

THE LEARNING MANAGEMENT SYSTEM DEVELOPMENT FOR MATHEMATICS AND SCIENCE LEARNING IN ISLAMIC JUNIOR HIGH SCHOOL (MADRASAH TSANAWIYAH) AS THE ONLINE LEARNING SOLUTION AMID THE COVID-19 PANDEMIC

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ABSTRACT

Teachers as "the agent of change" have important roles to improve education quality. In this current era, teaching and learning require innovations. Since COVID-19, many things have been changing in online-based media. This research aimed to (1) develops a learning management system for science and mathematics-science learning and (2) determine the developed LMS quality. This research & development applied the 4D approach. The researchers collected the data with a product quality questionnaire for material experts, media experts, peer reviewers, and science-mathematics teachers. The researchers also collected the learners' responses with a questionnaire. The researchers evaluated the product quality based on the judgment of a material expert, a media expert, 5 peer reviewers, 2 science-mathematics teachers, and 15 learners. The researchers analyzed the data descriptively qualitatively and quantitatively. The results showed that (1) the developed learning management system for science and mathematics learning at the Islamic Junior High School or Madrasah Tsanawiyah (Mts) became the online learning solution amid the COVID-19 pandemic; (2) the developed product quality was very excellent. The percentages obtained from the experts were: the material expert with 89.5%, the media expert with 88.4%, the peer reviewer with 89.1%, and science-mathematics teachers with 88.75%. The obtained total mean was 88.9%, categorized as very excellent. Thirdly, the responses of the learners indicated the product quality was very excellent with an ideal percentage of 82.4%.

Keywords: Kata kunci bisa berbentuk kata atau frase dan terdiri dari 4 – 6 kata/frase.

ABSTRACT

Abstracts and Keyword are written in Indonesian and English if the article uses Indonesian. If the article is written in English, abstract is just written in English. The abstract should describe clearly the content of the article. It includes **introduction** (the research problem in 1-3 sentence), **the aims of research, methods, findings, and conclusion or implication of the research**. Abstract is written in normal font for 150-250 words long, written in 1 paragraph, and *using past tense sentences*. If it is more than 250 words, the editor will ask the authors to have revision. On the other case, the editor has right to revise abstract in order to meet the standard. The font used for abstract is Calibri 10 pts with 1 spacing.

Keywords: keyword should in the word form or phrase which is contained in 4-6 words/phrase.

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INTRODUCTION

2020 was the most difficult and shocking period for the educational field with extremely dramatic changes. One of them was - the conventional change shifts. However, the COVID-19 pandemic made the Ministry of Education and Culture a policy to promote the online learning process. The policy was useful for the learners and educators to be safe from virus exposure. The implication of the COVID-19 pandemic demands digital technology implementation in various matters (Abdillah et al., 2020). Therefore, educators must have operational skills for educational technology and must understand learning in an online manner. Various policies support and promote online learning amid the COVID-19 pandemic. These policies provide evidence for educators to 1) change the cognitive level demand to construct understanding, 2) regulate the subject exploration, 3) improve the interaction with opened-mindset, 4) trigger and motivate learners to think, and 5) optimize the processes of interaction, communication, and education. The policy is also helpful for keeping the balance of the teachers as individuals and critical problem analysts in the learning process. Online learning provides specific challenges for educators (Lee & Balley, 2020). Therefore, educators must have excellent preparation to promote the learning process consistently to contribute to and improve the learning quality.

Educators must have learning strategies and media to promote the learning process excellently. Therefore, educators must be capable of integrating knowledge and technology for online learning (Juanda et al., 2021; Rizal et al., 2020). Besides educators, learners must also prepare for their online learning amid the COVID-19 pandemic. Learners must improve their skills with technology applications (Mallizar et al., 2020). This matter is important because learners will encounter newly applied applications or websites. The online learning commitment facilitates the notion of learning anytime and anywhere with Internet access (Saputro et al., 2021). Therefore, online learning provides flexibility for learners and educators to create effective and documented learning experiences. The online learning framework contributes to the learning environment that facilitates self-directed learning. However, the challenges of creating an effective online learning experience remain existing, such as the complexities of teaching and learning, starting from motivation, communication, and inter-learner interaction. The other challenges include the implementation of learner-centered learning to apply a constructive learning environment (Conrad & Donaldson, 2011).

Despite the challenges, online learning has superiority. For example, teachers could upload, access, and store the materials in the form of digital data (Rabiman et al., 2020). Educators must also use various e-learning as the learning media (Umek et al., 2015). The applicable e-learning to enrich learners' knowledge is a Learning Management System, LSM (Kasim & Khalid, 2016). LMS contains the management, production, and delivery of material (Tumbull et al., 2021). Learning with LMS is accessible online with website-based content (Kraleva et al., 2019). LMS presents multimedia learning materials, such as texts, figures,

animations, and videos (Méndez-Carbajo & Wolla, 2019). Many developers design LMS attractive so that learners could be motivated to learn with LMS (Trisnaningsih & Suyanto, 2016). Here are the other benefits of LMS. (1) LMS facilitates learners to learn and access materials anywhere and anytime (Budiyono Saputro & Susilowati, 2019). Therefore, learning with LMS can be done online and is effective (Soykan & Şimşek, 2017); (2) educators can easily use LMS, starting from Edmodo, Schoology, Google Classroom, WhatsApp Group, Virtual Class, Edusmart, Zoom, Jitsi Meet, Siakadu, etc; (3) LMS accelerates the digital learning; (4) LMS is applicable to fill the attendance, record scores, and determine the learners' advancements (Cavus & Alhih, 2014); and (5) learners could share responses and interact with teachers via the given LMS (Alghamdi & Bayaga, 2016; Almareta & Paidi, 2021).

The COVID-19 pandemic encouraged technological advancement for the progress of the learning process, including mathematics science lessons at the Islamic Junior High school level or Madrasah Tsanawiyah. The lessons require specific attention to online learning because of the Islamic Junior High school learners' characteristics. The learners still require guidance from the teachers. The science-mathematics lesson requires conceptual understanding because the lesson has various mathematics equations and abstract concepts. Thus, the lesson requires supporting media and strategies. Accurate applied media and strategies could improve the learners' understanding (Rahayu, Sutikno, & Masturi, 2015). The same matter was also applicable to online learning amid COVID-19. The roles of technology are crucial to support the learning process.

The survey results of science-mathematics teachers at Islamic Junior High School in the Special Region of Yogyakarta found the most applicable media by teachers for online learning were Google Classroom and WhatsApp. These media were useful to share materials and presentations. The teachers also used Google Forms to assess the learners. The implementations of the platforms are separated in the learning process. Teachers also analyzed the question item for the learners and made the progress reports based on the digital reports. These actions were ineffective because the learning process and online assessment were separated and promoted partially. Many teachers also had difficulties developing and operating online learning media (Winda & Dafit, 2021). Therefore, the teachers needed a system of application to ensure the implementations of online learning and assessment were integrated based on the teachers' and the learners' needs.

Online learning at schools had various effects on the learners. Thus, the learners had to adapt to the learning mode shift, from face-to-face learning to online learning. At the beginning of online learning, many learners were enthusiastic but some learners were demotivated. Based on the given questionnaire for the learners, the data showed that the learners had to install many applications for the learning process. They also needed much Internet balance so that the learning was ineffective. These shortcomings could be managed by integrating learning media into a platform or a learning management system.

LMS is defined as a web-based software platform to make the online learning process more interactive (Sanova, 2018). LMS could facilitate teachers' and learners' needs for online learning and minimize the entailing problems. However, at the school, the teachers did not have specific LMS for science-mathematics lessons to accommodate teachers' and learners' needs. Thus, the learning was more effective and systematic. Based on the explanation, the researchers

were interested to develop science-mathematics LMS for the Islamic JHS level. The developed LMS consisted of attendance, teaching material, discussion forum, YouTube link, video conference, assignment, and evaluation question maker (daily, midterm, and final term test). These components were integrated into a structured system to facilitate learning coordination and management (Hanafi, 2011). The researchers designed the evaluation items randomly for a certain period. The design also had question items and score analyses of the learners. Besides that, the final evaluation result component of the LMS was adjusted with the digital report application for Islamic JHS learners. Thus, the LMS could facilitate teachers to fill out the digital report application published by the Ministry of Religious Affairs. The researchers designed the LMS attractive with ease of operation for both learners and educators. The researchers also adjusted the learning needs for Islamic JHS levels to improve the online learning quality amid COVID-19. Therefore, this research aimed to develop a learning management system, LMS, for science-mathematics lessons at Islamic Junior High School, Madrasah Tsanawiyah, as the online learning solution amid COVID-19 based on the online report criteria; determine the quality of the learning management system for science-mathematics lessons at the school as the online learning solution amid COVID-19 based on the judgment of media experts, material experts, education experts, and teacher; and determine the learners' responses toward the developed LMS for science-mathematics lessons at the school as the online learning solution amid COVID-19.

METHOD

The applied development method for the science-mathematics LMS was Research & Development. The applied research design was the 4D model by Thiagarajan et al (1974). The model consists of four primary steps: defining, planning, developing, and disseminating. Figure 1 is shown the illustration of the 4D research model.

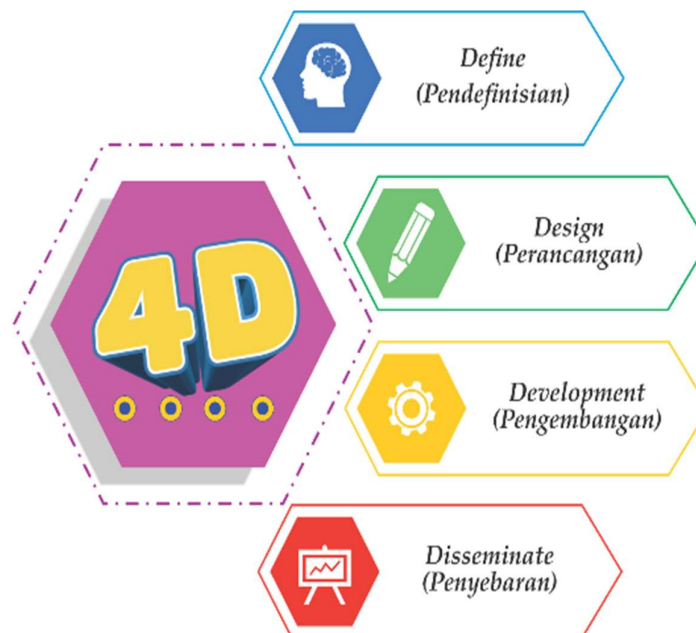


Figure 1. The Research step

The obtained data were the judgment results from the material expert, media expert, teachers, and learners' responses. The researchers obtained the data after distributing the judgment questionnaire. This data collection technique consisted of a systematically-arranged question list (Bungin, 2011). In this research, the researchers had two instruments to promote judgment. They were the instrument to determine the quality of the science-mathematics Learning Management System and to collect the responses of the developed LMS users. The instrument to obtain the data quality of the developed science-mathematics LMS based on the experts The descriptive qualitative and quantitative data analysis technique The procedure of quality assessment was based on the Likert scale. The applied categorization ranged from Very Excellent (SB) with a score of 5, Excellent (B) with a score of 4, Average (C) with a score of 3, Low (K) with a score of 2, and Extremely Low (SK) with the score of 1 (Best, 1982). The data analysis consisted of an assessment from the reviewers. The researchers calculated the mean score of each criterion aspect, convert the mean into qualitative values, convert the qualitative values based on the ideal assessment category classifications, and identify the results based on the product quality assessment regulation. The researchers arranged the instruments to collect the response data from the learning media users. The descriptive qualitative and quantitative data analysis technique The applied regulation to judge the product quality was with the Likert scale. The applied categorization ranged from Very Excellent (SB) with a score of 5, Excellent (B) with a score of 4, Average (C) with a score of 3, Low (K) with a score of 2, and Extremely Low (SK) with the score of 1 (Best, 1982). The researchers analyzed the data in the same way as the researchers analyzed the obtained data from the LMS quality judgment instrument.

RESULTS AND DISCUSSION

The Research & Development result was a blended-learning instrument in the form of a learning management system for science-mathematics at the Islamic JHS level. The promoted steps for the development were defining, planning, and developing steps.

Defining Step

This step defined the conditions of learning. The researchers defined and determined the learning conditions by analyzing the objectives and the copes of a material in the developed product. The analysis consisted of three matters: problems, learners' characteristics, and instructional analyses. The first analysis was problem-analysis with a survey of the science-mathematics teachers at the school. The survey was about the implementation of science-mathematics learning amid the COVID-19 pandemic at school. The results showed that the most applied media were Google Classroom and WhatsApp. The teachers used these media to share materials and attendance lists. Then, the teachers used Google Forms to assess. The implementations of the platforms are separated in the learning process. Teachers also analyzed the question item for the learners and made the progress reports based on the digital reports. These actions were ineffective because the learning process and online assessment were separated and promoted partially. Besides that, the teachers had difficulties developing and operating the online learning media. Therefore, the teachers needed a system of an application to ensure the implementations of online learning and assessment were integrated based on the teachers' and the learners' needs.

The second analysis dealt with learners' characteristics. The applied online learning at the school provided various effects. The learners must adopt the online learning mode. At the beginning of online learning, the learners were enthusiastic. However, some learners were demotivated during the online learning implementation. Based on the given questionnaire for the learners, the data showed that the learners had to install many applications for the learning process. They also needed much Internet balance so that the learning was ineffective. These shortcomings could be managed by integrating learning media into a platform or a learning management system.

The third analysis was instructional. This analysis dealt with the learning, starting from the curriculum, concept, and indicator of achieved competence on the material of living creature classification. At that time, the applied curriculum was the 2013 curriculum. The curriculum required material development with LMS, including science-mathematics material at all levels. In this research, the developed material in the product was science-mathematics materials for seventh graders of Islamic Junior High School in the first semester. Once the material concept was established in the lesson, the researchers analyzed the learning objectives. This process was useful to ensure consistency among the material presentation, activity development, and evaluation with the final objectives in the form of achievement indicators of competencies.

The Designing Step

In this step, the researchers prepared the prototype of the LMS. This stage produced a flowchart and a prototype (Himawan & Ariswan, 2021). The flowchart would be useful as the reference to design the LMS while the prototype contained figures of the developed LMS. This stage used the obtained data for producing the LMS. In the research design stage, the researchers promoted an FGD with the teachers to understand the expected criteria of the science-mathematics LMS. Then, the researchers arranged the research instruments, such as the product validity questionnaire, LMS quality questionnaire, and learners' responses. The applied questionnaire or validation sheet was useful to determine the validity of the developed product. The quality assessment questionnaire was useful to determine the product quality and the reliability of dissemination. Then, the questionnaire of learners' responses was useful to determine the learners' responses about the developed LMS. The researchers validated the instruments by involving experts in media, technology and information, learning, and physics. The researchers involved learning and physics experts and peer reviewers to determine the product quality. The questionnaire was a checklist to obtain the judgment of the reviewers (Setyosari, 2012).

The Developing Step

The developed product consisted of some parts. Login menu consisted of username, password, and institution. The username required the learner parent number for learners, the student parent number for students, and orn for teachers or lecturers. The users could use the website-lms if they had the admin to adjust the use so the users could access the LMS with the usernames, passwords, and institution origins.

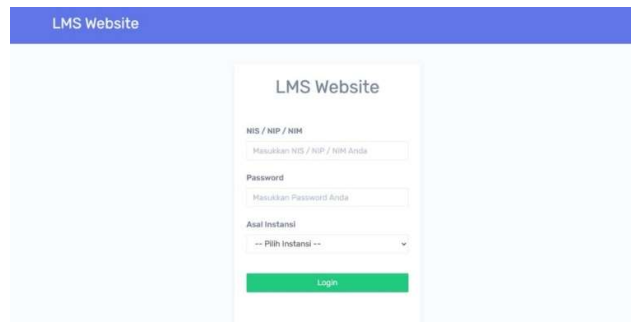


Figure 2. Login Menu

Figure 2 shows the login menu for teachers. This menu allows teachers to fill in and add materials, evaluations, and teaching materials.

Admin menu is useful to control all activities in the LMS. This menu grants the admin full access compared to teachers, lecturers, students, and learners. Figure 3 shows the admin menu display.

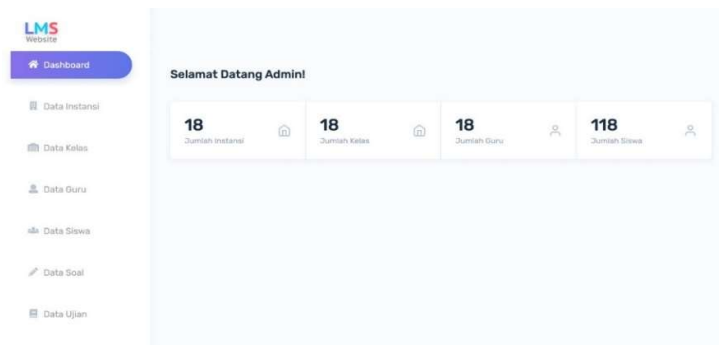


Figure 3. The Admin Menu

This menu consists of some parts, such as the institution data, the class data, the data of the teachers, the data of the teachers, the data of the learners, and the data menu of questions.

The institution data is useful to add and input the institution into LMS. Only the admin account could input the institution data. Figure 4 shows the institution data menu.

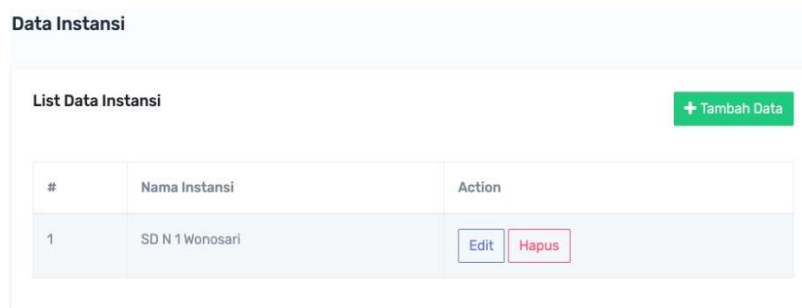


Figure 4. The Institution Data Menu

The class data is useful to add or input the class data into the LMS. It is shown in Figure 5. The class data consists of the institution and the class names where the teachers or lecturers teach.

Data Kelas

List Data Kelas + Tambah Data

#	Nama Instansi	Nama Kelas	Action
1	SD N 1 Wonosari	Kelas 10	Edit Hapus

Figure 5. The Class Menu

The data of the teachers is useful to add or input the data of the teachers into LMS. It is shown in Figure 6. The data of the teachers cover the ORN, names, institutions, and passwords. Only the admin could add the class data.

Data Guru

List Data Guru + Tambah Data

#	NIP	Nama	Nama Sekolah	Password	Action
1	12345	Yeni W	SD N 1 Wonosari	12345678	Reset Password Edit Hapus

Figure 6. The Data Menu

The data menu of the teachers could be added without being on the numbers of the teachers and the schools. Thus, the LMS could provide benefits for schools, teachers, and learners. Then, the data of the learners is useful to add or input the learners' data into the LMS. The data of the learners consist of the learner parent numbers, learners' names, institution names, and passwords. Only the admin could add the class data. It is shown in Figure 7.

Data Siswa

List Data Siswa + Tambah Data

#	NIS	Nama	Nama Sekolah	Password	Action
1	12345	Yeni W	SD N 1 Wonosari	12345678	Reset Password Edit Hapus

Figure 7. The Data Menu of Learners

The data menu of questions contains the question items of each material or sub-material. In this sub-menu, teachers can regulate the evaluation for each lesson and material.

For Teachers/Lecturers, it provides an account for every teacher and lecturer after being granted access by the admin. The question item data could be in the form of folders and sub-folders to facilitate question administration. It is shown in [Figure 8](#).

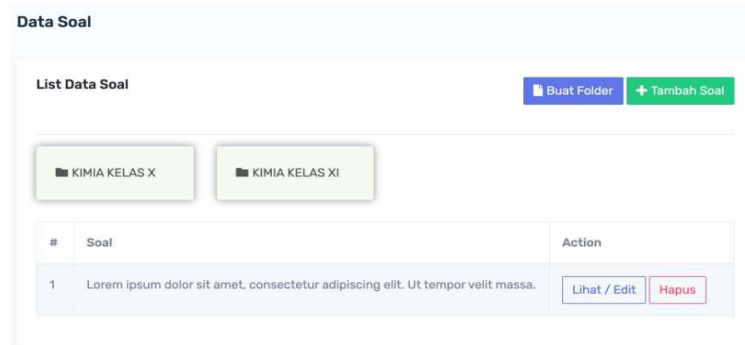


Figure 8. The Data Menu of Teachers and Lecturers

The data menu of the teachers includes Lesson/course. This sub-menu contains the class names of the teachers or lecturers and the access tokens for the class. The teachers and lecturers could add the class names or lessons into the LMS based on the lessons or courses. It is shown in [Figure 9](#).

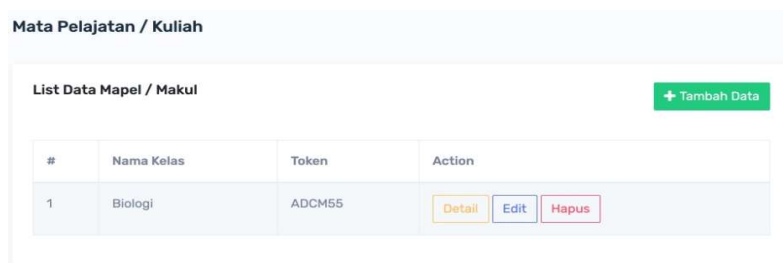


Figure 9. The Data Menu of the Lessons

The teachers could input the lesson materials into their accounts. It is shown in [Figure 10](#).



Figure 10. The Data Menu of the Course Description Entry

For Learners/Students, there is sub-menu that contains the visible lesson display for learners and students. The learners or students could find the materials and examinations given by the admin or the teachers. After working on the tests, the learners could direct find their scores in the LMS. Here is the menu shown in [Figure 11](#).

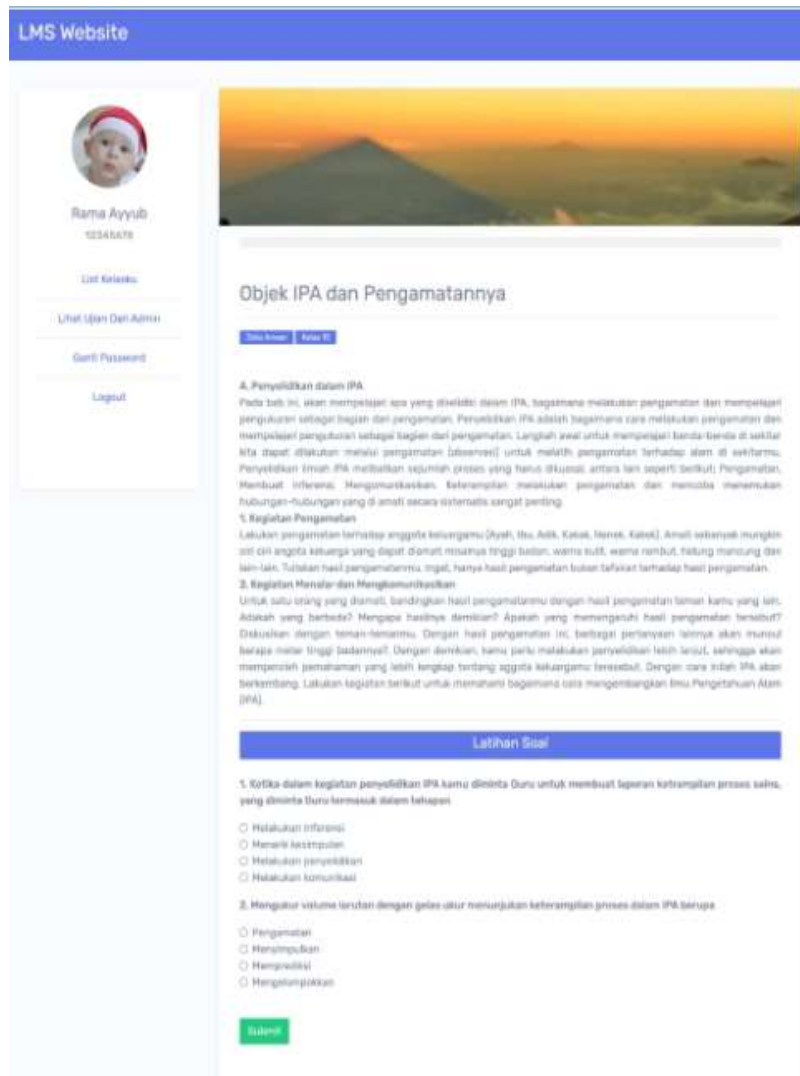


Figure 11. The Display of LMS Menu for the Learners

When the learners click the science object materials and observations, the display will be like in [Figure 11](#). The LMS could be used autonomously. The developed matters were orientation, problem formulation, hypothesis, data collection, data analysis, and conclusion.

The Developing Step

The product of this research had undergone some assessments by the experts, starting from science-mathematics teachers and peer-reviewers, before being deemed reliable. The product assessment also involved material and media experts. [Table 1](#) shows the assessment results.

Table 1. The Quality Assessment of the LMS by Media Experts

Aspects	The Highest Ideal Score	The Assessment Score Result	The Ideal Percentage	Quality
Content Reliability	40	35	87,5%	Very Excellent
Language	30	25	83,3 %	Very Excellent
Graphics	35	32	91,4%	Very Excellent
Operation	35	32	91,4 %	Very Excellent
Total	140	124	88,4 %	Very Excellent

The quality assessment of the LMS, based on the media expert, shows a higher mean in terms of the science-mathematics field. The media expert judged four aspects of the product, starting from the material reliability, language, graphics, and operational system. The expert deemed all aspects were very excellent with the obtained percentages between 83% and 93%. The highest aspect was material reliability with a percentage of 91.4% while the lowest aspect was the language with a percentage of 83.3%. The media expert stated that the product had very excellent quality with an ideal percentage of 88.4%.

The media expert also suggested the researchers apply consistent font size so that learners could use and read the LMS. In this case, the media expert focused on the display color of the LMS. The expert suggested making the color softer. The expert also suggested the researchers make a proportional text-to-button layout because the expert still found error buttons. The content quality result of the LMS from Material Expert Review is shown in [Table 2](#).

Table 2. Content Quality Result of the LMS (Material Expert Review)

Aspect	MS	TN	Average	Category
The content material of LMS	40	38 (95%)	89,5%	Very Excellent
Language and Communication of LMS	30	25 (83,3%)		
Visual of LMS	35	31 (88,5%)		
Function of LMS	35	32 (91,4%)		

Notes: MS: Maximum Score, TN: Total Number

The quality assessment is the average judgment of material experts within the field of science-mathematics lessons. The material expert judged the four aspects, starting from the material, language, graphics, and operational system. The expert deemed all aspects had very excellent quality with percentages between 83.3% and 95%. The highest percentage was the content or material aspect with an ideal percentage of 95% while the lowest aspect was the language with an ideal percentage of 83.3%. In general, the peer-reviewers explained the product had very excellent quality, with the ideal percentage of 89.5%.

The material experts suggested the researchers improve the font size adjustment to facilitate learners in reading the LMS. The peer reviewers also shared the same recommendations. The Peer-Review Assessment is shown in [Table 3](#). They suggested the researchers provide supporting activities for the materials based on the cognitive, affective, and psychomotor competencies. The peer reviewers also suggested the researchers put the content orderly and provide various activities so that learners would be motivated. After completing this quality assessment, the researchers revised and improved the product based on the recommendations.

Table 3. The Peer-Review Assessment

Aspects	MS	TN	Average	Category
The content material of LMS	40	38 (95%)	89,1%	Very Excellent
Language and Communication of LMS	30	24.5 (81,6%)		
Visual of LMS	35	32 (91,4%)		
Function of LMS	35	31 (88,6%)		

Notes: MS: Maximum Score, TN: Total Number

The quality assessment of the LMS was from the judgment of five peer-reviewers within the science-mathematics field. The assessment on four aspects, starting from the material, language, graphics, and operational system. The result deemed all aspects' qualities were very excellent with percentages between 81% and 95%. The highest aspect was the content validity with an ideal percentage of 95% while the lowest one was the language aspect with an ideal percentage of 81.6%. In general, the peer-reviewers explained the product had very excellent quality, with the ideal percentage of 89.1%.

The peer reviewers suggested the researchers keep the font size consistent so that learners could read the materials. The judgment of the peer reviewers was focused on the product designs, starting from the general display, button, font color, and activity variety to motivate learners to study. After completing this quality assessment, the researchers revised and improved the product based on the recommendations. The science and math teacher's validation result is shown in [Table 4](#).

Table 4. Science and Math Teacher's Validation Result

Aspect	MS	TN	Average	Category
The content material of LMS	40	34 (85%)	88,7%	Very Excellent
Language and Communication of LMS	30	27 (90%)		
Visual of LMS	35	31 (88,5%)		
Function of LMS	35	32 (91,4%)		

Notes: MS: Maximum Score, TN: Total Number

The quality assessment of the LMS is from the science-mathematics teachers. The peer-reviewers judged four aspects of the product, starting from the material reliability, language, graphics, and operational system. The expert deemed all aspects were very excellent with the obtained percentages between 85% and 91.4%. The highest aspect was material reliability with a percentage of 91.4% while the lowest aspect was the language with a percentage of 85%. In general, the peer-reviewers explained the product had very excellent quality, with an ideal percentage of 88.7%.

The teachers suggested the researchers keep the font size consistent so that learners could read the materials. The judgment of the peer reviewers was focused on the product designs, starting from the general display, button, font color, and activity variety to motivate learners to study. After completing this quality assessment, the researchers revised and improved the product based on the recommendations. [Table 5](#) shows the learners perceived the developed LMS as extremely excellent. For the learners, the material mastery was very excellent. The LMS design was also extremely excellent.

Table 5. Science and Math Students' Responses

Aspect	MS	TN	Average	Category
Interest	25	21 (84%)	82,4%	Very Excellent
Content Skill	25	19,8 (79,2%)		
Visual of LMS	10	8,2 (82%)		
Function of LMS	15	12,8 (85,33%)		

Notes: MS: Maximum Score, TN: Total Number

However, the learners argued that the operating system had both superiorities and shortcomings for further learning implementation. The superiorities of the LMS were: (1) the developed LMS had activities to observe the given phenomena via videos. This superiority made the learners attracted and participated properly. [Diani \(2015\)](#) and [Winda et al \(2017\)](#) also found that effective learning model development could improve the learners' competencies and activities. (2) the learners could train with the question exercise repeatedly in the online class with the randomized question system; (3) the question exercise provided feedback for both correct and incorrect answers; (4) the LMS provided conceptual mastery questions before being discussed in the online class; (5) the learners could access the LMS anytime and anywhere; (6) learners could review the learning materials anytime and anywhere; (7) teachers could discuss the learning in the Internet with messaging and discussion forum facility so that learners could be facilitated; (8) the LMS was efficient in terms of time, place, and cost; and (9) the LMS trained the learners to use Information, Technology, and Internet maximally.

Besides the superiorities, the LMS also had some shortcomings, such as (1) the LMS required an excellent Internet connection, (2) the researchers had not examined the effectiveness of the LMS, (3) the LMS might not be applicable for all Indonesia's regions due to the huge bandwidth requirement, (4) the LMS could only connect with a stable Internet connection, (5) the LMS did not have a validation system for the uploaded learning materials so that the materials might not be trustworthy, (6) the LMS might lower the social skills of the learners due to indirect interaction, (7) the limited learning model included the discussion forum so that the materials, such as practical materials, might not be delivered excellently; and (8) teachers and learners might not be habituated to use the LMS and got hindered to learn.

CONCLUSION

This research successfully determined the learners' responses toward the developed LMS for science-mathematics lessons at the school as the online learning solution amid COVID-19. The model consists of four primary steps: defining, planning, developing, and disseminating. Based on the 4D model, the research results showed that the developed product was very excellent. The obtained result from the material expert was 89.5%, the media expert 88.4%, the peer-review with 89.1%, and the science-mathematics teachers with 88.7%. Then, the total mean was 88.9%, categorized as extremely excellent. The learners also found the product quality was extremely excellent with an ideal percentage of 82.4%. Therefore, the LMS was reliable for further online learning implementation.

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