Development of Group Discussion Application Based on Multiple Intelligences

Riska Dami Ristanto[1*], Fitria Ekarini[1], Bait Syaiful Rijal[2], Arif Dwinanto[2], Muthia Muthia [2], Kurniawati Kurniawati [3]

[1]*Informatics and Computer Engineering Education, Universitas Negeri Semarang, Semarang, Indonesia*
[2]*Information Technology Education, Universitas Negeri Gorontalo, Gorontalo, Indonesia*
[3]*Information Systems and Technology, Universitas Ivet, Semarang, Indonesia*
[*]*Email: rdristanto@mail.unnes.ac.id*

ABSTRACT
The learning process is oriented towards facilitating active student participation. One viable approach for enhancing their engagement is through the utilization of discussion methodologies. Empirical observations have indicated that educators encounter challenges when it comes to determining the optimal composition of discussion groups. To address this issue, it is imperative to conduct research that aims to design and develop a decision support system specifically tailored to the task of forming discussion groups based on students' multiple intelligences. The research methodology employed in this study involves a research and development framework utilizing the waterfall development model. The decision-making process incorporates a simple additive weighting model for assigning weights. The quality assessment of the developed applications is conducted using the Web-QEM standard. The results of the testing phase substantiate that the group discussion application based on multiple intelligences has successfully met the established quality standards.

Keywords: *Web Application, Decision Support System, Multiple Intelligences, Group Discussion.*

1. INTRODUCTION

The teaching and learning process in the classroom has undergone a paradigm shift from the previous "teaching" to "learning" process [1]. Education in Indonesia has undergone renewal efforts, as seen in the development of learning curricula and processes. Currently, the curriculum being developed is the independent learning curriculum, which focuses on developing students' competencies. To achieve the curriculum's goals, innovations have been introduced in the learning process, transitioning from a subject-centered curriculum to a child-centered approach that emphasizes student involvement through student active learning methods [1]. In order to meet the demands of these innovations, educators employ multiple strategies to ensure that the learning process effectively and creatively engages students in an enjoyable manner.

Increasing student engagement in the teaching and learning activities is one of the factors for achieving educational goals [2]. Students' learning outcomes can improve in proportion to their level of engagement in the teaching and learning activities [2]. One way to enhance active student participation in the teaching and learning process is through the use of discussion methods. Discussion methods are one variation among many in the learning process [3]. Discussions are considered superior to lecture methods, especially when the audience is homogenous and the learning objectives are the same [4]. One particular discussion method that can be developed is the Buzz Group model, where small groups consisting of 3 to 6 members are formed [5].

Based on field observations conducted at a vocational high school in Yogyakarta City, the distribution of discussion groups is not optimal. This is due to the tendency of students to form groups based solely on their playmates. There hasn't been an effort to involve multiple intelligences and consider intelligence distribution. A student's talents and skills in the learning process to accomplish a task represent the essence of multiple intelligences. A student's intelligence is not solely

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determined by high academic achievements, but by the quality of learning using different learning styles [6]. Based on the observations, it was found that students' awareness of their own intelligence domains is still lacking [7].

In Indonesia, there are still few educational practitioners who incorporate multiple intelligence assessment into the discussion methods [8]. Considering multiple intelligences can create a discussion model that combines various types of intelligence within one group. Based on this issue, this research aims to develop a decision support system application for group discussion formation [9]. The application involves multiple intelligences to detect students' intelligence and provide recommendations for group discussion formation [10].

2. RESEARCH METHODS

The research method used in this study is Research and Development, with an application development model using the waterfall model. Rosa and Shalahudin (2014) described the stages of the waterfall development model, which include analysis, design, coding, and testing. The selection of the waterfall model is based on its systematic nature, which involves sequential processes in application development [11]. The schematic diagram of the waterfall model can be seen in Figure 1.

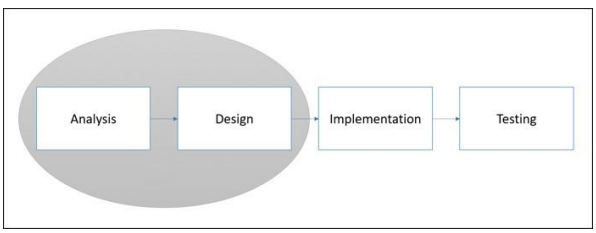

Figure 1. Development Scheme using the Waterfall Model.

The testing conducted in this research is divided into two parts. Firstly, testing in terms of efficiency and reliability with the research subject being the group discussion application. Secondly, functionality testing with the research subject being both the group discussion application and expert respondents.

2.1. Research Procedure

The development of the application follows a procedure consisting of analysis, design, coding, and testing. The analysis is conducted through field observations at a vocational high school in Yogyakarta City. The observation process involves observing learning activities inside the classroom [12]. The results of the needs analysis serve as the specification data for the application to be developed. Next is the design phase, which includes UML design, database design, and interface design. The outcomes of the design phase are blueprints ready for implementation or coding [13]. The Implementation phase involves coding the design results into an application. The developed application is web-based, built using PHP programming language with a MYSQL database. After the coding process is completed, the application undergoes testing. The testing is conducted using the Web-QEM quality standard, which evaluates the application's functionality, reliability, and efficiency [14]. Data collection during the testing phase is done through questionnaires and observations. Questionnaires are used to assess the functionality aspect involving expert respondents [15]. Observations are carried out to evaluate the reliability and efficiency aspects. The data obtained from the testing phase are then analyzed following the Web-QEM analysis standard [16].

2.2. Data Analysis Technique

Stress testing using tools such as WAPT 8.1 and *LoadImpact* is conducted to test the reliability aspect of the developed application. The efficiency aspect is analyzed using tools like *GTMetrix* and *Yslow*. *GTMetrix* is used to measure the load time of each page in the application, and if the load time is less than 10 seconds, the application is considered good (Nielsen, 2010). For the analysis of the functionality aspect based on ISO 9126 (ISO, 2002), a value close to 1 (0 <= x <= 1) indicates good functionality. The formula to calculate the functionality aspect is as follows in equation (1).

$$X = 1 - \frac{Function\ that\ are\ not\ working}{Total\ number\ of\ functions} \quad (1)$$

3. RESULTS AND DISCUSSION

Research and development have been conducted at SMK Negeri 1 Bantul. In this study, a decision support application for group discussion allocation has been developed [17]. The application is developed in the form of a website that can be accessed by teachers and students using any device, anywhere, and anytime. This development and research utilize the Research and Development (R&D) method, with application development following the waterfall model. The steps that have been taken are as follows:

3.1. Analysis

The findings from the analysis phase of the research have revealed that the application encompasses three distinct user roles, namely teachers, students, and administrators. The essential functionalities of the application encompass: (1) User registration, (2) User data management, (3) Assessment or survey of students'

multiple intelligences, and (4) Group formation feature that employs the calculated results from the student assessments.

3.2. Design

The outcomes of the research conducted in the design phase have led to the formulation of the system modeling design of the application using UML. The functional design is represented through the use case diagram, while the workflow is visualized using an activity diagram. The activity diagrams presented in Figures 2 and 3 provide a depiction of the group allocation process within the developed application.

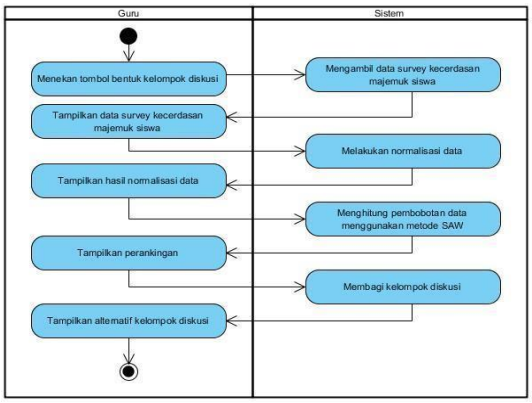

Figure 2. Activity Diagram for Group Formation Process.

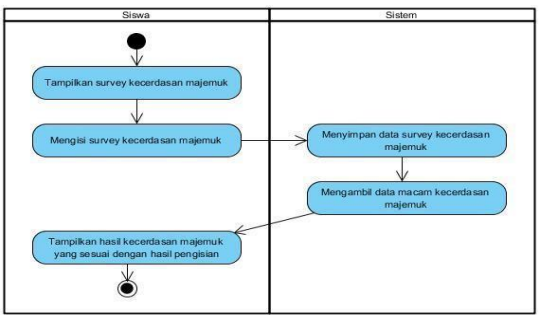

Figure 3. Activity Diagram for Student Testing Process.

The database consists of several tables, including class table, question table, matrix table, student table, user table, and teacher table. The detailed database design of the developed application can be seen in Figure 4.

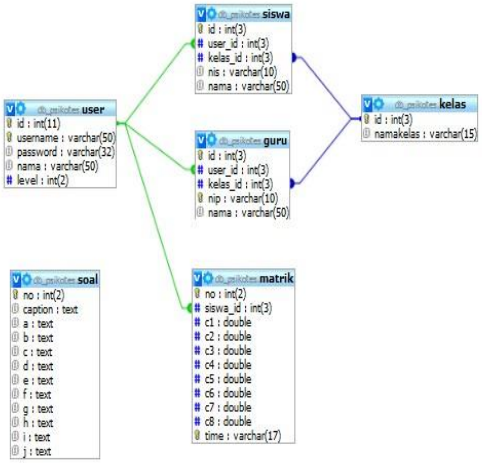

Figure 4. Database Design View of the Application.

The interface design layout consists of page designs within the application, such as the admin page, homepage, teacher page, and student page. The design layout of the core page for the group allocation process in the application can be seen in Figures 5 and 6. After completing the interface design layout, the next step is implementation, which involves the coding process of transforming the design into the developed application.

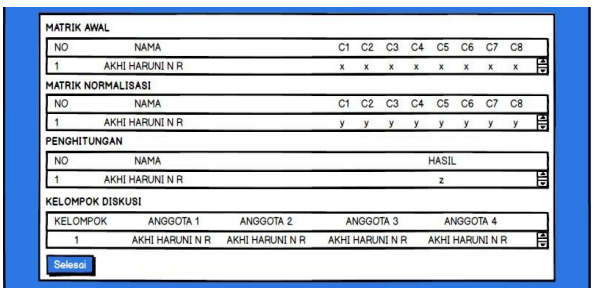

Figure 5. Teacher Dashboard Interface Design.

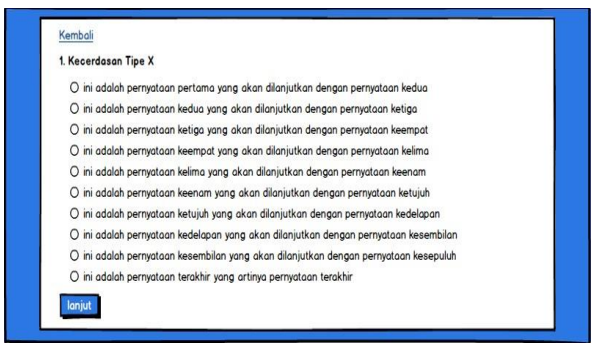

Figure 6. Student Dashboard Interface Design.

3.3. Development

The implementation phase is characterized by the coding process, during which the application is constructed in accordance with the predetermined design specifications. This phase encompasses the coding of the interface, database, and program components. The

database is established using MYSQL, while the interface is implemented utilizing the Bootstrap 4.3 framework and supported by the visual studio code text editor[18,19]. The program itself is developed using the PHP programming language, specifically PHP version 7.3. The final result of the application development can be seen in Figure 7.

Figure 7. Application Homepage Interface.

The testing results of the developed application using Web-QEM standard analysis consisted of functionality, reliability, and efficiency aspects. The functionality aspect was tested and obtained a good rating. The reliability aspect was tested and achieved a reliability level of 98.5% using WAPT 8.1 and 100% using LoadImpact. The efficiency aspect was tested using GTMetrix and obtained a load time of 0.65 seconds, and a score of 87.5% (Grade B) was obtained using Yslow.

4. CONCLUSION

The developed application for group discussions, incorporating the concept of multiple intelligences, has been effectively realized. Through quality analysis conducted in accordance with the Web-QEM standard, the application has been assessed to possess a commendable level of quality. The research findings have uncovered opportunities for future advancements, encompassing aspects such as the dynamic adaptation of the weighting system to cater to the specific needs of each class, the incorporation of a broader array of techniques for quality testing, the evolution of the application into an integrated framework harmonizing with other instructional methods or models, and the integration of supplementary enhancements, including a randomized pre-test, to enhance its naturalness and interactivity.

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