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MULTIPLE INTELLIGENCE APPLICATION DESIGN WITH SIMPLE ADDITIVE WEIGHTING FOR DIFFERENTIATION LEARNING

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Abstract

Information and communication technology (ICT) plays a pivotal role in the educational sector, serving not only as a medium for information dissemination and communication but also as a crucial tool in decision-making processes. Traditionally, the utilization of ICT in the realm of career studies and multiple intelligences has predominantly centred on academic career guidance, career development, and the exploration of individual interests and talents. This research aims to innovate by designing an application that serves as a teaching strategy recommendation system. This system employs the Simple Additive Weighting (SAW) method, grounded in the theory of multiple intelligences, to aid teachers in executing differentiated learning strategies effectively. The development process for this application follows the Rapid Application Development (RAD) methodology, ensuring a swift and adaptive creation cycle. The indicators for multiple intelligences are derived from the Multiple Intelligence Profiling III framework. This meticulously developed application assists teachers in identifying student groups based on their distinct multiple intelligences profiles. Consequently, it serves as a valuable reference for teachers to implement tailored learning strategies that cater to the diverse intellectual strengths of their students. By leveraging this application, educators can enhance their teaching methods, fostering a more personalized and effective learning environment that acknowledges and nurtures the varied intelligences of each student.

Keywords: Differentiated learning, Multiple intelligence profiling, Rapid application development, Simple additive weighting.

1. Introduction

Information and Communication Technology (ICT) plays a crucial role in modern education. Teachers equipped with ICT skills who integrate these technologies into their teaching practices can significantly enhance efficiency and job satisfaction [1]. The integration of ICT provides teachers with advanced recommendation systems [2], which create student profiles for use in student-centred or differentiated learning approaches [3]. Adapting teaching methods to the diverse characteristics of individual students is essential for effectively addressing the challenges posed by classroom diversity [4-6]. Teachers must possess pedagogical competence that embraces and understands these differences, enabling students to realize their full potential [6, 7]. From the learners' perspective, this diversity encompasses student readiness, interests, and learning profiles, while differentiated learning, from the teachers' perspective, involves variations in content, process, product, and learning environment [8, 9].

Multiple intelligences are one characteristic that can be utilized as a parameter in differentiated learning [10]. Each individual has a preferred learning style and teaching strategy [11]. Differentiated learning approaches that incorporate multiple intelligences have been shown to improve performance [12] and enhance students' achievements and attitudes towards subjects like science [13]. In practice, ICT serves not only as a medium for information and communication but also as a reference system supporting decision-making [14, 15], counselling [16, 17], career path recommendations [18], and identifying interests and talents based on multiple intelligences [19].

To date, the application of ICT in career studies and multiple intelligences has primarily focused on academic and career guidance [20], as well as the exploration of interests and talents. However, the use of ICT as a recommendation system for differentiated teaching strategies based on multiple intelligences remains limited. This research aims to design an application that functions as a teaching strategy recommendation system using the Simple Additive Weighting (SAW) method, grounded in multiple intelligences, as a tool for teachers to implement differentiated learning [21]. The developed application is expected to assist teachers in forming flexible student groups [22] and planning teaching strategies tailored to students' multiple intelligences.

2. Methods

The system development method used in this application is Rapid Application Development (RAD), which focuses on rapid prototyping and user feedback over extensive planning [23]. RAD enhances productivity by involving users intensively, leading to a better understanding of technology products [24, 25]. Figure 1 illustrates the RAD process stages: needs identification, system requirements analysis, and implementation. The requirements planning stage includes identifying software needs and intelligence indicators based on multiple intelligences, with data sourced from the Multiple Intelligence Profiling Questionnaire III (MIP III) [26].

The implementation phase translates these requirements into system design, utilizing a web-based client-server architecture accessible via a browser using TCP/IP [27, 28]. The intelligence categories are calculated using the Simple

Additive Weighting (SAW) method, which normalizes performance ratings for each intelligence type (A) based on questionnaire criteria (C). The normalized matrix R is derived using the equation (1), and the final preference value is calculated with equation (2) to determine the best alternative intelligence indicator [29, 30]. The development phase involves prototyping in PHP with Laravel and MySQL, iterative testing, and refinement based on user feedback [31].

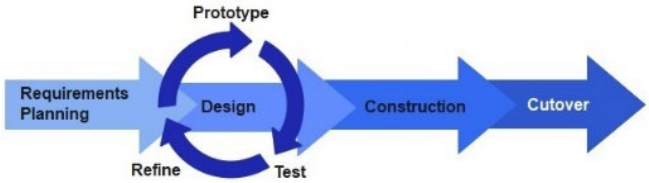


Fig. 1. RAD method.

$$r_{ij} = \frac{x_{ij}}{Max\ x_{ij}} \tag{1}$$

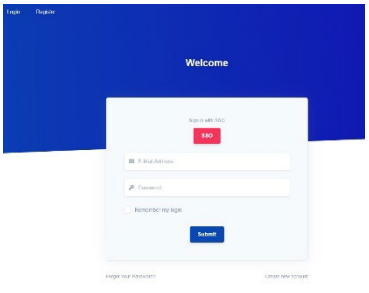
$$V_i = \sum_{j=1}^{n} w_j\, r_{ij} \tag{2}$$

3. Results and Discussion

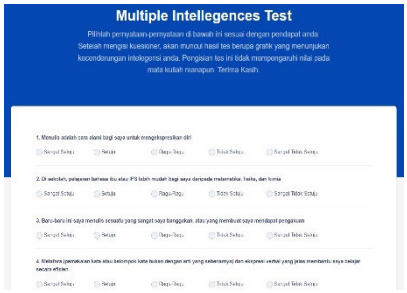
The aim of developing this system is to determine the type of student intelligence based on the Multiple Intelligence theory. Students can find out their intelligence tendencies and teachers can use this data to implement teaching and learning strategies that are appropriate to each student's intelligence so that they can actualize the various potentials they have.

The system developed is web-based using web responsive design (WRD) so that it can be used by users online using browsers for various devices [32, 33]. Students open the application using a browser then log in to the application to fill in their personal data. After filling in their personal data, students fill in the questionnaire as shown in (Fig. 2 point C). Next, the application will perform calculations based on the results of the answers using the SAW method and save the calculation results in the database. After filling out the questionnaire, students can find out the results of the calculation in the form of a radar graph that depicts which intelligence is most dominant (Fig. 2 point D). Radar charts were chosen to facilitate data interpretation so that it is easy to understand [34]. At the bottom of the graph there is an explanation for each type of intelligence.

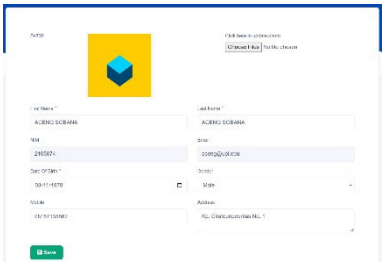
On the admin page there are four main functions, including managing criteria, viewing the intelligence potential of each student, viewing recommended learning strategies and managing groups. The potential results test page functions to view details and results of students' intelligence potential tests which are displayed in the form of a radar graph as well as scores for each intelligence criterion (Fig. 3).



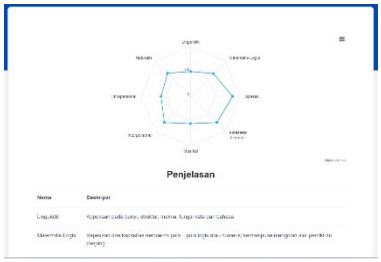
(a) Login page



(b) Questionnaire form



(c) Learner profile



(d) Learner intelligence profile

Fig. 2. Student page.

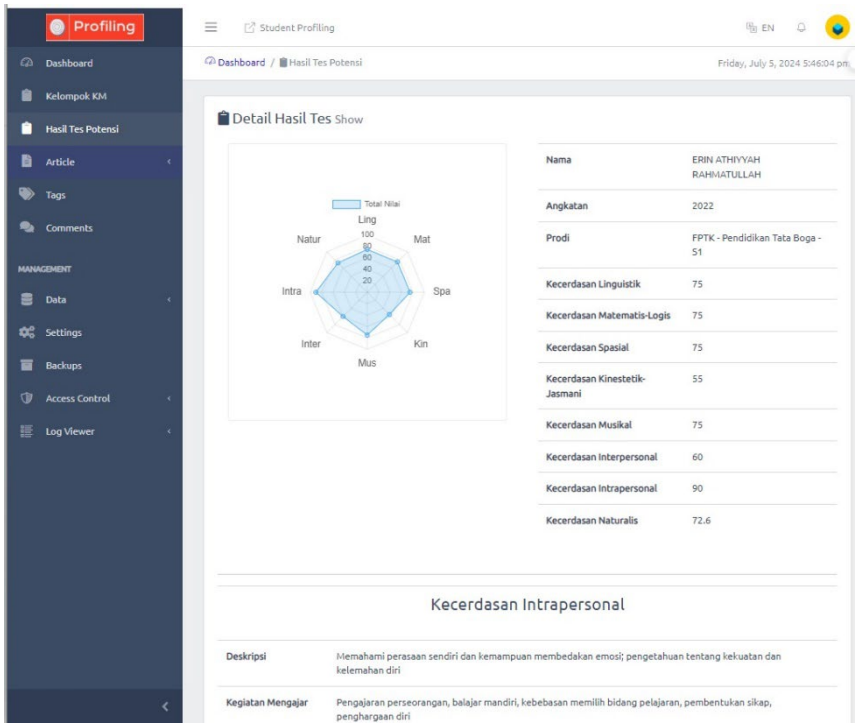
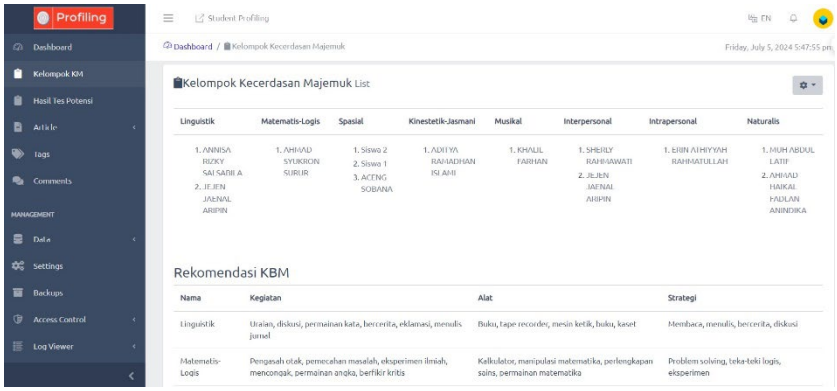
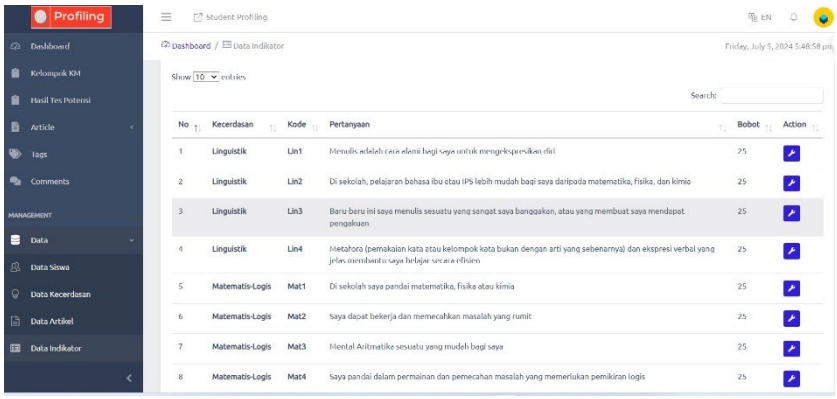


Fig. 3. Intelligence test results and strategy recommendations.

On the test results page, a search form is also provided along with filters in the class and study program columns to make it easier to display the list according to the criteria. At the bottom of the test results page, recommendations for learning strategies based on dominant intelligence are also displayed. Figure 4 point A shows a page for grouping students based on intelligence categories. Based on the intelligence group information, teachers can plan a learning process that is tailored to the needs of each group, for example different material content for each group or giving assignments tailored to the intelligence group [35, 36]. The criteria management page (Fig. 4 point B) functions to adjust the questionnaire so that the questions can be understood by students. To make adjustments to the questionnaire, the admin selects the edit button then makes adjustments.



(a) Grouping



(b) Criteria management

Fig. 4. Intelligence group and manage indicators.

4. Conclusion

Research in designing multiple intelligence applications holds significant value in the ICT field, offering crucial tools for teachers to accurately identify and leverage students' diverse intelligences for differentiated learning. This application empowers students to discover their unique intelligence profiles and provides teachers with a robust platform to manage and analyse this intelligence data effectively. By forming

student groups based on these profiles, teachers can tailor their instructional strategies to meet the specific needs and strengths of each group. Consequently, this approach not only enhances the learning experience for students but also promotes a more efficient and personalized educational environment. The integration of such technology in classrooms represents a transformative step towards fostering individual student growth and optimizing teaching methodologies.

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