

DEVELOPMENT OF A DESIGN LEARNING MANAGEMENT SYSTEM (LMS) TO IMPROVE STUDENT SKILLS: CASE STUDY IN A SCIENCE LEARNING MEDIA DEVELOPMENT COURSE

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Abstract

This research aims to develop a Learning Management System (LMS) to improve students' skills in creating science learning media for early childhood. This research used the Design-based Research (DBR) method through stages: analysis, design, development, and evaluation. The research results showed that the LMS can improve students' skills in creating science learning media for early childhood. The results of expert validation regarding the quality of the LMS used in science learning media courses for early childhood were stated to be good, in the sense that it meets needs, and has a flexible nature. Thus, students can learn anywhere and anytime, is interactive, and challenges students to be digitally literate. The impact of this research is that in carrying out lectures lecturers need to provide facilities in the form of innovative learning approaches and technology. Thus, they can improve students' abilities.

Keywords: Design-based research, Learning management system, Science learning media, Student skills.

1. Introduction

This research focused on a Learning Management System (LMS) designed to improve student skills in creating science learning media. The LMS in this research is from software called Pedagogy.id with features that enable educators to carry out science learning courses with students. Student skills are one of the practical abilities that students are expected to have after they receive material about science learning media. Science learning media in this research are products produced by students in the form of visual, audio-visual, and multimedia media that can be used to teach science to students. Science learning is attractive since it is one of the difficult subjects, making many researchers focus on this topic [1-5].

Previous research findings regarding LMS design are shown in Table 1. Mostly, the research uses a log and database query system intensively at a state university that has been using LMS for 15 years. LMS plays an important role in higher education and online learning institutions to inform the development of next-generation learning systems or other innovative technologies. Some researchers used a literature review to make a comparison of selected providers, showing that the LMS was considered flexible, easy to use, accessible, and user-friendly [6-8]. Research findings on science learning using experimental methods show that the use of an inquiry-based didactic method can significantly increase student development.

Some researchers showed that STEAM-based video learning media developed according to the criteria can be applied well in educational environments [9]. The pre-test score which exceeds the post-test shows the effectiveness of video media in increasing understanding of morning phenomena, also increasing religious and moral values, and increasing students' STEAM creativity. Here, different from other reports, the novelties of this study are (i) developing mastery learning features to facilitate student learning potential, (ii) developing a comfortable and contemporary user interface, and (iii) develop connectivity features between students to facilitate the ability to collaborate in producing science learning media products.

Table 1. Previous studies on LMS.

No.	Title	Ref.
1.	Determinants of learning management system (LMS) adoption by university students for distance learning.	[6]
2.	The effectiveness of distance learning using learning management system media and WhatsApp groups at senior high school.	[10]
3.	The influence of spada learning management system (LMS) on algorithm learning and programming of first grade students at Universitas Pendidikan Indonesia.	[11]
4.	The attitude of distance learners towards the utilization of learning management system (A case study of National Open University of Nigeria).	[12]

2. Literature Review

2.1. Learning management system (LMS)

LMS is a software system used to manage learning and assessment, this system is central to learning [13]. Nowadays universities have made LMS a central system in learning administration [14]. Figure 1 explains the general architecture regarding the main actors involved in using the LMS. Even though it is considered a complex

techno-social system, LMS has great potential in knowledge construction and skill development if it is developed concerning learning theoretical foundations [15].

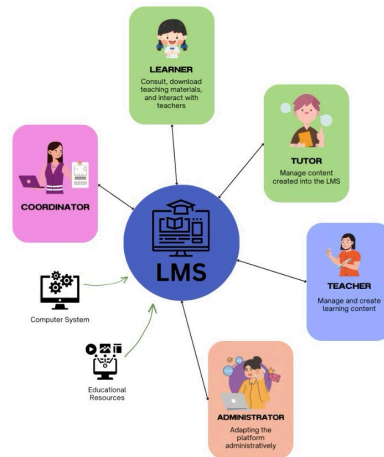


Fig. 1. General LMS architecture.

There are at least four learning theories that can be used as a theoretical basis for LMS development, including (i) pedagogical theory that encourages educators to provide structured learning programs; (ii) behaviourist theory, this theory encourages educators to be able to provide stimuli that generate positive student behaviour. Thus, a meaningful learning environment is built; (iii) Cognitive theory showed that educators' understanding of students' cognitive development stages will be the basis for educators in determining learning outcomes and processes that are structured and appropriate to student development; (iv) Connectivity, connectivism can be a sustainable conceptual framework. Thus, it can motivate students to develop knowledge through digital spaces such as discussions and social networks [16]. This theoretical basis will support the LMS function to work well in helping to achieve learning goals.

Figure 2 explains the function of using an LMS. Based on its function, LMS becomes a bridge that allows educators to create courses easily and monitor the learning process to student learning outcomes [17-20]. Apart from that, LMS allows communication between users. Thus, there is potential for collaboration between users both in terms of building knowledge and in working on learning projects. As well as enabling collaboration between agencies or agencies and parents. Interaction between communities will not be hindered by space and time because the LMS has a flexible function that can be accessed anytime and anywhere [21].

Of the many LMS functions, they can also be differentiated based on type. First, the cloud storage-based LMS is a technology platform specifically designed to provide an integrated online learning environment and utilizes cloud storage as storage. Thus, learning can be accessed much more easily [22]. Second, an on-premise-based LMS is an LMS that uses local server storage hosting, usually created specifically for an institution or company and accessed by internal members of the institution or company. Third, Open-source LMS is a system in the form of open-source code. Thus, it allows users to modify the system according to their needs.

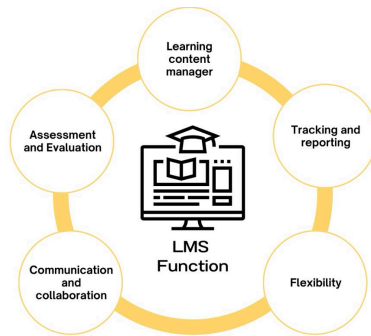


Fig. 2. LMS function.

Based on the types of LMS above, Cloud LMS is an LMS with more advantages. Cloud LMS is created by utilizing cloud storage and using the internet network to access it. Thus, instructors can design lessons anywhere using portable devices such as laptops and mobile phones. Apart from that, other advantages of Cloud LMS include (i) it has a disaster recovery function which allows for automatic data backup. Thus, if the main data is lost, it can be easily restored; (ii) the cost is affordable because it does not require maintenance and support; (iii) security is more guaranteed. Therefore, we developed a Cloud LMS with the name pedagogy.id with features that allow educators to build platforms to carry out learning with students.

2.2. Science learning in early childhood

Science is a collection of knowledge obtained through methods based on observation [23, 24]. Science learning at the early childhood education level is aimed at fostering students' understanding, interest, and appreciation for the surrounding environment. Therefore, the scope of studies on the introduction of science in early childhood includes the study of plants, animals, sun, moon, stars, weather, seasons, energy, and even simple chemistry [25, 26].

Table 2 shows the dimensions and objectives of science learning for young children. The introduction of science to early childhood emphasizes three important substances, namely (i) science as a process; (ii) science as a product, and (iii) science as an attitude.

Table 2. The dimensions and objectives of science learning for children.

No.	The science dimension	Science Learning Objectives
1.	Science as a product	(i) Mastery of a body of knowledge, (ii) Ability to explain what is already known, (iii) Ability to explain how to gain knowledge, and (iv) Comprehensive mastery of science.
2.	Science as a process	(i) Master the skills to explore and discover science, (ii) Make observations, (iii) Master how to solve problems, and (iv) Have process skills such as observing, explaining, asking questions, classifying, gathering power, and so on.
3.	Science as attitude	Forming individuals who have scientific attitudes such as honest, creative, critical, humble, mutual respect, discipline, high curiosity, and so on.

2.3. Learning media

Learning media is a means used to convey planned messages to students to encourage a more efficient and effective learning process [27, 28]. The use of learning media helps students to understand the learning material presented more optimally. The learning media used at the Early Childhood Education level can help children to think concretely.

Figure 3 shows that learning media functions as an intermediary to convey messages in the form of learning material delivered by teachers to students. The use of media in learning has four main functions, namely (i) attention function, (ii) affective function, (iii) cognitive function, and (iv) compensatory function.

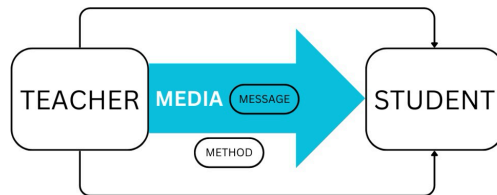


Fig. 3. Function of media in the learning process.

Table 3 displays the classification of learning media into several types. Along with advances in ICT, learning media utilizes the existence of the internet and electronic media. The integration of ICT makes learning media increasingly diverse, starting from social media, e-learning, LMS, and so on.

Table 3. Classification of types of learning media.

Types of learning media	Form of learning media
Visual	(i) Slides, (ii) Picture, (iii) Film strips, (iv) Comic, (v) Poster, (vi) Chart, and (vii) Photo
Audio	(i) Radio, (ii) Telephone, (iii) Audio disc, and (iv) Cassette recorder
Audiovisual	(i) Film, (ii) Television, and (iii) Videocassette
Wide	(i) Social media, (ii) Learning platform, (iii) Website, (iv) LMS, (v) Radio, and (vi) Television
Limited	(i) Film, (ii) Slide, and (iii) Film strip
Individual	(i) Programmed module, (ii) Restricted learning platform, and (iii) Printed book

3. Research Methodology

Figure 4 shows the Design-based Research (DBR) steps. This research is a case study of the development of LMS to improve student skills in PAUD science learning media development courses using a DBR approach. At the analysis stage, the need for LMS development in PAUD science learning media development courses will be investigated. Next, in the design stage, LMS design is carried out to determine LMS features that can facilitate a meaningful learning process to produce good science learning media products. The development stage is LMS production. Next, an evaluation of the effectiveness of the LMS is carried out by referring to the results of student product assessments.

4. Results and Discussion

4.1. The urgency of LMS development

Judging from the trend of the past decade until now, research on LMS is still an interesting issue to be explored further [29-31]. One of the issues that is a challenge in LMS development is learning features and social interaction features that are not integrated into one LMS. For example, in the learning process using two to three different platforms. On the other hand, LMS development that does not pay attention to pedagogical foundations and computer science has an impact on the quality of learning using the LMS. Based on the literature analysis above, the basic aspects of technology-based learning that underlie LMS development need to be identified further.

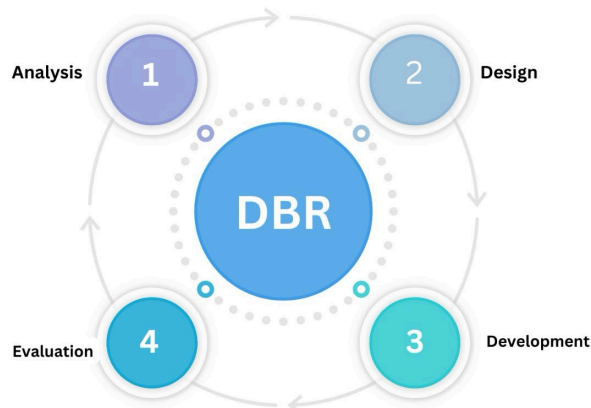


Fig. 4. Design-based research steps.

Students are used to using social media in their activities on the internet every day. User Experience (UX) and User Interface (UI) in social media applications have become comfortable for students. Therefore, in LMS development it is necessary to pay attention to things such as the social environment, social media activities, and student learning potential. This will affect the LMS-based student learning process and outcomes [32].

4.2. Design of learning management system (LMS)

This LMS applies a techno-pedagogy approach. Pedagogy is the basic concept that underlies an educator to build educational activities with their students [33]. Learning activities are built through educators' understanding of their students, through this understanding the learning experience in the educational process that educators present will be close to students and easily accessible. Thus, the learning experience becomes meaningful. Four aspects can be used to identify concepts and content used to develop Techno-pedagogy approach learning designs, namely learning difficulties, learning styles, digital literacy, and pedagogy of interest.

Figure 5 informs the techno-pedagogy approach. This approach is expected to develop educators' understanding of students consisting of learning potential, social environment, and social media activities. Figure 6 shows the usage flow

and features found in the LMS. In general, the features and flow are not much different from LMS, but this LMS has innovations in several features. Such as personal pages, interactive features in learning content, and collaboration features which represent a techno-pedagogy approach.

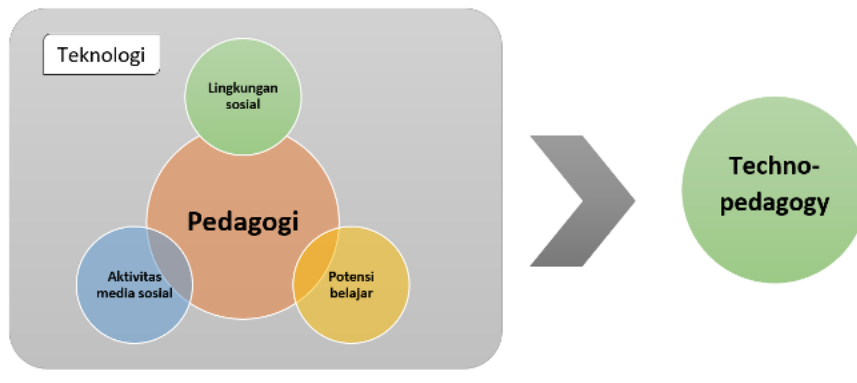


Fig. 5. Design of a pedagogical model in the digitalization frame.

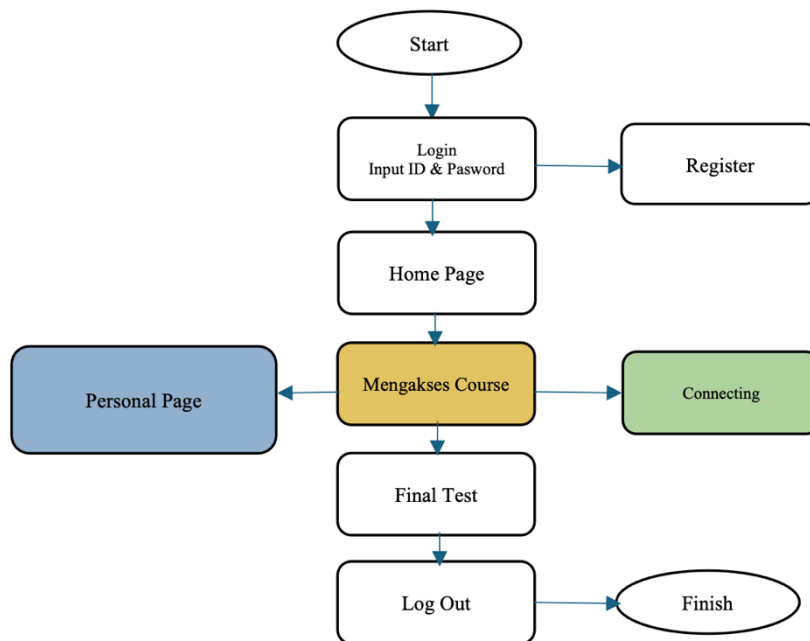


Fig. 6. Flowchart of LMS.

4.3. Development of learning management system (LMS)

Table 4 shows the LMS user experience and appearance features. The LMS design based on a techno-pedagogical approach in this research was implemented in the form of developing a learning platform in the form of an e-course.

Table 4. User experience and appearance features.


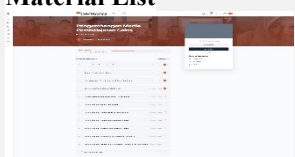
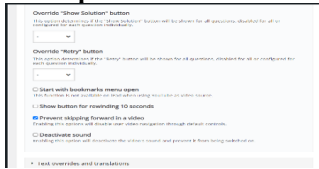
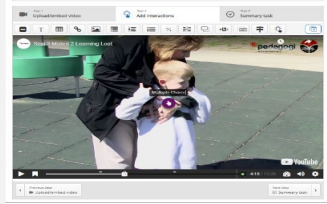
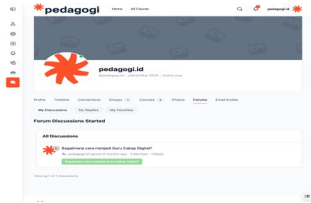
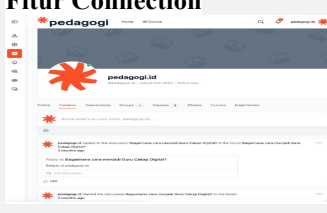
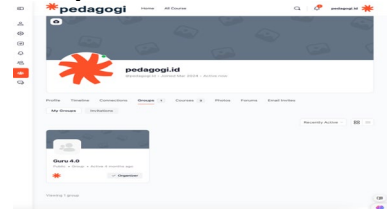
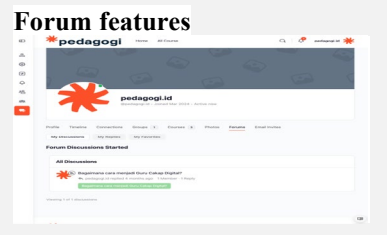
Future	Function
<p>Register for Courses</p> 	<p>This feature provides a list of courses that students can choose from.</p>
<p>Material List</p> 	<p>The material list feature is a structure of the content that will be studied in the course.</p>
<p>No skip feature</p> 	<p>The no-skip feature was created. Thus, students can watch the learning video until the end without skipping or speeding up.</p>
<p>Interactive video feature</p> 	<p>Through this feature, lecturers can create quizzes that will appear in the form of a popup in the middle of the video to ensure students focus on the content they are listening to.</p>
<p>Notification feature</p> 	<p>This feature allows students to get notifications about the latest activities connected to them.</p>
<p>Fitur Connection</p> 	<p>Connectivity features allow students to connect to dialogue, revise other students' work, and provide input. This feature was developed through connectivism theory which seeks to facilitate students' social skills in e-learning.</p>

Table 4. (Continue) User experience and appearance features.

Future	Function
<p>Group Features</p> 	<p>The group feature is provided as a special space for the student community to study certain themes.</p>
<p>Forum features</p> 	<p>The forum feature is a space provided for lecturers to share supplementary material that is not presented in the course.</p>

The features developed in this LMS attempt to provide a learning environment that is contextual to students' digital culture by referring to previous studies. These features include (i) a course list feature that allows students to select the required courses; (ii) a content list feature that allows students to get an overview of the structure of the content to be studied; (iii) The no skip feature was created. Thus, students can watch the learning video until the end without skipping or speeding up. This feature adopts a mastery learning approach to facilitate students' learning potential. Thus, they can improve their understanding and skills. This feature is found in the video content in the course section; (iv) interactive features in video content. Through this feature, lecturers can create quizzes that will appear in the form of a popup in the middle of the video to ensure students focus on the content of what they are listening to. this quiz feature is an alternative to improving the quality of learning; (v) The notification feature is a notification feature based on certain activities in the LMS; (vi) connectivity features that allow students to connect for dialogue, revise other students' work and provide input. This feature was developed through connectivism theory which seeks to facilitate students' social skills in e-learning. Based on this, it is believed that connectivism is one of the most prominent learning theories and was developed for e-learning environments; From the same theory, (vii) group feature was also developed which provides a dialogical space in studying certain themes. Dialogue in the learning space can improve students' understanding and critical thinking; (h) the forum feature is a space for lecturers to share material supplements that are not available in the course.

4.4. Student learning outcomes

This research hypothesizes that LMS does not have a positive effect on students' skills in creating learning media. Based on the data centre symptom calculation, the number of samples is 30, the average is 80.8167, and the standard deviation is 0.66479. The results of the normality test using the Shapiro-Wilk value were $0.383 > 0.05$. Thus, it can be concluded that the value of the learning media produced by students has a

normal distribution. Thus, the assumption of normality in the One-Sample T-Test has been fulfilled. The results of the one sample T-test are a t-count of 8.750 with degrees of freedom (df) 29 and a significant value of 0.000. Based on the results of the "One-Sample Test" the Sig. (2-tailed) is $0.000 < 0.05$. Thus, following the basis for decision making can be concluded that H_0 is rejected, and H_a is accepted. Thus, the LMS has a positive effect on students' skills in creating learning media. This paper also adds new information in the education, as reported elsewhere [34, 35].

5. Conclusion

This research produced a general conclusion regarding the development of LMS to improve students' skills in creating science learning media. The use of the pedagogy.id is for supporting LMS in science learning courses that can improve students' skills in creating science learning media in the form of visual, audio, and multimedia media. The results of expert validation regarding the quality of the pedagogy.id LMS used in Science Learning courses were declared good. The results of this research have the impact that in carrying out lectures lecturers need to provide facilities in the form of learning approaches using innovative technology. Thus, they can improve students' abilities.

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