EVALUATION OF THE UTILIZATION OF LMS (LEARNING MANAGEMENT SYSTEM) IN SCIENCE COURSES IN THE POST-COVID-19 PANDEMIC ERA WITH THE SAMR (SUBSTITUTION, AUGMENTATION, MODIFICATION, AND REDEFINITION) MODEL AT SMP NASIONAL PLUS BPK PENABUR BOGOR

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Abstract. *In today's digital era, the ability to use technology effectively in learning is a very important skill. aims to see how LMS is applied in various stages of the SAMR (Substitution, Augmentation, Modification, and Redefinition) model to evaluate the extent to which this technology can change the way science learning is carried out and improve student learning outcomes. Therefore, the evaluation of the use of LMS is not only seen in terms of the effectiveness of science learning, but also in terms of the development of students' digital skills that will be useful for their lives in the future. This study began with direct observation of the use of the Learning Management System (LMS) in science subjects at SMP Nasional Plus BPK Penabur Bogor. This observation aims to directly observe how LMS is used by teachers and students in teaching and learning activities after the COVID- 19 pandemic. This study uses a qualitative method with a case study type of research which aims to provide an in-depth overview of the use of LMS (Learning Management System) in science subjects at SMP Nasional Plus BPK Penabur Bogor after the COVID-19 pandemic. The results of the study show that the Substitution stage contributes to the accessibility and efficiency of the learning process. However, this stage has not shown any transformation in learning methods. Therefore, Substitution is an important first step in the integration of educational technology. stage Augmentation , Teachers do not only deliver materials in one direction, but also provide direct feedback through the platform. The Modification stage shows a real change in the way learning is designed and implemented. LMS is no longer just a tool , but as the main platform for project-based learning. Teachers design collaborative activities that allow students to work together online. Students create multimedia presentations, experiment videos, and group discussions through the LMS forum. stage Redefinition , LMS is used to create learning experiences that were previously impossible without technology.*

Keywords: *LMS (Learning Management System), SAMR model (Substitution, Augmentation, Modification, and Redefinition), Science Learning.*

1. INTRODUCTION

In science subjects, these competencies are very important, considering the challenges faced by students in solving scientific problems and understanding natural phenomena. Therefore, LMS evaluation should include an analysis of the extent to which the technology supports the development of these skills through the features available in the LMS. LMS is a software application or online technology that is used to implement, design, and evaluate procedures in teaching and learning activities (KBM) (Arifin et al., 2023). LMS is a system that contains various features for assessment, monitoring student progress, and collaboration between educators and students and parents of students (Hunt, 2010, from Arifin et al., 2023)

Evaluation also needs to look at the role of teachers in utilizing LMS. Although technology can provide many benefits, the success of its use is highly dependent on the

skills and understanding of teachers in integrating LMS into the learning process. Teachers who are not familiar with technology may find it difficult to utilize LMS optimally. The Bogor Regency Education Office stated that SMP Nasional Plus BPK PENABUR Bogor is the best national plus standard educational institution in Bogor Regency that uses LMS in the Teaching and Learning Activities (KBM) process, especially in Natural Sciences (IPA) subjects. This is evidenced by the existence of several LMS user students who won the Science Olympiad because LMS makes it easier for students to learn. With LMS, science teachers can deliver more flexible and interactive materials using various methods.

However, after the pandemic ended, many questions arose regarding the effectiveness of using LMS. The integration of technology that is very dominant in the era of the COVID-19 pandemic, now presents new challenges to the institution. Although SMP Nasional Plus BPK PENABUR Bogor uses LMS in the pandemic era which has proven to help the teaching and learning process, there are also several obstacles and shortcomings that have emerged over time. One of these obstacles is students' dependence on technology. In addition, even though LMS provides advanced features, not all teachers utilize the full potential contained in these features. Therefore, there needs to be an in-depth evaluation, especially in the context of science learning. Evaluation of LMS usage is very important because it is used to assess the extent to which the technology can improve the quality of learning and achieve educational goals. SAMR (Substitution, Augmentation, Modification, and Redefinition) is one of the models that can evaluate the use of LMS. The SAMR model was developed by Dr. Ruben Puentedura to describe how technology has a more significant impact on the teaching and learning process when applied in the field of education (Puentedura, 2010).

Substitution level in SAMR, can measure the extent to which technology is used to replace traditional tools without changing the basic function of learning. In this science lesson, LMS is used to deliver material that was previously provided through conventional learning via textbooks/whiteboards. At the augmentation level , the use of technology brings improvements in learning, such as the use of interactive features in the LMS to discuss in forums. Both levels of this model provide efficiency and ease in using the LMS, but have not completely changed the way of learning in depth. This is different from the modification level, where technology allows for profound changes when the teaching and learning process takes place. LMS can create a more interesting and relevant learning experience, for example, collaboration between students or the use of multimedia that facilitates the understanding of more complex science concepts. The use of an LMS at this level can have a significant impact on student motivation and engagement in learning. Finally, at the redefinition level, technology is used to create completely new and innovative learning experiences that would not have been possible without technology. At this level, students can learn science in very different ways, such as through scientific simulations or international collaborations with students from other countries.

The SAMR model provides a clear framework for measuring the extent to which LMS can be used to improve the quality of science learning at SMP Nasional Plus BPK Penabur Bogor. By evaluating the use of LMS at each SAMR level, it is expected that areas that need to be improved or modified can be found so that the use of technology in science learning is more effective and optimal. In this case, the evaluation conducted not only measures the extent to which technology is used, but also how it impacts students' learning outcomes and their skills in understanding science concepts. During the pandemic, many teachers felt helped by the use of LMS, but they also realized that there were limitations in terms of direct interaction with students.

After returning to face- to-face learning, the main challenge faced is how to optimally integrate technology back into the classroom. Some students feel more comfortable with conventional learning methods, while others are more accustomed to online learning. The relationship between LMS and blended learning has been studied by Sankaran &

Saad (2021). Evaluation of LMS to support blended learning methods that combine online and face-to-face learning must continue to be carried out.

Student engagement and motivation in using LMS can vary depending on various factors, such as interest in science subjects, comfort level with technology, and support from parents. Therefore, this study will evaluate the extent to which students feel motivated and engaged in science learning through LMS. This engagement can be measured through participation in online discussions, assignment submission, and success in understanding the material taught. LMS at SMP Nasional Plus BPK PENABUR Bogor has various features that can be used to support science learning, such as discussion forums, interactive quizzes, and multimedia learning modules. These features have great potential to improve students' understanding of abstract and complex science concepts. However, not all features are used optimally by teachers and students. Therefore, this evaluation will identify which features are most effective in improving the quality of science learning and which ones need to be improved or adjusted to students' needs.

In this evaluation, it is important to look at student learning outcomes as one indicator of the success of LMS use. Assessment of science learning outcomes can be done through exams, assignments, and observations of the development of students' practical skills, such as the ability to conduct experiments or observe natural phenomena. Good learning outcomes indicate that the LMS can be used effectively to support science learning, while less than satisfactory results may indicate a need for improvement in the use of the technology. In addition, it is important to assess the sustainability of LMS use after the pandemic. Although face-to-face learning has been re-implemented, the use of LMS still has the potential to enrich students' learning experiences, especially in distance learning or as a tool outside of school hours. Therefore, this study will also evaluate whether LMS remains relevant and effective in the context of science learning after the pandemic, or whether there are changes in the way the technology is used along with changing situations. This study aims to provide a comprehensive overview of the evaluation of LMS use in science learning at SMP Nasional Plus BPK PENABUR Bogor after the COVID-19 pandemic. By using the SAMR model, it is hoped that recommendations can be found that can help maximize the potential of LMS in supporting better, more innovative, and more relevant learning for students' needs in the future.

2. LITERATURE REVIEW

2.1 Utilization of LMS in Science Learning

The use of the internet is currently very important in the field of education. Learning Management System (LMS) has become an integral component of the educational process in the era of industry

4.0 which focuses on digitalization. The use of the internet has now replaced conventional learning. Computer designers in the 1950s believed that LMS could advance education (Bradley, 2020). This is also reinforced by (Yu, 2023) the saying that in 1956, a group of scientists gathered at Dartmouth College to explore the possibility of automation through machine learning and other technologies that affect the human cognitive domain.

Educational institutions around the world use LMS as a center and management of learning resources, educational services, learning activities, and to disseminate information within an institution (Steindal et al., 2021) Wibowo, HS (2023) said that through LMS, students and teachers and fellow students can interact using audio, video, or text in online discussions. LMS can help teachers organize learning in a structured manner and with LMS teachers can track student progress. LMS has also been proven to be effective in informing students about important things. The results of research conducted by (Emmamoge et al., 2020) prove that students have a positive attitude towards LMS. Also supported by research conducted (Furqon et al., 2023) that LMS can

effectively help students get important information that makes it easier for them to understand and remember the content provided. The study conducted Rizal et al., 2020, proved that there are 10 indicators regarding student satisfaction in utilizing LMS, namely ease of use of the application, communication interactivity, work collaboration, virtual lab access , availability of teaching materials, evaluation systems, assessment variations, collection of assignments, quality feedback, and learning synchronization.

The results show that the level of student satisfaction is high on all indicators. One of the national plus private schools in Bogor Regency chose to use the Scola LMS because it is very easy to use. Scola is an LMS that was created in 2016 to help educational institutions build and realize a digital education ecosystem (Riyadi & Sukmayadi, 2023). LMS Scola was developed by PT. Digital Scola Indonesia (Kartasura, n.d.). LMS Scola is not only application-based, but can also be accessed via a website with a domain according to the school. Scola is an LMS made by Indonesian children that was created to help partner schools in providing SIM (Management Information System) services to parents and students (Novita Sari et al., 2022). LMS Scola is a centralized and integrated LMS where parents and teachers can monitor student learning outcomes. The appearance of LMS Scola on each teacher, student, and parent account is different. The Scola LMS used by teachers serves to provide materials, assignments, and exams to students. The materials provided in the Scola LMS can be in the form of text, pdf, word, excel, ppt, video, audio, or website links.

On the other hand, the practice of science learning, the practical implementation of the learning process, is carried out with a combination of lecture methods, information discussions, demonstrations, and observations. The lecture method is given when providing theoretical supplies which are then continued to discuss science processes and followed up with demonstrations in the laboratory. The learning method still uses the method that is usually used for teaching, although in its application other learning methods are developed. This is one of the characteristics or characters of the science learning process in junior high schools. The use of this learning method is in accordance with the theory of Suryosubroto (2009: 32-43) in Retna et al. (2013) which states that the teaching method is one way which is used by teachers in establishing relationships with students during teaching. So it can be interpreted that the use of learning methods can facilitate the process of teaching and learning interactions between teachers and students. This laboratory is used by teachers as a means of media where science teaching and learning practices are carried out.

The laboratory is a place to train students in terms of skills in conducting practice, demonstration, experimentation, research, and development of science. This is in accordance with research conducted by Hofstein & Lunetta (2008) in Retna et al. (2013) that school laboratory activities have special potential as learning media that can support important science learning outcomes for students. By utilizing the laboratory according to its function and role, the laboratory will be able to act as a learning media as an effort to improve student learning outcomes.

2.2 SAMR Model (Substitution, Augmentation, Modification and Redefinition)

Models help educators integrate technology into learning and improve teaching practices. This study explores how both models can be used together to design effective learning experiences. Puentedura explains the stages in the SAMR model, which consist of Substitution, Augmentation, Modification, and Redefinition. Furthermore, this study also explains how these stages relate to the components of TPCK (Technological Pedagogical Content Knowledge).

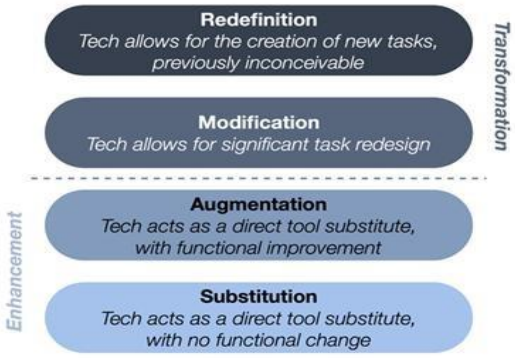

Figure 1. SAMR Model (Source: Puentedura, 2010)

The SAMR model provides a framework for evaluating the level of technology integration in learning, ranging from simple substitution to redefinition of learning tasks. Meanwhile, TPCK focuses on the knowledge needed by teachers to effectively integrate technology in their teaching. By combining these two models, educators can design learning that not only uses technology, but also leverages it to create transformative learning experiences. From the explanation of the image, Substitution is the first level in this framework. Substitution means that technology acts as a direct substitute for a tool, without any functional changes (Alivi, 2019). In utilizing LMS, substitution functions to replace traditional learning methods with digital alternatives without changing the substance of the tasks given. In the substitution stage, technology is used as a substitute for existing tools, such as converting paper worksheets into PDF format that can be accessed online.

This way, students can upload their assignments digitally, thereby reducing the reliance on physical documents. Additionally, teaching can be done through recorded videos uploaded to the LMS, allowing students to learn asynchronously. Although there are no significant functional changes, the use of LMS at this stage provides convenience in managing teaching materials and communication between teachers and students. The next stage is augmentation, at this stage it is not much different from the first stage, but at the augmentation stage the teacher does not only deliver using the lecture method but also provides feedback to students so that active and interactive two-way communication occurs. The augmentation stage means that technology acts as a direct substitute for tools, with functional enhancements (Alivi, 2019). LMS plays an important role in the augmentation stage of the SAMR model, which focuses on enhancing the learning experience through technology. At this stage, LMS not only replaces traditional methods, but also adds new features that replace interaction and collaboration between learners. By using LMS, teachers can integrate online collaboration tools such as discussion forums and interactive quizzes that allow students to participate more actively in the learning process. The third stage is modification. The modification stage is “the use of technology that allows teachers to modify or redesign tasks or activities in the virtual classroom” (Jackson & Shyamsundar, 2022). At this stage, students can use learning applications to interact with other students such as group work. At the modification stage, technology not only replaces traditional methods but also changes the way students interact with the subject matter and each other.

By using an LMS, teachers can design more complex and collaborative assignments, allowing students to work in groups virtually. For example, students can create multimedia projects or interactive presentations that utilize the various digital resources available in the LMS. Additionally, LMS allows for effective collection and management of assignments, so teachers can provide faster and more targeted feedback. The highest level of integration is redefinition which indicates “technology enables teachers to create tasks that were previously unsolvable or unimaginable within traditional approaches

(Jackson & Shyamsundar, 2022)". In the final stage of redefinition, students can publish their work to the public for educational purposes. The COVID-19 pandemic has driven significant changes in the world of education, especially in the implementation of Learning Management Systems (LMS) related to the SAMR model, especially at the refinition stage. Refinition in this context means creating new learning experiences that would not be possible without technology, such as online collaborative learning and the use of interactive tools that support student engagement. In the post-pandemic era, LMS has become a vital tool to address educational challenges arising from physical restrictions and the need for distance learning. This rapid digital transformation has enabled teachers and students to adapt to new teaching methods, increasing the effectiveness of learning through innovative features offered by LMS. In addition, the integration of technology in education helps bridge the existing digital divide, so that more students can access learning materials online.

3. RESEARCH METHODS

This study uses a qualitative method with a case study research type that aims to provide an in-depth overview of the use of LMS (Learning Management System) in science subjects at SMP Nasional Plus BPK Penabur Bogor after the COVID-19 pandemic. The researcher conducted a grand tour to private schools with national plus standards in Bogor Regency, which are known to have implemented LMS in learning management. In addition, the researcher also collaborated with the Bogor Regency Education Office to obtain data on the best schools that use LMS with the aim of exploring the implementation of LMS more comprehensively and the relevance of its use in the context of education in the post-pandemic era.

Qualitative data in this study were taken through in-depth interviews with science teachers at the school. This interview aims to obtain direct views and experiences from teachers regarding the implementation of LMS, as well as to prove the relevance and effectiveness of LMS in improving the quality of science learning in the post-COVID-19 pandemic era. With an interview approach, researchers can gather deeper information about the challenges faced, the benefits perceived, and how LMS can support a more effective learning process. This research process began with direct observation of the use of the Learning Management System (LMS) in science subjects at SMP Nasional Plus BPK Penabur Bogor. This observation aims to directly observe how LMS is used by teachers and students in teaching and learning activities after the COVID-19 pandemic. After the observation was carried out, the next step was to identify topics relevant to the research objectives, namely the evaluation of LMS utilization with the SAMR (Substitution, Augmentation, Modification, and Redefinition) model. This identification process includes determining aspects that need to be evaluated, such as effectiveness, constraints, and the impact of LMS use on student learning outcomes. Next, interviews were conducted with teachers and students to dig deeper into their experiences in using LMS during science learning. This interview was conducted in a structured manner by asking questions that had been prepared in advance. The data obtained from this interview were then analyzed and processed to gain a deeper understanding of the implementation of LMS, as well as how its implementation relates to the SAMR model. After the data was collected and analyzed, the researcher will conduct an evaluation based on the four stages of the SAMR model, namely Substitution, Augmentation, Modification, and Redefinition, to determine the extent to which LMS improves the quality of science learning in the post- pandemic era.

4. RESULTS AND DISCUSSION

BPK PENABUR began with the Kie Tok Kauw Hwee Khu Hwee Chinese Education Agency of West Java (BP THKTKHKH Djabar). BP THKTKHKH Djabar was established on July 19, 1950, namely an educational institution that was a concrete step by the Indonesian Christian Church of West Java which embodied the value that the church

must also serve in education. Initially, BP THKTKHKH had a number of schools that were grants from Vereniging Christelijke Scholen (VCS), a Christian school organization owned by the Netherlands. The provision of schools from the Dutch organization was based on the awareness that its position in Indonesia would end sooner than previously thought. VCS then placed several teachers from the THKTKHKH church in leading schools from the Dutch organization. Thus, the process of Indonesianization occurred in the field of education. The principle of being independent in fostering schools left over from the colonial era by the church is an important basis for the development of Christian schools in which later changed its name to the PENABUR Christian Education Agency (BPK PENABUR).

SMP Nasional Plus BPK PENABUR Bogor has been using LMS Scola as a means of KBM (Teaching and Learning Activities) since 2020. Initially, LMS Scola was used to support PJJ (Distance Learning) during the COVID-19 pandemic. Reported from the website https://scola.id/, Scola LMS has been trusted by more than 100 schools and educational institutions in Indonesia. There are approximately 8,000 teachers using Scola and 55,000 students using the Scola LMS. LMS Scola has interesting features and is easy to understand for beginners who use it. Every school that uses LMS Scola will be given a domain according to the name of the school. Like SMP Nasional Plus BPK PENABUR Bogor uses the page https://smppenabursentul.scola.id/ to enter the LMS. LMS Scola can also be accessed through the application. However, currently only students and parents can use the Scola application on their devices. While teachers can only access the Scola LMS through the website. The following is a display of the Scola SMP Nasional Plus BPK PENABUR Bogor website.

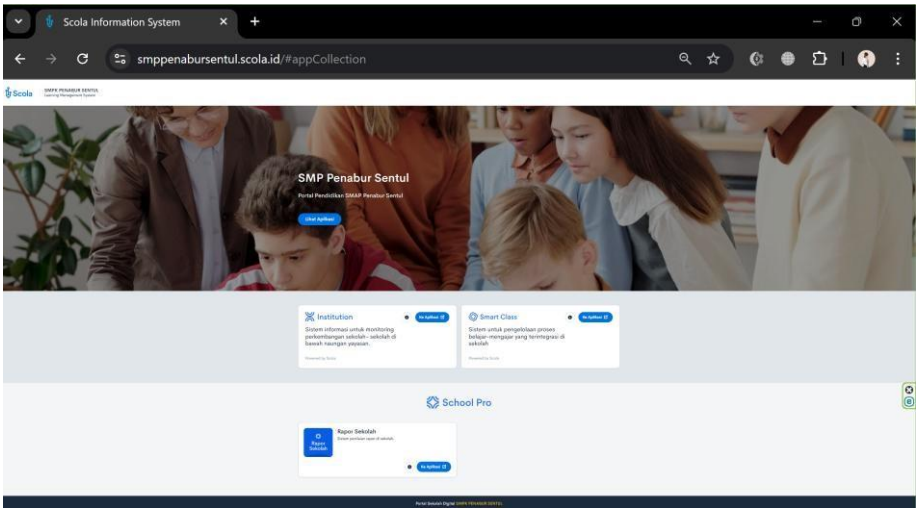

Figure 2. Website page (Source: https://smppenabursentul.scola.id)

The LMS Scola SMP Nasional Plus BPK PENABUR Bogor website page is divided into 3 menus, namely the institutional menu which is used as an information system for monitoring the development of schools under the auspices of the foundation. The smart class menu which is used as a system for managing integrated teaching and learning processes in schools. The school report menu which is used as a report card assessment system in schools. The menu used by students and parents is the smart class menu. If you want to enter the smart class menu, Scola users must enter the username and password that has been registered by Scola. Username and password are confidential. Every school or educational institution has an admin who is trusted to hold the username and password that has been created by Scola. If the user forgets the username and password, the user can report to the school admin and the admin will provide a new username or password.

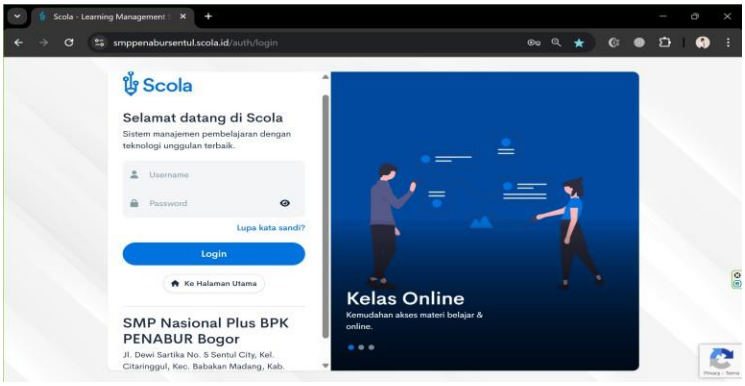

Figure 3. Smart class menu page

The image shows the login page of Scola, a learning management system (LMS) used by SMP Nasional Plus BPK PENABUR Bogor. On the left side of the screen, there is a form to enter a username and password, indicating that access to this platform is private and can only be used by registered users. In addition, there is an option to reset the password if you forget it, as well as a button to return to the main page. Scola stands out as a platform with superior technology that supports the digital learning process. On the right side, there is an illustration of two people interacting virtually, illustrating the concept of online classes offered by Scola. The short narrative below the illustration emphasizes the ease of access to learning materials and online learning which is the main advantage of this platform. With a modern and informative appearance, Scola facilitates the needs of distance learning and supports digital transformation in the world of education, especially in the environment of SMP Nasional Plus BPK PENABUR Bogor.

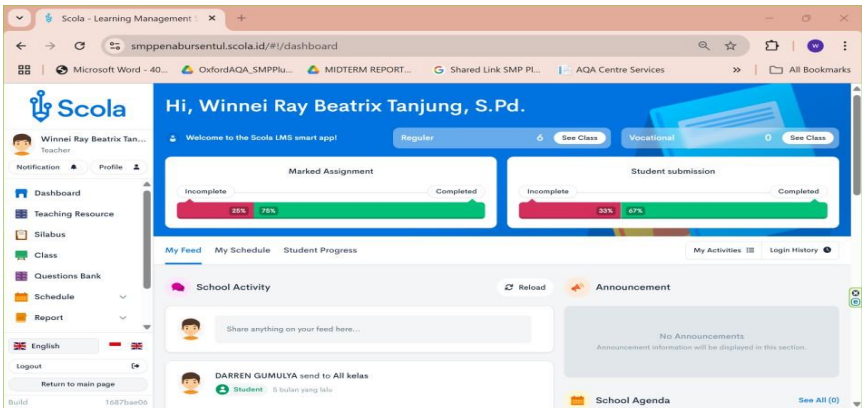

Figure 4. Dashboard menu page

The dashboard in this image displays the main view of the Scola Learning Management System (LMS) platform. At the top of the dashboard, there is information about the number of regular and vocational classes taught, as well as statistics related to assignments that have been assessed and assignments submitted by students. These statistics show the percentage of completed and incomplete assignments, making it easier for teachers to monitor student progress and performance in real-time.

In addition, key features such as teaching resources, syllabus, class, questions bank, schedule, and Report can be easily accessed through the menu on the left side of the screen. In the middle of the dashboard, there is a school activity column that allows students and teachers to share information or short messages with the entire class. Beside it, there is a column for announcements and school agenda, although at the time this screenshot was taken, there were no announcements or agendas listed. These

features are designed to support communication and coordination between teachers and students, and ensure that all parties are up to date with learning activities at school. With a simple appearance and clear navigation, Scola LMS helps simplify the administration and interaction processes in a digital education environment.

CONCLUSION

This study found that at the Substitution level, the use of LMS has replaced traditional learning tools and methods without changing its basic functions. Science teachers at SMP Nasional Plus BPK PENABUR Bogor use LMS to replace blackboards and printed books with digital content. Learning materials are uploaded in the form of documents or videos that can be accessed by students at any time. The assignment collection process is also carried out through LMS as a substitute for manual assignment collection. Although there are no functional changes, the use of LMS makes the process more practical and efficient. Teachers and students are no longer bound by space and time to deliver or receive materials. This shows that the Substitution stage contributes to the accessibility and efficiency of the learning process. However, this stage has not shown any transformation in learning methods. Therefore, Substitution is an important first step in the integration of educational technology. Strengthening this stage is very necessary as a foundation for moving to the next SAMR stage. Overall, the application of the SAMR model in science learning shows success at each stage, although with varying levels of achievement. The Substitution and Augmentation levels are easier to adopt because they only require minor adjustments from teachers and students. However, the Modification and Redefinition levels require higher technical and pedagogical skills. The implementation of these four stages provides an illustration that LMS can be used as more than just a medium for distributing materials. With adequate training and support, teachers can reach the full transformation stage in learning. The biggest challenge lies in the readiness of human resources and technological infrastructure. However, the potential for LMS to improve student learning outcomes and experiences is enormous. Therefore, evaluation based on the SAMR model is important in measuring the maturity of educational technology. This model becomes a strategic framework for developing digital learning in a more innovative and meaningful direction.

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