that is readily understandable by all business users. This includes those business analysts make a preliminary design of the process to the responsible technical developer implement the technology that will carry out the process.

BPMN will be constrained to support only the concepts of modeling that are applicable to business processes. This means that other types of modeling done by organizations for business purposes will be out of scope for BPMN. For example, the modeling of the following will not be a part of BPMN:

- 1.Organizational structures and Resources
- 2.Functional breakdowns
- 3.Data and information models
- 4.Strategy
- 5.Business Rules

Business process modeling is used to communicate a wide variety of information to a wide variety of audiences. BPMN is designed to cover many types of modeling and allows the creation of end-to-end business processes. The structural elements of BPMN will allow the viewer to be able to easily differentiate between sections of a BPMN Diagram.

There are three basic types of sub-models within an end-to-end BPMN model:

- 1.Private (internal) business processes
- 2.Abstract (public) processes
- 3.Collaboration (global) Processes

2.2 Rational Unified Process (RUP)

RUP is software development that uses an iterative, architecture-centric, and use-case-driven approach. The RUP process has been carried out well-defined and structured so

that the concept offered by RUP is widely used by software development projects [8]. RUP is also a process product that provides a customizable process work environment for device engineering software. RUP uses an iterative approach therefore there is a process sequence that is repeated where each repetition has several steps such as data collection (requirements), analysis, design, implementation, and so on. Figure 1 shows the iterative model and stages in the RUP which starts with planning, requirements, analysis, design, implementation, and testing. After testing if there are changes or errors then will start with the initial process but if there are no changes it will log in at the deployment stage.

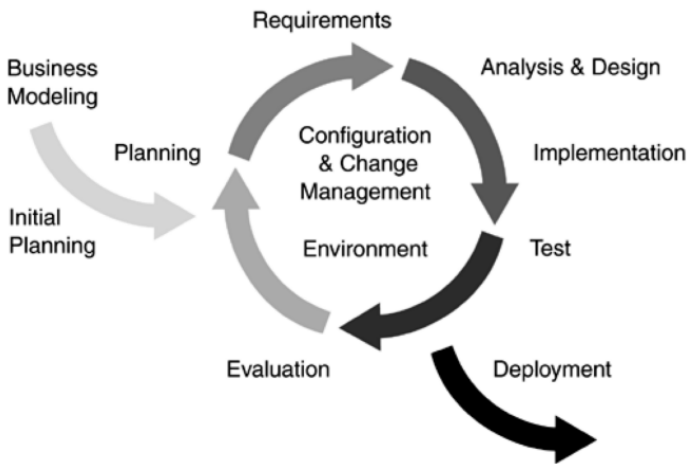


Fig. 1. Process in RUP

RUP modeling uses Process Engineering Metamodel Software, which is the modeling process standard for the Unified Modeling Language (UML). Figure 2 is the RUP architecture in a two-dimensional model. It contains two structures, namely dynamic structures and static structures. Dynamic structure is a horizontal dimension that shows the time dimension of the process. Here it shows the processes, expressions in cycles, phases, iterations, and efforts in the life cycle of a project. Meanwhile, the static structure depicted in the vertical dimension describes how the process elements (activities, disciplines, data, and rules) are grouped into core process disciplines (workstreams).

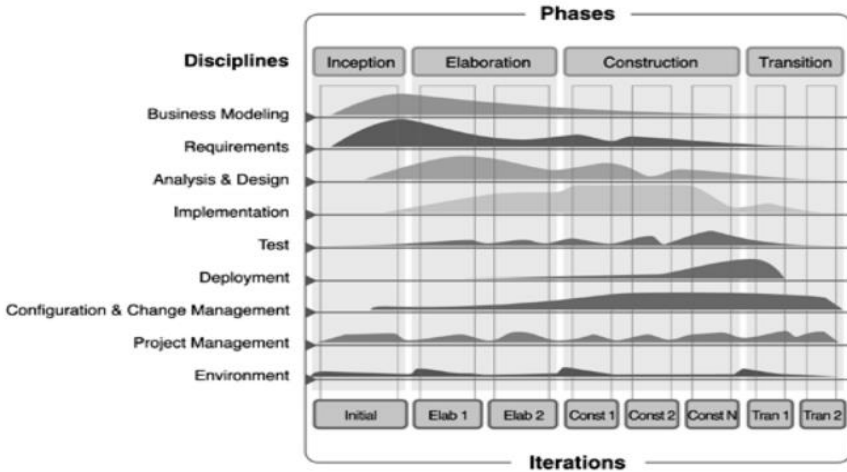


Fig. 2. 2-dimensional process in RUP [8]

2.3 Blended Learning

In simple terms, it can be said that blended learning is learning that combines face-to-face (conventional learning, where educators and students interact directly with each other and can exchange information regarding learning materials), independent learning (learning with various modules that have been provided), and online independent learning.

In blended learning, there are six elements that must be present, namely: (1) face-to-face (2) independent learning; (3) application; (4) tutorial; (5) collaboration; and (6) evaluation.

1.Face to face

Face-to-face learning is a learning model that is still being implemented and is very often used in the learning process. Face-to-face learning is a form of conventional learning model that brings together teachers and students in one room to learn.

2.Learn to be independent

One form of learning model activity in blended learning is individualized learning, that is, students can learn independently by accessing information, materials, or lessons online via the Internet. This doesn't mean studying alone, but independent learning means learning on the initiative with or without the help of others in learning.

3.Application

Applications in blended learning-based learning can be done through problem-based learning, students will actively define the problem, look for various alternative solutions, and track the concepts, principles, and procedures needed to solve the problem.

4.Tutorials

In the tutorial, students are active in conveying the problems they face, and a teacher will act as a guiding tutor. Even though technology applications can increase student involvement in learning, the role of teachers is still needed as tutors.

5. Cooperation

Collaboration skills must be an important part of blended learning-based learning. This is certainly different from conventional face-to-face learning, where all students study in the same class under the control of the teacher. Meanwhile, in blended-based learning, students work independently and collaborate.

6. Evaluation

The evaluation of blended learning-based learning will, of course, be very different compared to the evaluation of face-to-face learning. Evaluation must be based on processes and results that can be carried out through student learning performance evaluations based on portfolios. Likewise, assessment needs to involve not only the teaching authority but also self-assessment by students as well as other student assessors.

3 RESEARCH METHODOLOGY

3.1 Study of Literature

The first stage carried out in this research was a literature study related to the concepts and theories of business process modeling, rational unified process, and blended learning. Literature studies were carried out by reading journals, proceedings, and books regarding business process modeling, rational unified processes, and blended learning. The literature reading sources were obtained from libraries and the internet. The results of the literature study obtained a good understanding of the concepts and theories that will be used in the research.

3.2 Systems Analysis

At the system analysis stage, the results obtained are a comprehensive system description. The system that will be used in this research is the Prima Insani Integrated Islamic School. The system analysis process is carried out by visiting and observing directly at SIT Prima Insani. The way to analyze the system is by conducting interviews with the parties involved, studying existing documents, and being directly involved with the workflow at SIT Prima Insani.

3.3 Business Process Analysis of the Ongoing Learning Process

Business process analysis is carried out by:

1. Observing the workflow carried out by people involved in the learning process, such as teachers, students, education staff, and deputy principals.
2. study academic documents
3. Conduct interviews with business process actors.
4. Take part in the ongoing process.

3.4 Data Collection and System Requirements

The purpose of collecting data and system requirements is to obtain specifications for the blended learning system that will be created. The method used for collecting data and meeting system requirements is the same as that used for business process analysis.

3.5 E-Learning Web Application Development

The following is an explanation of the stages of web application development using the method RUP.

1. Inception

- Elicitation : The literature study was carried out by collecting journal papers and textbooks from various sources such as Science Direct, Springer, and IEEE Explore related to the fields of Blended Learning, RUP and BPMN. From the results of this literature study, basic knowledge and research roads in this field will be obtained. Needs analysis was obtained from users and SIT Prima Insani stakeholders
- Analysis: The needs that have been collected are interpreted to mean the needs obtained. Needs originating from users and stakeholders are analyzed to determine implementation priorities. The interpretation of a requirement can be in the form of data, constraints, rules, scenarios, and software functionality.

2. Elaboration

- Database design: Database design is a continuation of database analysis.
- Interface design: designing a GUI (Graphical User Interface)-based input and output display using Microsoft Visio.
- Web application design: designing program modules in object form, which will later be used when coding the system. The module design can take the form of algorithms, UML notation, or pseudocode.

3. Construction

- Database implementation: the database design is implemented in the form of tables using MySQL DBMS.
- Interface implementation: the interface design is converted into a web application interface using HTML and the Bootstrap framework.
- Web application implementation: The e-learning web application design is converted into a program using the CodeIgniter framework, which uses the PHP programming language. The architecture of this web application uses the MVC (Model-View-Controller) architecture.

4. Transition

The transition phase is the final part of the e-learning web application development cycle. In this phase, the web application that has been created is tested in the user's environment

3.6 Business Process Document Development

Business process management is created using BPMN diagrams. Business processes were obtained from SIT Prima Insani academic documents, observations, and interviews with the parties involved. The business processes obtained are the main business processes. Next, the main business process is broken down into smaller business processes. The business processes obtained were made into BPMN diagrams and simulated through the Bizagi application.

3.7 Implementation of the Blended Learning System

The e-learning web application and business process management documents have been created, so the next step is to implement them at SIT Prima Insani. The e-learning web application will be published via internet media. Teachers will be given an explanation regarding the management of the learning system using the blended learning system. The implementation of this blended learning system will be monitored for 3 months.

4 RESULT

4.1 System Description

Prima Insani Palembang Integrated Islamic School is one of the providers of Islamic education located in the city of Palembang. It was founded by Mrs. Hj. Sheltri Jannah, S.Pd.I., in 2008. Since its inception, this school has provided formal education in the field of Islamic education. As time went by, this school provided formal education at the kindergarten (TK), elementary school (SD), and junior high school (SMP) levels.

Prima Insani Integrated Islamic School occupies 2,000 m² of land located on the side of Sapta Marga Road, Griya Sapta Permai Complex No. 1, Bukit Sangkal Village, Kalidoni District, Palembang. On this land, there is one main building, namely the school building, management office, mosque, and dormitory. Kindergarten and elementary school study hours are held during the day, while middle school study hours are held during the day. The students at the Prima Insani Integrated Islamic School come from communities living around Kalidoni District.

4.2 Business Process

The results of the analysis and direct observation process at SIT Prima Insani revealed seven business processes related to academic processes. The teaching and learning process between students and teachers is part of the academic process. Teachers teach students to apply a blended learning system by combining face-to-face lessons in class and utilizing e-learning web applications. In this section, only two processes will be discussed. Business processes are described using BPMN notation.

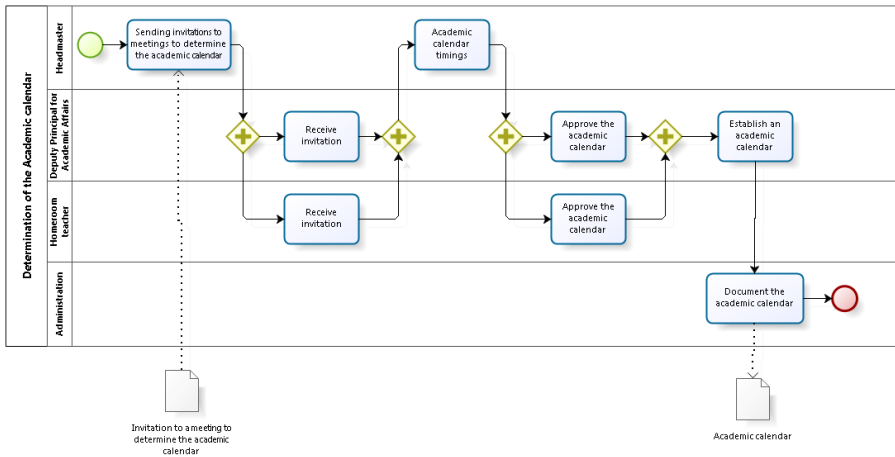


Fig. 3. Business process for preparing for the academic year

The first business process that will be discussed is the academic year preparation process. The process starts with the principal sending an invitation to a meeting to determine the academic calendar to the deputy principal for academic affairs, homeroom teacher, and administration. At this meeting, school activities will be determined during one lesson. The results of this academic meeting will be recorded by the administration department.

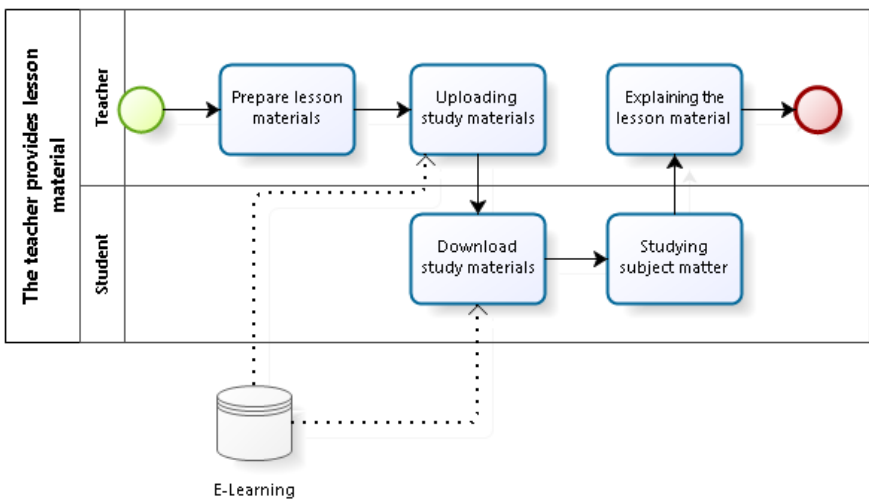


Fig. 4. Teacher Business Process Using Blended Learning to Give Assignments to Students

Figure 4 depicts the business process of teachers teaching their students. Before teaching, the teacher prepares the teaching materials that will be given to the students. Teaching materials in the form of presentation slides, notes, or videos. All teaching materials are uploaded to the e-learning web application. Students registered in these courses can upload teaching materials.

4.3 Use Case Diagram



Fig. 5. Uses Case Diagram for E-Learning Blended Learning

The e-learning use case diagram is shown in Figure 5. Three actors who interact with the blended learning system, namely: the administrator, who is responsible for all data in the system; the teacher in charge of teaching students; and the students who receive lessons from the teacher. Each actor has their duties according to the respective functions depicted.

4.4 Application View

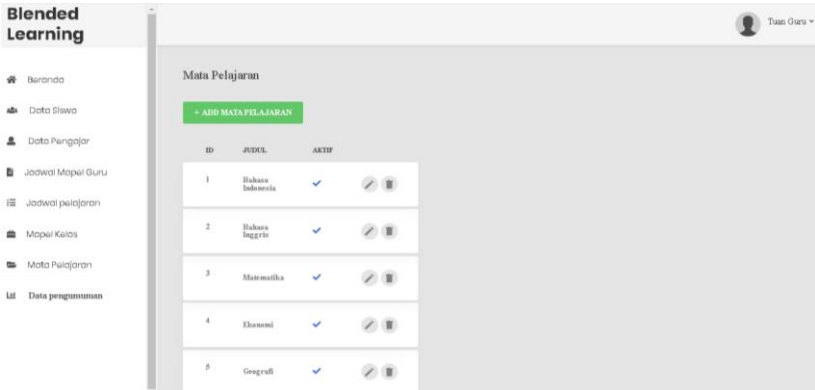


Fig. 6. E-Learning Subject Management

Page One of the e-learning web application page displays is shown in Figure 6, namely subject management. On this page, teachers can add, delete, change, and search for subject data. This page can only be accessed by e-learning web application administrators.

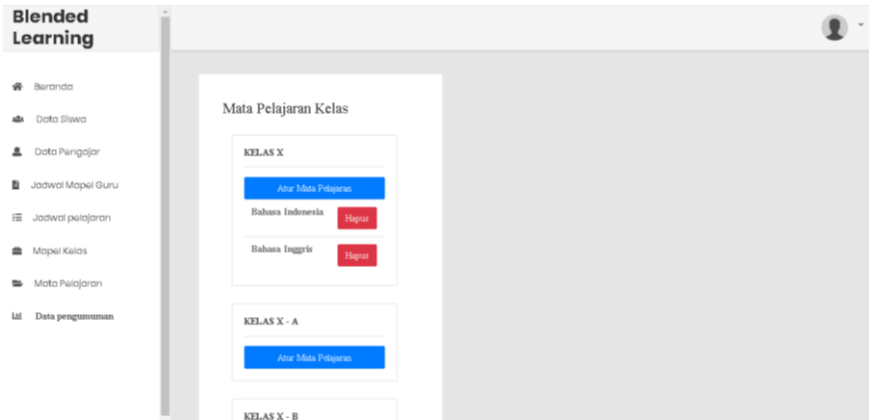


Fig. 7. E-Learning Class Management Page

Figure 7 shows the relationship between subjects and classes. On this page, the web application administrator can organize subjects by class. The concept of setting one class is that there are many subjects taught by the teacher.

5 CONCLUSION

The results of this research can lead to several conclusions:

1. Development of e-learning web applications using the RUP method in a blended learning system to produce high-quality software
2. The use of BPMN in describing business processes using a simple blended learning system so that it is easy for users to understand.
3. Collaboration of the RUP and BPMN methods in the blended learning system produces a powerful system that is easy to use by teachers and students at SIT Prima Insani.

6 REKOMENDATION

This research focuses on the blended learning development process at SIT Prima Insani. It is hoped that the research will carry out discussions related to testing the use of the blended learning system among users (teachers and students).

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