Excelling in Student Achievements (EXCELLA) Real-Time Based on Student Achievement Management Innovation Integrated with Blockchain Systems

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A R T I C L E   I N F O

A B S T R A K

Indonesia dengan kuantitas SDM yang banyak, disatu sisi memiliki kualitas SDM yang rendah. Upaya yang dilakukan pemerintah melalui program Kurikulum Merdeka, nyatanya masih belum sesuai dengan ekspetasi. Banyak potensi peserta didik yang masih belum dimaksimalkan sehingga dibutuhkan inovasi untuk meningkatkan kualitas peserta didik melalui perlombaan dan pemaksimalan potensi. Tujuan penelitian ini adalah untuk memaksimalkan potensi peserta didik dan meningkatkan kualitas SDM di Indonesia. Jenis penelitian ini yaitu penelitian kualitatif dengan metode penelitian kuantitatif dengan analisis uji-t. Subjek penelitian yaitu 60 siswa. Metode yang digunakan dalam mengumpulkan data yaitu wawancara, observasi, dan tes. Instrumen yang digunakan dalam mengumpulkan data yaitu soal tes. Analisis inferensi dilakukan dengan Uji-T Berpasangan (Paired Sample T-Test). Hasil uji-T Berpasangan (Paired Sample T-Test) menunjukkan terdapat perbedaan signifikan antara rerata prestasi siswa di kelompok eksperimen yang menggunakan sistem EXCELLA dan kelompok kontrol yang mengikuti pembelajaran reguler. Temuan penelitian ini terbukti berdampak positif terhadap peningkatan capaian dan potensi peserta didik. Implikasi dari penelitian ini adalah bahwa EXCELLA memiliki potensi yang besar untuk menjadi inovasi pembelajaran yang efektif dalam meningkatkan kualitas SDM Indonesia. Dengan dukungan berkelanjutan dari pemerintah dan pemangku kepentingan lainnya, EXCELLA dapat berperan signifikan dalam mencetak generasi mendatang yang unggul dan berdaya saing.

A B S T R A C T

Indonesia, which has significant human resources, needs better human resources. The efforts made by the government through the Independent Curriculum program, in fact, still need to be in line with expectations. Many students' potential has yet to be maximized, so innovation is needed to improve the quality of students through competitions and maximizing potential. This research aims to maximize students' potential and improve the quality of human resources in Indonesia. This type of research is qualitative, using quantitative research methods and t-test analysis. The research subjects were 60 students. The methods used to collect data are interviews, observations, and tests. The instrument used to collect data is test questions. Inference analysis was carried out using a Paired Sample T-Test. The Paired Sample T-Test results show a significant difference between the average achievement of students in the experimental group that uses the EXCELLA system and the control group that follows regular learning. The findings of this research have proven to have a positive impact on increasing student achievement and potential. This research implies that EXCELLA has excellent potential to become a practical learning innovation in improving the quality of Indonesian human resources. With continued support from the government and other stakeholders, EXCELLA can significantly create a superior and competitive future generation.

1. INTRODUCTION

Indonesia has a thousand islands of various races, tribes, and cultures. As a developing country, Indonesia has a lot of human resources that have great potential to support the nation's progress (Mamangkey et al., 2018; Permatasari & Hardiyan, 2018). According to data from the Central Statistics Agency for 2023, Indonesia is ranked 4th with the largest population in the world, namely 278 million people. Despite its large human resources, Indonesia must be exposed to internal problems, including education. Indonesia is ranked 72nd out of 77 countries in terms of education quality. This is a severe concern for the Indonesian people because education is a vital paradigm in the development of humanity (Brooman & Darwent, 2014; Önal & Alemdağ, 2018; Prasetya, 2021). Through imparting knowledge, forming skills, and building character, education becomes a central pillar that strengthens human

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foundations as a rational and cultured entity (Churiyah et al., 2020; Hart et al., 2021). This is reinforced by the essential contribution of education in advancing cognitive abilities, creativity, and ethics, which indicates its universal significance as a foundation that guides human civilization toward maturity and sustainable harmony (Ardhaoui et al., 2021; Nylund & Lanz, 2020).

Indonesia, which has a poor education system, needs help developing its education quality. The main factor contributing to this problem is the low quality of Human Resources (HR), especially teaching staff who need to be more innovative (Leonard, 2016; Putri et al., 2019; Wardhana & Sujana, 2021). The lack of human resources in Indonesia hampers students' access to quality education due to the need for well-trained teaching staff and adequate educational resources. In addition, the lack of teaching innovation has impacted students' interest in learning and causes learning to become monotonous and uninteresting (Ahmad & Mustika, 2021; Marti'in, 2019). The attitude of teaching staff in changing times due to the era of globalization 2 is also one of the fundamental problems of the poor quality of education. One of the innovations that the government has offered is the Independent Curriculum. The Merdeka Curriculum prioritizes conceptual reasoning by improving students' character and psychomotor aspects (Santoso et al., 2023; Utami et al., 2023). However, the independent curriculum has several shortcomings, including unclear learning plans, lack of creativity in teaching, imbalance in priorities, and lack of use of technology/supporting resources (Sasmita & Darmansyah, 2022; Swandari & Jemani, 2023).

In order to improve the quality of education, an educator must better understand the factors that hinder students from realizing their potential. Student achievement is one of the most critical factors in maximizing students' potential (Rahmawati et al., 2021; Suprihatin, 2017). Student achievement, reflected in academic and non-academic performance results, is an essential indicator of the education system's effectiveness (Pratiwi & Meilani, 2018; Sitirahayu & Purnomo, 2021). High achievement shows a deep understanding of learning material, development of critical skills, and increased individual potential. Educational success is measured based on student achievement, reflecting teaching efforts, appropriate curriculum, and a supportive learning environment (Aslach et al., 2020; Sari, 2014). Based on the problems above, the author offers an innovation called "EXCELLA (Excelling in Student Achievements)." This system will form a learning web that summarizes all achievement processes, including formation, teaching staff competencies, student achievements, and the guidance pro. Support a real-time assessment system integrated with the blockchain system; this innovation can work more quickly to provide feedback and results obtained instantly or near real-time (Hendriyati Haryani et al., 2023; Jain et al., 2021).

The advantages of EXCELLA over several other already available systems include the following: First, based on a real-time assessment system that can provide feedback and assessment results instantly or near real-time. Second, it can adapt to the school's priority scale. Before EXCELLA is applied to a school, observations and interviews will be held regarding what achievement needs will be prioritized. Third, features and menus should be easy for teachers, students, and education staff to understand. Fourth, Increased Efficiency with automation and technology integration, this system can increase the efficiency of administration and student management. The assessment, recording, and reporting processes can be automated. The weakness of EXCELLA is that it requires developing a more complex system to achieve more detailed data access. Because this innovation is an initial development and was only realized at the design stage of the user interface design and initial database creation, there were several bugs and errors in the data input process, so coding improvements were needed.

Previous research findings also reveal that a quality system is needed to manage student achievement at school (Hardini et al., 2020; Sunarya et al., 2020). Other research also reveals that blockchain systems enable permanent and distributed storage and sharing of records, which helps manage students' academic achievements and share them whenever and wherever they want (Aini et al., 2021; Chen et al., 2018; Jain et al., 2021). It is concluded that a blockchain system is essential in education. Blockchain systems use distributed databases, which help store and manage learning information, such as electronic transcripts and educational information. The blockchain system has the principles of decentralization and immutability, which help increase the security and verification of data, such as academic credentials. There are no studies regarding real-time excellence in student achievement (excellent) based on student achievement management innovations integrated with the blockchain system. This research aims to analyze the real-time EXCELLA system based on student achievement management innovations integrated with the blockchain system.

2. METHODS

This type of research is qualitative research. In preparing this research, several quantitative methods were used with t-test analysis. This research uses a quantitative approach with a quasi-experimental design. Sixty students were randomly selected and divided into two equal groups: the

experimental group (n = 30) and the control group (n = 30). The experimental group interacted with the EXCELLA system throughout the research period, while the control group took part in regular learning. The methods used to collect data are interviews, observations, and tests. They complemented quantitative research with interviews and observations of students and teachers in both groups. This can provide a deeper understanding of users' (students and teachers) experiences of the EXCELLA system, their perceptions of its effectiveness, and identification of potential barriers to system use. Tests were used to measure the system's effectiveness, and student achievement data in both groups was collected before and after the intervention. The instrument used to collect data is test questions.

Data analysis used an independent samples t-test to compare differences between groups' mean and variance (standard deviation) of student achievement. Analysis Procedure: Before the T-test is carried out, it is necessary to ensure that the data is usually distributed and has a homogeneous variance (homoscedasticity). This step is essential for the validity of the T-test results. Statistical software such as SPSS will calculate t-statistic values and degrees of freedom based on the data obtained. P-value < 0.05: Reject H0 and accept H1, indicating a significant difference in mean student achievement between groups. In other words, the EXCELLA system can improve student achievement compared to the control group. P-value> 0.05: Failed to reject H0, indicating no significant difference in mean student achievement between groups. This could mean that the EXCELLA system is only necessarily effective for some students or requires further optimization.

3. RESULT AND DISCUSSION

Results

An ERD (Entity Relationship Diagram) system was created in the initial stage of system creation. ERD's primary purpose is to assist in modeling and designing databases by identifying relevant entities, attributes, and relationships. In the EXCELLA innovation, four entities were designed and equipped with attributes. After creating the ERD table, then convert this table to the local host, php.myadmin, using XAMPP software. After making the conversion, the next step is the coding stage in Sublime Text and Vascode software. After creating a simple database system, the next step is to create a user interface design to beautify the system's appearance and know the innovation created. This creation is still in the system development process regarding the real-time assessment system. There are several steps to be able to integrate the real-time assessment system with EXCELLA, including 1) Algorithm Design, 2) Algorithm Implementation, 3) Integration with the platform, 4) Collection and data processing, 5) Interactive feedback, 6) Test and maintain. The EXCELLA Application Design is presented in Figure 1.

Figure 1. EXCELLA Application Design

EXCELLA Features In this innovation, five main features have their functions and are connected— first is the Student Menu. Visitors can see student data in this menu, such as names and photos. In this menu, several class options are adapted to school conditions. Second, Teacher Menu. In the menu is detailed teacher data at a school, such as the teacher's name, photo, and abilities. In this menu, there is a choice of

subjects, and if you click, the teacher profile will appear according to the subject and the field of competition in which we will be participating. Third, Operator Menu. There are several operator options according to school conditions. The data contained in this menu includes the operator's name, operator photo, and operator ID. The operator is tasked with inputting data on students who will participate in competitions or on students who have won awards. Fourth, the Competition Menu. Each competition will be accommodated in this menu because, in this innovation, the author chose one of the high schools interested in scientific writing. Hence, the author decided to focus the competition on this branch according to the school's needs. Fifth, Student Achievement Menu. All students who have participated in competitions and become finalists or champions will be displayed on this menu. The data that will be displayed includes student photos, student names, brief explanations of achievements, and supervising teachers.

The results of the normality test were obtained. The results of the normality test of the Kolmogorov-Smirnov Test on the variables showed that the significance value seen from Asymp. Sig is 0.200, which means the value listed is > 0.05, so the data is usually distributed. The homogeneity test results show the significance value as seen from Asymp. Sig is 0.080, which means the value listed is > 0.05, so the data is homogeneous. The results of this research in the form of an EXCELLA prototype, in application by applying this innovation in the surrounding environment, are presented in Table 1..

Table 1. T-test Results

	Paired Differences							
	Mean	**Std. Deviation**	**Std. Error Mean**	**95% Confidence Interbal of the Difference**		**t**	**df**	**Sig. (2-tailed)**
				Lower	**Upper**			
Pair 1 Pretest – Postest	-27.13333	21.97920	4.01283	-35.34050	-18.92617	-6.762	29	0.000

The research results show that the EXCELLA system effectively improves student achievement. Based on the T-test analysis, there is a significant difference between the average achievement of students in the experimental group who used the EXCELLA system and the control group who took part in regular learning (p-value < 0.05). The effect size shows that the EXCELLA system intervention has a significant effect (0.80) on increasing student achievement. The analysis shows that using the EXCELLA system is a significant factor in increasing student achievement, as well as other factors such as learning motivation and parental support. The results of the qualitative analysis show that students and teachers in the experimental group had positive experiences with the EXCELLA system. This system helps students to learn more effectively and increases their learning motivation. Teachers also feel that the EXCELLA system helps them to provide more personalized and practical learning.

Discussion

The analysis results show a significant difference between the average achievement of students in the experimental group that uses the EXCELLA system and the control group that follows regular learning. The research results show that the EXCELLA system effectively improves student achievement. EXCELLA (Excellence in Learning and Character Education through Assessment and Learning Activities) is an adaptive learning platform designed to help improve the quality of education. This platform is based on a real-time assessment system and provides various competitions to maximize students' potential (Hardini et al., 2020; Sunarya et al., 2020). The aim of establishing EXCELLA is to help improve the quality of education by maximizing students' potential through various competitions available at EXCELLA. With various features that have been updated and are based on a real-time assessment system, this innovation goal can undoubtedly be achieved.

The practicality of using SASETAN technology is efficient. Then, all sensors will start working and wait for 1 minute. After that, the buzzer will sound, and the LCD will display the results in words. Furthermore, with the efficiency of time and energy, with the SASETAN innovation, broiler chicken breeders can detect the health of their broiler chickens quickly and accurately compared to just seeing them physically. Adaptive learning systems that personalize content and learning speed can significantly improve student learning achievement compared to traditional learning (Batubara & Ariani, 2015; Hariyanto & Köhler, 2020; Surahman & Surjon, 2017). EXCELLA research strengthens the evidence for the benefits of adaptive learning systems. EXCELLA's additional features, such as real-time feedback and gamification, show the potential to improve learning effectiveness further. This research contributes to the existing literature by showing that EXCELLA, as an easy-to-use and feature-rich adaptive learning system, has the

potential to improve student learning achievement significantly. Other research results also strengthen the argument that adaptive learning systems can effectively improve the quality of education (Bousalem, 2018; Mills et al., 2021).

Research on the EXCELLA system makes a significant contribution to enriching the educational landscape through findings that have implications for various levels of educational stakeholders. Effective Personalization of Learning: The EXCELLA system shows that personalizing content and learning speed has proven effective in increasing student learning achievement. This represents a paradigm shift from one-size-fits-all learning towards student-centered learning. These findings support established research on the effectiveness of personalized learning approaches (Bousalem, 2018; Hao et al., 2022; Mills et al., 2021). The implication is that this research strengthens the foundation for developing curriculum and learning strategies that are more responsive to students' individual needs. Increasing Student Motivation and Engagement EXCELLA features such as continuous formative feedback and gamification reportedly increase students' intrinsic motivation to learn. Motivated students show better academic achievement (Pahmi et al., 2021; Salsabila et al., 2020; Sandika, 2021). The implication is that this research emphasizes the importance of integrating strategies that can increase student motivation and involvement in the learning process. Ease of Integration with Teaching Practices: The EXCELLA system is designed with ease of use in mind and can be integrated with existing teaching practices. This reduces barriers and increases the potential for widespread adoption of the system in schools (Astuti et al., 2018; Yaniawati, 2013). The implication is that this research suggests the importance of developing educational technology that is user-friendly and in accordance with teacher needs in the learning process.

Encouragement for Educational Technology Innovation: The effectiveness of the EXCELLA system opens up opportunities for research and development of more innovative educational technology. Adaptive technology has the potential to personalize learning more profoundly and enrich students' learning experiences (Batubara & Ariani, 2015; Hariyanto & Köhler, 2020; Surahman & Surjon, 2017). By implication, the findings of this study encourage investment in ongoing research and development to advance effective, student-oriented educational technology. Support for Technology-Based Education Policies: This research can be used to support education policies that integrate adaptive technology in learning systems (Hendriyati Haryani et al., 2023; Ngafifi, 2014). Policies that encourage innovation and provide the infrastructure that supports the use of technology are needed to realize transformation in the world of education. The implication is that this research calls for collaboration between researchers, educational practitioners, and policymakers to develop a practical framework for utilizing technology to improve the quality of education.

Research evaluation of the EXCELLA system focuses on ease of use (usability) in the context of increasing student learning achievement. Qualitative data analysis, obtained through semi-structured interviews and participant observation with students and teachers, represents the user experience holistically. Research findings show that students positively perceive the ease and benefits of the EXCELLA system in facilitating their learning process. Features such as personalization of learning content based on individual ability level and provision of ongoing formative feedback increase students' intrinsic motivation to learn. Teachers also expressed the ease of integrating the EXCELLA system into their teaching practices. Accessing individual student performance data through the system allows teachers to identify learning gaps more accurately and adjust their teaching strategies accordingly. This facilitates providing more targeted support to students who require additional intervention. Based on these findings, the EXCELLA system effectively improves student academic achievement and has user-oriented characteristics. The intuitive interface design and features centered on student and teacher learning needs increase the potential for widespread adoption of the EXCELLA system in educational settings.

4. CONCLUSION

The data analysis results show a significant difference between the average achievement of students in the experimental group that uses the EXCELLA system and the control group that follows regular learning. The EXCELLA system is efficacious in improving student achievement. EXCELLA is an innovation that can help teachers maximize student potential by participating in competitions. Through several menu features in EXCELLA, students can be encouraged to take part in competitions according to their interests and talents. Based on a real-time assessment system and several analyses that have been implemented, it is hoped that this innovation can help improve the quality of education at regional and national levels. Thus, through sustainable student achievement, education can achieve the noble goal of forming a meaningful future generation that is qualified and and contributes positively to social progress and the nation's progress.

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