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Analysis of the UtilizationUtilization of a Learning Management System Based on the Independent Curriculum in Physics Education at Sikka Coastal Schools

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Abstract

Online learning has emerged as a dominant trend since the onset of the COVID-19 pandemic, leading to significant changes in the educational landscape. Numerous studies have examined using learning management systems (LMS) in educational settings. However, few have addressed the urgency of implementing LMS and the specific challenges coastal schools face. To explore these challenges, the researcher conducted a qualitative, descriptive study to analyze the use of LMS, focusing on a case study of high schools in Sikka Regency. The study involved nine schools, namely SMAN Pemana, MAS Nurwahid Gunung Sari, MAS Muhammadiyah Nangahure, MAS At-Taqwa Beru, SMA Muhammadiyah Maumere, SMAN Magepanda, SMA 1 Talibura, SMKN Talibura, and SMAN 1 Waigete. Data were collected through interviews with nine physics teachers. The research data were then analyzed using NVivo software to obtain quantitative percentages. The findings indicated that all participating schools utilized LMS, with the majority adopting Google Classroom. However, the most significant challenge identified was internet connectivity, with over 50% of the schools acknowledging this issue. Additionally, many students lacked smartphone access, particularly at MAS Muhammadiyah Nangahure, where nearly 2% of students did not own a smartphone, compared to approximately 5% at similar schools. Other challenges included the lack of internet data and limited understanding of technology among students. The most common concern reported by schools was the inflexibility of LMS platforms, particularly concerning their dependence on internet connectivity. For instance, SMAN Pemana noted a 4.8% incidence of issues related to the LMS they were using. Given these obstacles, many schools have turned to alternative solutions to support online learning, such as WhatsApp Groups, which 80% of the schools employ.

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INTRODUCTION

Digital-based learning has gained significant popularity in educational settings due to recent advances in information and communication technology (ICT) (Alfalah, 2023; Baryanto et al., 2023; Kharismatunisa, 2023). This is evident in the increasing number of schools in Indonesia adopting technology in their educational practices (Koten et al., 2022; Mishra et al., 2023). According to the research by (Al-Ghurbani et al., 2022; Haleem et al., 2022), integrating technology and digital systems in education has become a critical component of teaching and learning, facilitating greater student success and enhancing operational efficiency. Since the onset of the COVID-19 pandemic, the role of technology in online learning has continued to evolve (Efastri & Islami, 2021; Camilleri & Camilleri, 2022). This advancement is exemplified by the widespread adoption of Learning Management Systems (LMS), which now serve approximately 14.2% of global users (Mpungose, 2020). The widespread use of LMS has had a profound impact on educational practices worldwide, including in the Sikka region of Nusa Tenggara Timur (NTT), where LMS integration has contributed positively to student satisfaction and has implications for the future of educational technology (Chuenyindee et al., 2022; Mohd Nasir et al., 2021).

Studies indicate that using Learning Management Systems (LMS) offers significant flexibility, as students can access lessons anytime and from anywhere (Hikmatiar et al., 2020; Sahlan et al., 2023; Sher et al., 2022). Chang et al. (2022) found that adopting LMS in higher education improved academic performance. Similarly, Mpungose and Khoza (2022) highlighted that LMS is increasingly utilized in formal learning environments to meet the specific needs of various subject disciplines, including physics education. However, Al-thresher (2022) noted that teachers require extensive training, encouragement, and support to transition toward more advanced pedagogies and effectively engage in online collaboration. One significant obstacle to using LMS, as identified by Ikhsan et al. (2023), is the limited availability of internet infrastructure in certain regions. Challenges in implementing online learning extend beyond internet infrastructure to include issues with the LMS, which serves as the primary medium for two-way communication between teachers and students. Veluvali and Surisetti (2022) further identified several barriers to LMS usage, including subpar presentation of learning materials, insufficient peer involvement, difficulty understanding content, and limited understanding of navigating the system's features. While several studies have focused on the role of LMS in enhancing student cognition, few have addressed the practical challenges associated with its use and potential solutions. Notably, recent studies have begun to explore the specific challenges and solutions related to LMS usage in coastal areas. This study aims to analyze the use of LMS in coastal schools, focusing on the LMS platforms employed, the obstacles frequently encountered, and potential solutions to these challenges.

Coastal schools are educational institutions located along coastal areas, where students and teachers are typically residents of the region (Hikmatiar et al., 2023). The introduction of the Independent Curriculum has led to an expectation that students across the country meet standardized educational outcomes (Farizi et al., 2024). However, this presents particular challenges for teachers and students in coastal schools, who often face low levels of ICT literacy and unstable internet connectivity (Adhani & Nazurrail, 2022; Akmad, 2024). Research by Taufik et al. (2023) and Febrianto et al. (2022) indicates that the uneven adoption of digital technology in coastal schools has resulted in significant disparities in teacher competencies, leading to a knowledge gap compared to other regions. These challenges directly affect the achievement of learning objectives (Natsir et al., 2021; Wei et al., 2023). In response, it is crucial to examine how LMS are applied in these schools, identify the obstacles they face, and explore the strategies employed by coastal schools to address these issues.

Based on prior research, it has been concluded that existing studies do not fully address the specific challenges coastal schools face, particularly in using LMS. Furthermore, these

studies have not adequately explored the issues related to LMS usage in these schools. In light of this gap, the researcher has chosen to investigate the application of LMS within the framework of the Independent Curriculum, focusing on equalizing educational opportunities through the use of LMS technology in coastal areas of Sikka Regency. The primary aim of this study is to examine the extent to which LMS, as part of the Independent Curriculum, is implemented in physics education in coastal schools in Sikka Regency. Through this exploration, the study seeks to identify strategies for overcoming challenges and supporting the equitable use of LMS in schools with limited facilities and infrastructure. Specifically, the study will focus on how LMS is utilized in physics instruction in the context of independent learning, as well as the obstacles faced and the solutions implemented by these schools.

METHODS

The qualitative descriptive study aimed to analyze the use of LMS deeply through a case study method at high schools in coastal areas of Sikka. The research data were divided into two types: secondary data and primary data. Secondary data were obtained from previous research through a literature review on the general use of LMS in education. Primary data were collected through interviews with physics teachers, who served as respondents from coastal schools in the Sikka region. According to Mpungose & Khoza (2022), the quantitative descriptive research method was used to describe a phenomenon, event, symptom, or incident that occurred in a factual, systematic, and accurate manner.

Data collection was conducted through interviews, which included several indicators representing the issues to be studied. These indicators were: 1) Description of coastal school learning, 2) UtilizationUtilization of technology, 3) Technology readiness, 4) Description of the educational environment, and 5) Problem-solving. The target schools for data collection consisted of nine schools across six sub-districts in Sikka. Although there were more than nine high schools in the area, this study focused on the nine schools that were categorized as coastal. The sub-districts where the research was conducted included Alok, West Alok, East Alok, Magepanda, Talibura, and Waigete. The nine schools involved in the study were: SMAN Pemana, MAS Nurwahid Gunung Sari, MAS Muhammadiyah Nangahure, MAS At-Taqwa Beru, SMA Muhammadiyah Maumere, SMAN Magepanda, SMA 1 Talibura, SMKN Talibura, and SMAN 1 Waigete. A description of the locations of the research schools can be seen in Figure 1.

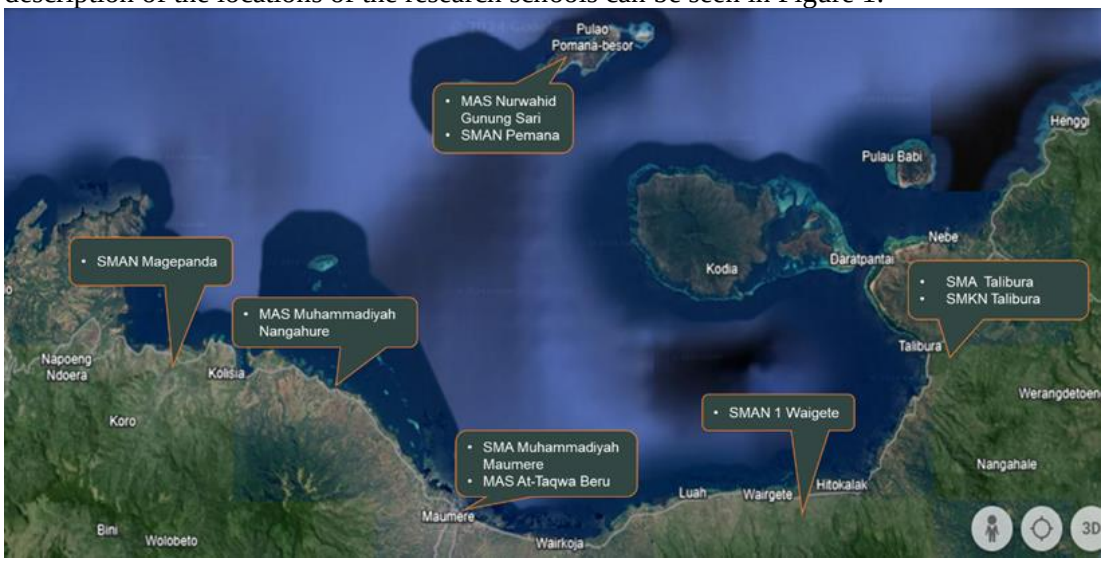

Figure 1 Location of the research school

The study's respondents were physics teachers from nine high schools in the coastal area. Nine respondents participated in the study, each from one of the selected schools. Data was collected through direct interviews with the nine respondents, one from each school. During the interviews, the respondents were asked questions about using LMS at their respective schools, their obstacles, and the solutions they implemented to address these challenges.

Data analysis for the research was carried out using Microsoft Excel, which facilitated data organization into thematic categories. Additionally, NVivo software was employed to help visualize and present the research data. The results of the data analysis provided insights into the use of Learning Management Systems (LMS) based on the Independent Curriculum in physics education, particularly in coastal schools. This research was conducted at the school level, as it aimed to describe the challenges associated with using LMS, which were influenced by various factors, including human resources, school facilities, and infrastructure. The study's findings were intended to identify which LMS platforms are most suitable for use in areas with similar conditions, particularly for physics education in the context of the Independent Curriculum.

Figure 2 illustrates the flow of the research method for analyzing LMS usage in coastal schools in Sikka District.

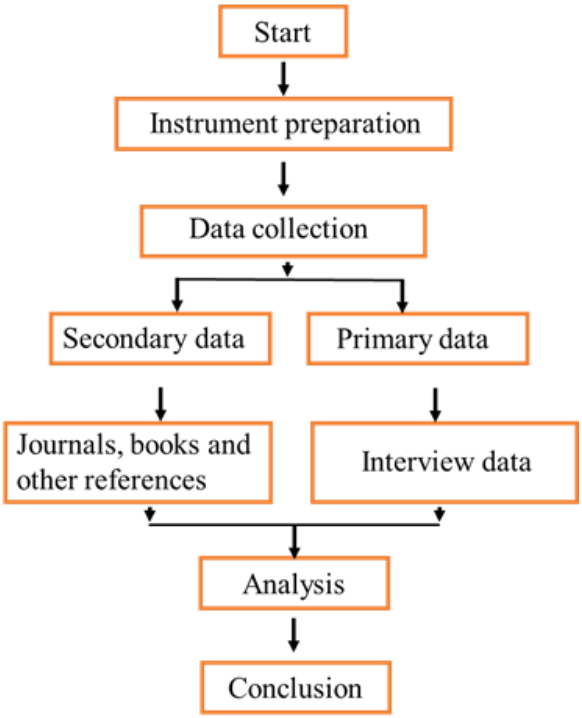

Figure 2 Research flow

RESULTS AND DISCUSSION

The study was conducted in coastal schools, with 13 respondents, including two physics teachers from each of the nine research schools, who were willing to participate in interviews. The research data were presented through indicators derived from the interview instrument administered by the researcher. The research results presented various aspects, including coastal school learning, the utilization of technology, technological readiness, the educational environment, and problem-solving strategies.

Coastal School Learning Overview

The schools targeted by the research were primarily located along the coast of Sikka Regency. The selection of respondents was explicitly limited to physics teachers at these schools who were willing to participate in interviews. While the coastal schools targeted by the research varied in distance from the coast, all nine schools involved were still classified as coastal schools.

The learning conditions in the nine schools had diverse backgrounds, which could be attributed to the varying statuses of the schools, including both public and private institutions. The results of the interviews indicated that most schools were relatively new to implementing the Independent Curriculum. Despite this, these coastal schools frequently used LMS in physics learning, allowing teachers and students to become familiar with the system and its functions. Of the nine schools, only five—SMAN 1 Talibura, SMAN Magepanda, SMAN Pemana, SMA Muhammadiyah Maumere, and MAS Nurwahid Gunung Sari—routinely implemented LMS in their learning practices. The percentage of schools using LMS regularly is shown in Figure 3.

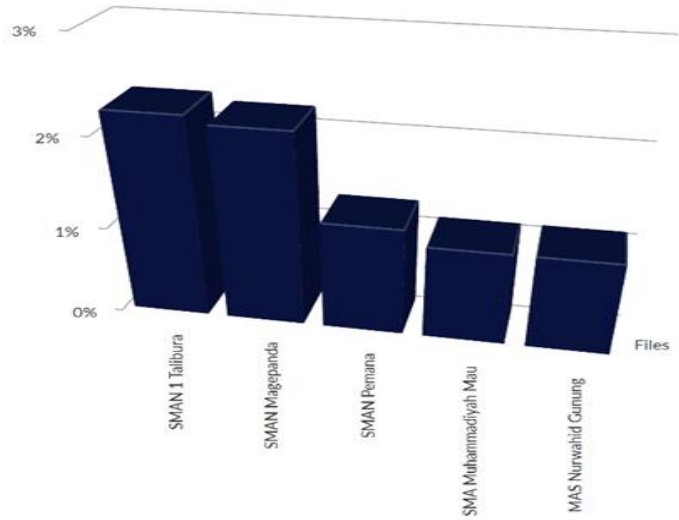

Figure 3 Percentage of schools with regular use of LMS

Figure 3 shows that, of the nine schools in coastal areas, more than half regularly used LMS in their learning, while the remaining schools used LMS but not regularly. Geographically, the five schools that implemented LMS regularly were located in diverse areas, including islands and urban coastal regions. The most significant obstacle faced by these schools in online learning was primarily related to the internet network in the area. This issue was confirmed by all physics teachers in the coastal schools, as reflected in the interview responses when they were asked about the causes of challenges in online learning. Four schools, in particular, struggled to apply LMS routinely in their learning due to limited internet access.

"*The most common problem we encounter in online learning is the internet network.*"
(Data from interviews with all respondents)

Schools encountered another challenge in online learning besides internet-related issues: the LMS. While most students were familiar with LMS, some still experienced difficulties using it. After confirmation with the teachers, it was found that this issue arose from using multiple LMS platforms. This problem was confirmed by SMAN Pemana, which faced difficulties similar to those of six other schools. Only two schools reported that using LMS was not a contributing factor to the problems in online learning. These schools were SMAN Magepanda and SMA Muhammadiyah Maumere. The percentage of these two schools in addressing these issues is shown in Figure 4.

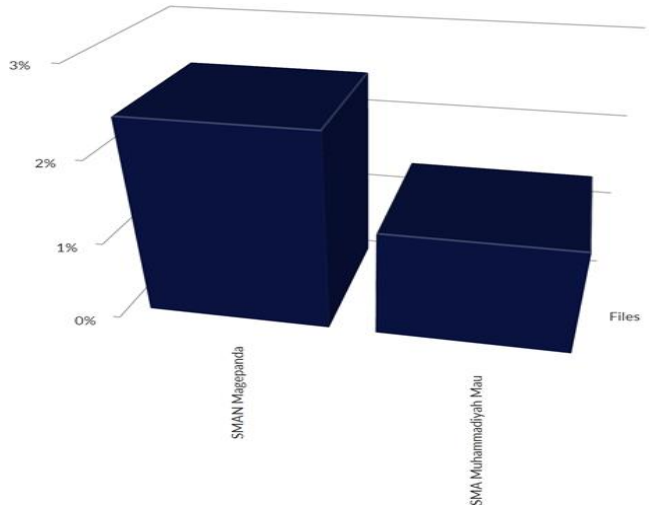

Figure 4 Percentage of schools that consider LMS not a problem of online learning

Based on Figure 4, only two schools agreed that LMS was not an obstacle to online learning. In contrast, the other seven schools held the opposite view, citing several factors as the cause. These included insufficient school human resources and issues related to internet connectivity at the schools.

UtilizationUtilization of Technology

The application of LMS in online learning helps improve education quality. In addition, it makes it easier for teachers to monitor students' progress and enhances the productivity of the learning process. This sentiment was shared by all research respondents, except for those from SMKN Talibura, who directly stated that learning through LMS did not improve the quality of education.

"*The online learning we have implemented using LMS has not improved the quality of our students' learning.*"

(Results of interviews with respondents at SMKN Talibura)

The use of LMS that is not implemented routinely will indeed make it difficult to observe tangible results, especially in terms of improving the quality of learning in schools (Allam et al., 2024; Lutfi, 2022). This is particularly true for schools with the lowest frequency of LMS usage in online learning. Nevertheless, the use of LMS is recognized by all coastal schools as a valuable tool to help ease the teaching burden. Research by (Asamoah, 2021; Kurniawan et al., 2023) This view is also supported by the evidence that LMS can facilitate learning activities and lighten teachers' workloads. Although many schools, such as SMKN Talibura, SMAN Waigete, and MA Muhammadiyah Nangahure, do not prioritize LMS as a primary medium for online learning, other schools consider it a priority. The percentage of schools prioritizing LMS in learning can be seen in Figure 5.

Based on Figure 5, the largest percentage of schools prioritizing LMS in online learning was SMAN Magepanda, at 2.43%. In contrast, the school with the smallest percentage, at 1.17%, was MAS Nurwahid Gunung Sari. However, three of the nine schools did not prioritize LMS due to pressing factors. These schools faced significant obstacles in using LMS for learning, including issues related to learning effectiveness, internet connectivity, technology proficiency, and students' limited access to technology.

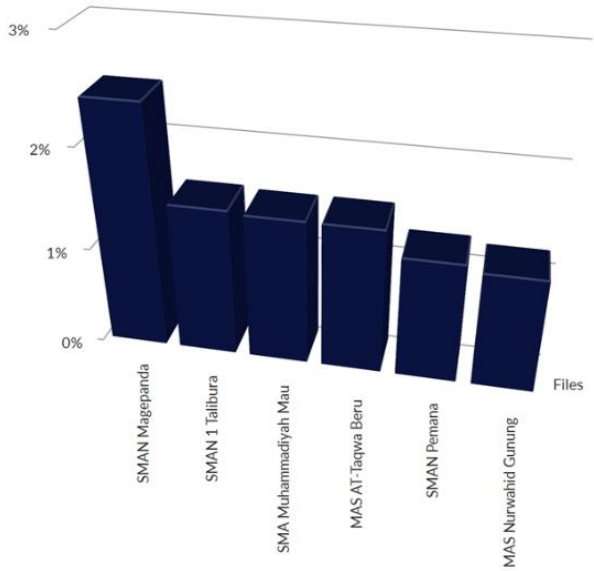

Figure 5 Percentage of schools with the assumption that LMS is a learning priority

Technology Readiness

In general, the LMS used by schools has an attractive design, is easy to access, and is engaging for students. However, in online learning, not all schools fully support the teaching and learning process, including covering the costs of internet packages for both teachers and students and providing necessary technology. The extent to which schools facilitate these aspects can be seen in Figure 6.

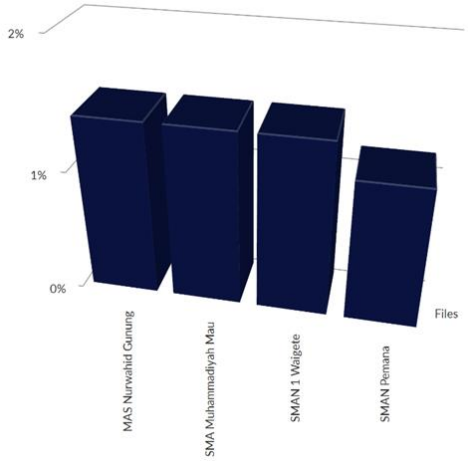

Figure 6 Schools that have not yet facilitated technology and the internet

Four schools faced this issue: SMAN Pemana, SMAN 1 Waigete, MAS Nurwahid Gunung Sari, and SMA Muhammadiyah Maumere. This difficulty made it challenging for students to access the internet outside the school environment. According to research by Surbakti et al. (2021), one of the main factors affecting online learning was the limited availability of internet networks, which often led to communication issues and miscommunication. However, based on the interview results, students were generally able to access learning technology in the school environment. Additionally, the LMS used was relatively easy to follow and met the needs of online learning. The interview findings indicated no significant obstacles to technological readiness for online learning.

Overview of Educational Environment

The coastal schools selected as research subjects were located close to the coast. Several of these schools have provided their teachers with training on using LMS. In implementing LMS as a learning medium, schools encountered obstacles, mainly because not all students had access to technology, such as smartphones, let alone laptops. The percentages of schools facing these challenges can be seen in Figure 7.

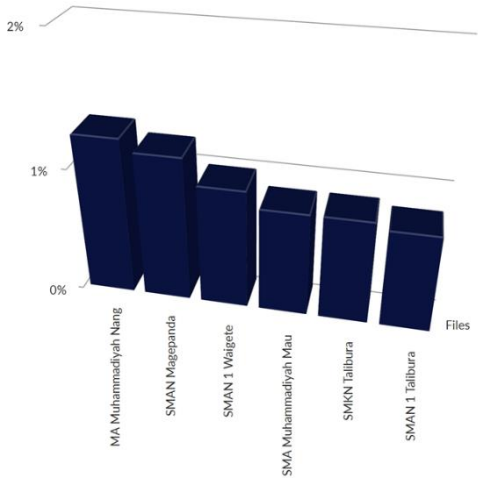

Figure 7 Percentage of schools with teachers and students who do not have smartphones

The schools depicted show that MA Muhammadiyah Nangahure had the largest percentage of schools facing problems related to students and teachers who did not have smartphones. In response to this issue, most teachers at the school divided students into groups, combining those who lacked technology with those who had access to it. However, another obstacle was that not all students lived in areas with reliable internet access. Although students could accept LMS as an online learning medium, the challenges they faced were a significant reason for schools to reconsider the implementation of LMS in online learning.

"*As all students are happy, so are the teachers with the implementation of online learning using LMS, but the network around them does not support it*," explained the physics teacher at MAS Nurwahid.

Students had to find a place with a stable network for online learning to proceed as planned. This challenge was experienced by almost all the teachers who were interviewed, including a teacher from MAS Nurwahid Gunung Sari. The Gunung Sari area's network conditions were significantly worse than those in other regions. Students had to walk to locations with better network coverage to participate in online learning with their peers. The percentages of schools facing poor internet access can be seen in Figure 8.

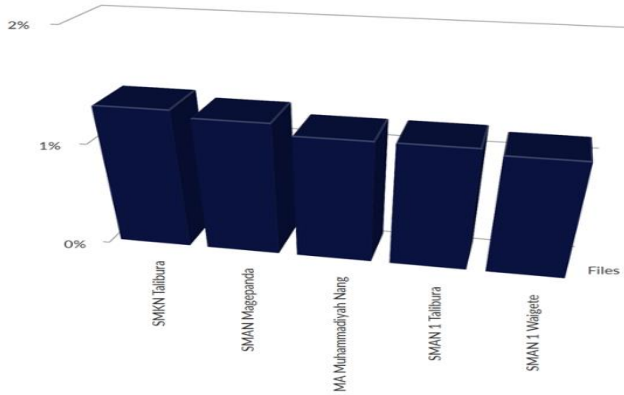

Figure 8 Percentage of schools with poor internet quality

Figure 8 shows the percentage of the five schools with poor internet access was almost the same. Some of these schools were located in coastal urban areas. In contrast, the other four schools reported that internet access around their schools was generally good.

Problem-Solving

All coastal schools shared the same response regarding using LMS, which was seen as a tool that made it easier to address challenges in online learning (Akaadom et al., 2024; Hamidy et al., 2021). Although only a few schools agreed that using LMS aligned with the student's learning culture, many teachers provided continuous training to help students effectively use LMS. Considering the background of students in coastal areas, it was clear that this was not necessarily a benchmark for determining the cultural compatibility of students with LMS. Essentially, LMS was designed to be accessible to anyone desiring to use it, regardless of their available devices—such as smartphones, computers, and others—(Nina et al., 2022).

The question in the problem-solving indicator that received the most rejection in teacher responses was the issue of using LMS easily and flexibly, even when the internet was weak and unstable. The reality conveyed by the respondents indicated that the LMS did not effectively help students address their learning challenges. This was reflected in using alternative media, such as WhatsApp, as a substitute for LMS in online learning at school. The percentages are shown in Figure 9.

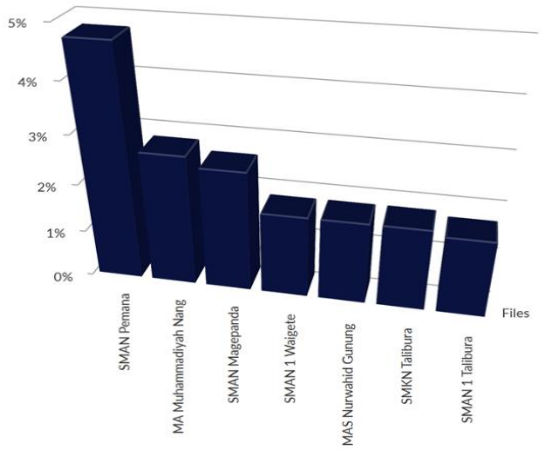

Figure 9 Percentage of schools that consider LMS not flexible

Based on Figure 9, it can be seen that SMAN Pemana faced the most significant issues related to the flexibility of LMS use. This was largely due to the internet network, which hindered the effective use of LMS whenever connectivity was problematic. As a result, many schools disagreed with the statement regarding the flexibility of LMS. In contrast, two other schools, SMA Muhammadiyah Maumere, and MA At-Taqwa, reported no issues with the LMS used. This, of course, depended on the users' perspective. What was found was that these two schools were particularly responsive to the challenges they faced when using LMS.

Table 1 presents research results from physics teachers in the nine coastal schools in the Sikka district.

Table 1 Summary of interview results for each school regarding the use of LMS

School	LMS Used By Schools	Other Alternatives	Barriers to LMS Usage	Solution
SMAN Pemana	Google Classroom	-	Technological media and internet access (data credits) are limited.	Returning to face-to-face learning.
MAS Nurwahid Gunug Sari	Google Classroom, E-Learning Madrasah, Moodle,	WhatsApp Group	There are significant constraints regarding internet access, and schools do not provide internet connectivity.	Using WhatsApp Group and group study.
SMAN 1 Waigete	Google Classroom	WhatsApp Group	Students face challenges accessing the internet outside of school, with many not owning cell phones.	Using WhatsApp Group as a medium for collecting assignments.
MA At-taqwa Maumere	Google Classroom with Canva	-	Not all students have access to cell phones, and many experience difficulties with internet connectivity.	Continuing learning through the available LMS.
SMAN Magepanda	Google Classroom	WhatsApp Group	Students encounter difficulties with network access when returning home and face challenges related to internet data usage.	Sharing learning materials in WhatsApp Groups, with schools facilitating student data credits.
SMA 1 Talibura	-	CBT and Google Form	Internet access constraints and the economic situation of students' families hinder their ability to participate in online learning.	Using WhatsApp Group to form groups that unite students with smartphones with those who do not.
SMKN Talibura	Google Classroom with Canva	WhatsApp Group	Network access is problematic, and not all students have access to cell phones.	Conducting training for students and facilitating learning through WhatsApp Groups.
MA Muhammadiyah Nangahure	E-Learning Madrasah, Moodle, LMS Desktop	WhatsApp Group, Zoom Meeting	Unstable internet connections affect the reliability of online learning, and extra hours are sometimes required for completion. The LMS is primarily used during exams.	Distributing Chromebooks to students who do not have smartphones.
SMA Muhammadiyah Maumere	Google Classroom, Chandy CBT	WhatsApp Group	The network connection is unstable; there is a lack of data credits, and not all students can access cell phones.	Returning to face-to-face learning.

As shown in Table 1, the study's results indicated that online learning in coastal schools in the Sikka area was significantly influenced by infrastructure and technological constraints. These challenges were evident in implementing the Learning Management System (LMS), which faced major issues such as unstable and limited internet access and inadequate availability of technological devices among students. These constraints hindered the effectiveness of online learning and forced schools to seek alternative solutions. For instance, using WhatsApp Groups as an additional learning platform demonstrated a flexible adaptation to technological limitations. WhatsApp Groups proved effective in delivering materials and collecting assignments, although they did not fully replace the functions of a formal LMS (Ningsih et al., 2021).

Although several challenges were encountered in implementing LMS in education, some schools have implemented solutions such as data credit sharing and the provision of devices, including Chromebooks. These efforts represented significant steps toward addressing accessibility issues and ensuring students could consistently access learning materials despite technological limitations. However, some schools, such as SMA 1 Talibura, lacked specific solutions for internet access and economic challenges, highlighting the need for additional strategies to ensure all students could engage in online learning. Such strategies include collaborating with external organizations to improve infrastructure or providing economic support to students' families.

Overall, although the LMS based on the Independent Curriculum offered significant potential to enhance learning, the challenges faced by coastal schools highlighted the need for a more holistic approach to improving both access to and the quality of education. Improved infrastructure, the provision of devices, and economic support were identified as key factors for the successful implementation of LMS in less developed areas. The alternatives implemented by schools in coastal regions served as potential solutions for other institutions facing similar challenges in online learning through LMS. One of the most commonly adopted solutions among these schools was using WhatsApp Groups as a substitute for LMS in learning. This approach was implemented to maintain consistency with the ongoing shift to online learning.

CONCLUSION

With the demands of fast-paced learning supported by technology, all schools were disciplined in utilizing technology for educational purposes. One key application of technology in learning was using LMS in online education. This approach was implemented in schools across the coastal areas of Sikka Regency, as observed in the nine schools that served as the targets of the study.

In general, the nine schools involved in the study had used LMS for school learning. However, the frequency of its use varied according to the specific needs of each institution. While most schools regularly used LMS, others used it less frequently. The variation in LMS usage was due to particular reasons identified during the study. The study demonstrated that, although using LMS based on the Merdeka Curriculum presented opportunities to enhance both access to and the quality of education, various infrastructural and technological constraints in coastal schools in Sikka affected its overall effectiveness. Notably, issues related to internet access and technological devices were significant obstacles. Schools such as MAS Nurwahid Gunung Sari, SMA Muhammadiyah Maumere, and SMAN 1 Waigete reported similar challenges, with approximately 1.5% of the surveyed schools facing these problems. Consequently, practical solutions, such as using WhatsApp Groups and shared data credits, were implemented in these schools, with 80% of the sample schools adopting these measures. Another solution involved providing students with the tools necessary to engage in online learning via LMS, which is essential for fostering effective learning. To address the technological gap faced by students, many

schools provided Chromebooks, a measure that was taken by over 50% of the schools experiencing such technological deficiencies.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS STATEMENT

During the research, a division of tasks was designed to facilitate researchers' project completion. The tasks were divided into several stages, along with those responsible. HH and ZAF carried out conceptualization. AJ and BH carried out the methodology fully. HH and N were involved in data analysis and drawing conclusions, which were carried out with the involvement of NVivo. Jayadin is responsible for documenting and completing research instruments.

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