IIETA International Information and Engineering Technology Association
Advancing the World of Information and Engineering

Ingénierie des Systèmes d'Information
Vol. 30, No. 3, March, 2025, pp. 731-744
Journal homepage: http://iieta.org/journals/isi

Revitalizing Pastoral Care: Leveraging Stupa Learning Management System in Diocese of Maumere

Gabriel Rolly Davinsi[1*], Harco Leslie Hendric Spit Warnars[2], Maybin Muyeba[3]

[1] Computer Science Department, BINUS Graduate Program-Master of Computer Science, Bina Nusantara University, Jakarta 11480, Indonesia
[2] Computer Science Department, BINUS Graduate Program - Doctor of Computer Science, Bina Nusantara University, Jakarta 11480, Indonesia
[3] School of Science, Engineering & Environment, University of Salford, Manchester M5 4WT, United Kingdom

Corresponding Author Email: gabriel.davinsi@binus.ac.id

https://doi.org/10.18280/isi.300317

Received: 28 November 2024
Revised: 23 January 2025
Accepted: 27 March 2025
Available online: 31 March 2025

Keywords:
learning management system, Moodle, e-learning, digital technology, pastoral education, catholic church, Diocese of Maumere

ABSTRACT

The Catholic Church of the Diocese of Maumere is developing a learning management system (LMS) for its pastoral training program called the Weekend Pastoral Study, which is also abbreviated in Indonesian as Stupa. The aim of this LMS development is to enhance access and flexibility in pastoral education. Utilizing Design science research methodology (DSRM), the LMS was designed and developed using the Moodle platform along with various technologies such as PHP, MariaDB with MySQLi extension, HTML, CSS, and JavaScript. The performance of the Stupa LMS was evaluated through Black Box Testing based on ISO 25010 standards, focusing on pastoral ministers as the end users. The research findings indicate that this LMS has the potential to enrich spiritual experiences and enhance the effectiveness of learning for pastoral ministers at Diocese of Maumere, helping the Catholic Church address challenges in the digital era.

1. INTRODUCTION

The rapid development of information technology, particularly during the Covid-19 pandemic, has prompted various institutions, including the Catholic Church, to adapt [1, 2]. The Diocese of Maumere, through the Pastoral Center, is striving to implement technology to support the execution of pastoral programs, one of which is the Stupa program. This program was designed as a response to issues identified during the First and Second Synods, which have been ongoing since 2012. The primary challenge faced is the low quality of pastoral ministers in terms of knowledge, skills, and commitment, resulting from the lack of continuous pastoral guidance and low motivation to learn. Whereas, as seen in the basic pastoral scheme of the Diocese of Maumere in Figure 1, the empowerment of pastoral ministers plays a crucial role in integrating religious teachings and values into communal life. Pastoral ministers activate and strengthen networks within the community, raise social awareness and liturgical participation, and reinforce the pastoral organizational structure. They also play a vital role in guiding the community to adapt and remain resilient in the face of changing times, ensuring that the community remains relevant and responsive to social and political challenges, down to the smallest unit within the church structure, the Ecclesial Basic Communities (KBG).

Since 2019, Stupa has aimed to enhance the capacity of pastoral ministers in terms of their knowledge, skills, and commitment, making them more competent in fulfilling their duties. The program focuses on creating reliable ministers in various areas of service, as well as administrators capable of managing services efficiently. The empowerment of pastoral ministers and organizational development is expected to serve as a foundation for community empowerment, in order to achieve the Diocese of Maumere's vision as a faithful, prosperous, solidary, and liberating community in the light of God's word [3]. As highlighted in Lumen Gentium's teachings, Stupa is expected to respond to current pastoral issues comprehensively and compassionately while helping fulfil the Catholic faithful's calling to serve as priests, prophets, and kings [4].

Stupa's implementation is not without its difficulties. The challenges identified included long distances, difficult pastoral terrain, limited number of participants that could be reached, differences in parish capacity to support participants, and scheduling conflicts between Stupa programs and community or personal activities. The urgency of this research lies in the fact that, to date, the Diocese of Maumere has not yet had a widely accessible digital-based pastoral learning model for pastoral ministers. This LMS is not merely a technological innovation but also a response to the pressing need for more flexible and sustainable learning methods. With this system, the Church can reach more pastoral ministers without physical or geographical barriers, ensuring that every individual has an equal opportunity to receive quality faith formation.

Therefore, this study aims to develop an LMS. Thus, the faith of the community will be strengthened and pastoral care in the Diocese of Maumere is expected to be more effective, and its pastoral servants can continue to learn about church

doctrine and teachings in the digital era with the help of the Stupa LMS. In general, the main focus of the development of this LMS is to create a system that facilitates interaction between learners (pastoral servants) and facilitators (instructors). In addition, this study explores how the LMS can be integrated with existing systems in the Diocese of Maumere. The existing integration will further increase the accessibility and effectiveness of pastoral education. Meanwhile, the LMS trial involved stakeholders such as the Pastoral Center of the Diocese of Maumere and pastoral servants. This is to ensure that the system is in line with church needs.

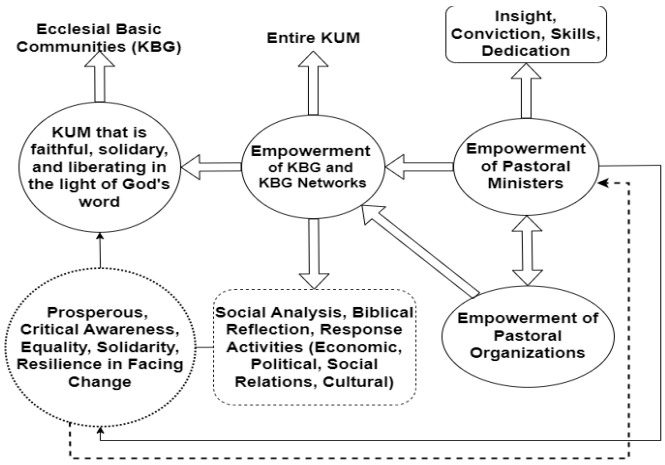

Figure 1. Basic pastoral scheme of the Diocese of Maumere [3]

The application of technology has been carried out in the Catholic Church environment. The aim is to improve service, administration, and spiritual experience. Before the COVID-19 pandemic, the Church used parish and diocesan websites to share information and interact with the congregation. In the Diocese of Jakarta, for example, the BIDUK platform is used to facilitate data-based administration. In the Philippines, the Liturgical Planner app helps the clergy manage the liturgical calendar and administration [5]. Ancient churches in Romania have already been using web portals with VR for their spiritual tours [6]. The Notre-Dame Cathedral in Paris offers virtual tours using VR after the fire. In Europe, several cathedrals use AR, VR, and AI to enrich visitors' experiences [7]. In Spain, a mobile application is being developed for Gothic cathedrals to facilitate access to cultural and architectural heritage. This technology expands access and enhances the spiritual and cultural experience of the faithful [8].

From the results of the Systematic Literature Review (SLR), although various dioceses have implemented technology for administrative management and communication, very few utilize an LMS as a digital-based pastoral learning platform. This further reinforces the urgency of this research, as the LMS Stupa is not merely an administrative support tool but also a learning platform that provides pastoral ministers with the opportunity to receive more systematic and sustainable education.

Moodle was chosen for the Stupa LMS program out of a number of LMS platforms because it provides a solution that satisfies the requirements of this program at Diocese of Maumere [9]. This study uses the DSRM. DSRM has six stages, namely identifying problems, determining solution objectives, designing and developing, demonstrating, evaluating, and communicating results. This methodology is also a structured approach that ensures that LMS development is truly responsive to the church's needs in general and pastoral minister at Diocese of Maumere in particular. The presence of this LMS also signifies that the Catholic Church is entering a new era of digital-based faith formation. By providing a widely accessible platform, LMS Stupa not only helps overcome geographical barriers in pastoral learning but also strengthens the continuity of faith education that is community-based and oriented toward sustainable development.

2. METHOD

The implementation of this research uses the DSRM or Design Science Research (DSRM) method. DSRM was first proposed by Peffers, Tuunanen, and colleagues in 2008 [10]. This model was later adapted by Jan vom Brocke, Alexander Maedche, and Alan Hevner, offering four possible entry points: problem-centered initiation, objective-centered solution, initiation-centered design and development, and client- or context-centered initiation [11]. The DSRM model is used to facilitate research by identifying specific problems, defining solution objectives, creating a model, demonstrating its use, evaluating the solution, and communicating the results to stakeholders. This helps create an innovative model that can solve real-world problems with impactful innovation. This adapted model is applied in this study, as shown in the research process techniques and methods diagram in Figure 2.

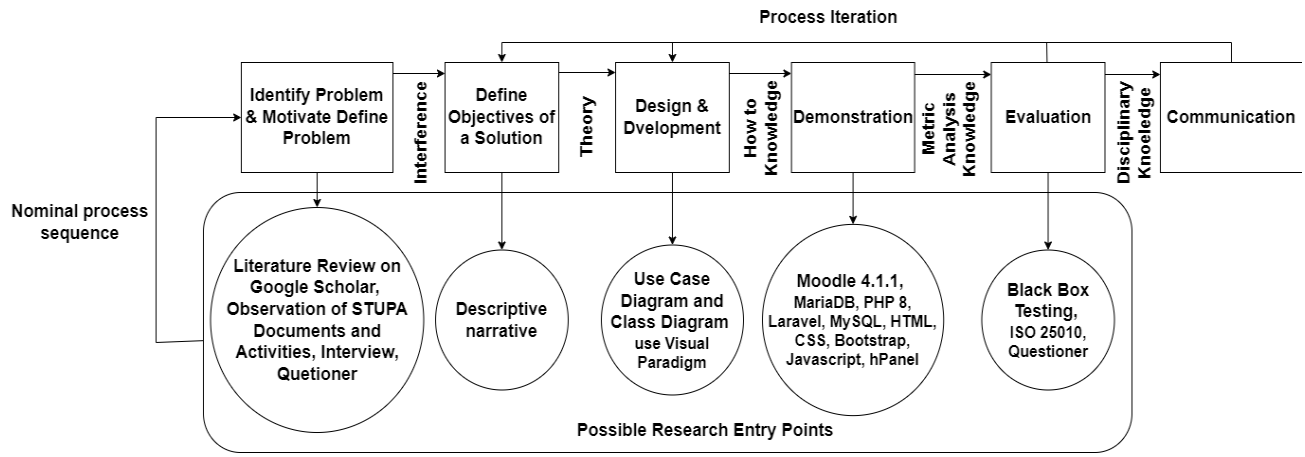

Figure 2. Research techniques and methods diagram

The steps of DSRM described include, first, Identify Problem and Motivation: Determining the specific problem faced, such as the transition from onsite to online learning. Data collection was conducted both qualitatively and quantitatively using techniques such as observation and review of the onsite implementation of Stupa, interviews, and questionnaires with Stupa alumni, as well as interviews with administrators and key stakeholders, such as the Bishop and The Director of the Pastoral Center of the Diocese of Maumere. The main objective of this step is to understand user needs, technical challenges, and the key motivations. Second, Define Objectives of a Solution: Establish clear objectives, both quantitative and qualitative, that will be achieved through the proposed solution.

Third, Design and Development: Create the system model, including the process of designing the model architecture, Use Case design, and Class Diagram using tools such as Visual Paradigm to illustrate the interaction between users (participants, facilitators, and administrators) and the LMS. Prototype development for the user interface includes the landing page and chatbot. Specifically, the LMS interface is developed using Moodle. Fourth, Demonstration: Implement the designed system, such as the LMS that uses Moodle and other related technologies. Fifth, Evaluation: The LMS is introduced, used, and tested by end users using the Black Box Testing method based on ISO 25010 standards to assess system quality.

3. RESULTS AND DISCUSSION

3.1 Identify problem and motivation

Based on the observation of Stupa's implementation, Figure 3 presents the Business Use Case of Stupa.

This Black Box Testing method focuses on the functions produced by the system without investigating the internal coding processes [12]. Sixth, Communication: Communicating the results to the scientific community through publications and documentation prepared in an academic format.

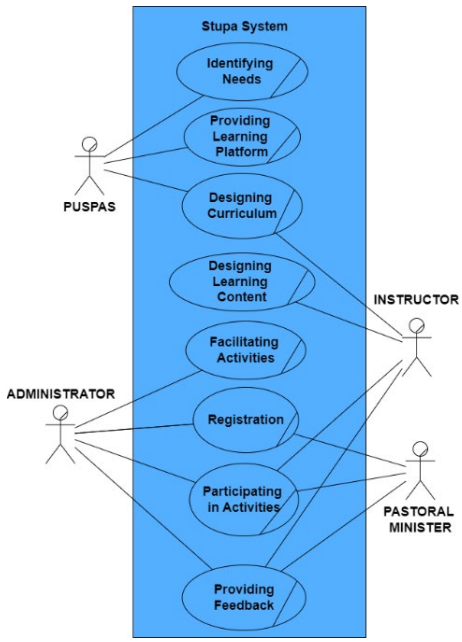

Figure 3. Business use case of Stupa

The Business Use Case in Figure 3 illustrates how Pastoral Center of the Diocese of Maumere initiates the process by identifying the training needs to improve pastoral skills for ministers at various levels. Once these needs are identified, the Admin and Facilitators design a curriculum that includes various important topics such as liturgy, scripture, family, community economy, and other themes relevant to the strategic plan of the Diocese of Maumere. Pastoral ministers register for the training sessions, which are designed in a modular format and led by trained facilitators.

The training sessions are held on weekends and involve interactive discussions and in-depth learning to enhance participants' knowledge and skills. After the training is completed, participants and admins provide valuable feedback to refine future sessions. Pastoral ministers who have completed the training then apply their new knowledge and skills in their work, with the aim of improving the quality of the pastoral services they provide. To ensure continuous development, Pastoral Center of the Diocese of Maumere provides a platform and resources to support ongoing learning, enabling the ministers to adapt to emerging challenges in the future.

The implementation of this stage uses a questionnaire distribution method. The questionnaire contains questions about the implementation of the Stupa, impressions and messages, to the involvement or role of pastoral servants in Stupa activities. The questionnaire involved 53 respondents, consisting of 35 pastoral ministers (participants), 14 facilitators/instructors, and 4 administrators. All respondents had prior experience with the Stupa program, either through face-to-face sessions or online live streaming YouTube. The selection criteria ensured that all respondents were directly involved in the program, guaranteeing that the collected data accurately reflects real user experiences. The respondents were from various age groups, with the majority being over 50 years old and 31-40 years old as shown in Figure 4.

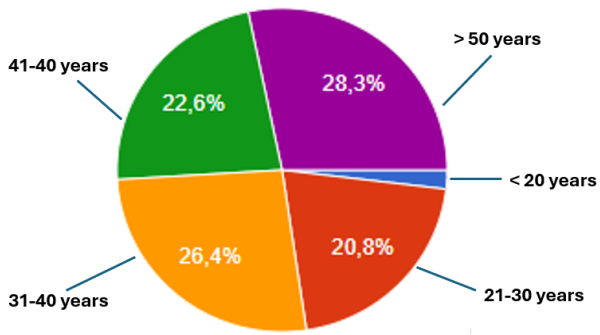

Figure 4. Distribution of age range of questionnaire participants

Most are regular participants who have previously attended Stupa, while the rest are instructors and administrators. The questionnaire results showed that most participants rated their experience in the face-to-face STUPA sessions as positive. Face-to-face activities were considered to provide better interaction and allow for effective in-depth learning. The main challenges reported included scheduling conflicts with personal activities, low participant engagement, and accessibility issues such as distance and transportation, as seen in Figure 5.

When the pandemic emerged, restrictions on gatherings and social distancing sparked the idea of conducting Stupa online.

As the pandemic subsided, the online format continued alongside face-to-face sessions, resulting in a hybrid format. Participants who joined the hybrid format via Zoom or YouTube live streaming, as well as in person, responded positively to the flexibility and expanded access offered by this format, although some noted that face-to-face activities were more effective in terms of interaction and focus. These positive aspects were supported by features such as screen sharing and commenting, which facilitated material presentation and discussions. The structured learning materials were also considered very helpful during the learning process, as can be seen in the diagram in Figure 6.

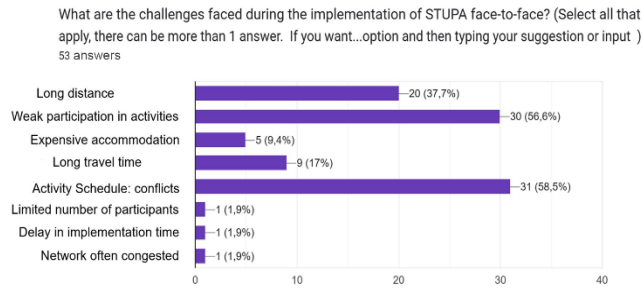

Figure 5. Identification of obstacles in the implementation of face-to-face Stupa

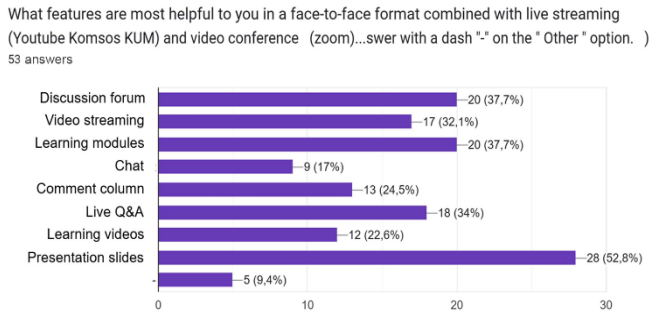

Figure 6. Feature preferences for hybrid learning formats

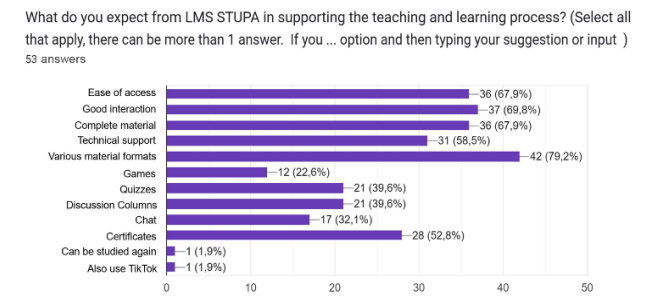

Figure 7. User requirements for Stupa LMS

The results of this questionnaire, as also seen in Figure 7, are supported by an interview with the Bishop of Maumere, who emphasized the importance of utilizing technology to address the challenges faced in the Stupa program, such as enhancing interactivity and expanding access through the development of the LMS. The Pastoral Center director and daily executive chairwoman shared their perspectives on the program's operational difficulties and solutions, such as the necessity of modifying outreach tactics and themes to boost participation. Administrators from Stupa then talked on the operational and technical difficulties encountered during the deployment, as well as possible fixes using an LMS to raise the caliber and efficacy of instruction. Overall, the questionnaire and interview results highlighted a clear need for an LMS that could overcome geographical limitations, encourage interaction and engagement, document and present material clearly and with quality, and expand access and flexibility for Stupa programs.

3.2 Define objectives of a solution

The Stupa program has been running for 4 years since 2019. Initially, Stupa was implemented face-to-face. However, the COVID-19 pandemic made it fully online. Finally, with the pandemic subsiding, an initiative emerged to implement Stupa face-to-face without having to eliminate the online format. So, the hybrid model was implemented which combines face-to-face with the use of online technology such as Zoom and/or YouTube live streaming which has proven to be able to improve the quality of learning and participant engagement. This technology integration plays an important role in the possibility of a new approach to the learning process that supports increased participation and more dynamic interaction between participants and their facilitators. In addition, the Zoom and YouTube features allow for real-time discussion and collaboration. This hybrid format ensures that all participants, regardless of geographic location, can be actively involved.

The successful implementation of the hybrid model sparked the idea for the Pastoral Center of the Diocese of Maumere to develop a clearer and more structured digital learning platform. The realization of this determination is the development of a robust and adaptive LMS that can overcome common logistical and technical problems often found in distance education, such as limited internet connectivity, device compatibility, and sometimes poorly organized documentation of learning materials. This means that this LMS is made to provide adequate technical support, a clear and structured curriculum, and learning resources that can be accessed in various digital formats, well-documented and organized so that participants with various levels of technological proficiency can follow the program easily and can access it at any time.

The capabilities of this system make it easy for participants in remote areas or those with time or physical limitations to use. Through the Stupa LMS, pastoral learning materials can be accessed anytime and anywhere, expanding the reach of education and enabling learning that is tailored to the needs of each individual or community, whether KBG, Environment, or Parish. The LMS's features and structure are also quite important. In addition to offering interactive elements like discussion boards, tests, and evaluation tools, the LMS should be easy to use. In addition to encouraging better organized, thorough, and documented instruction, this enhances the learning process for the participants by enabling adaptive instruction that meets their needs.

The emphasis is also on sustainable pastoral learning so that its development also pays attention to the long-term sustainability of the Stupa LMS itself. The support between the two opens the potential for the dissemination of church teachings in the Catholic church to be stronger over time. Key factors such as platform stability, ease of use, and adaptability to evolving technology ensure that the Stupa LMS can maintain the sustainability of pastoral learning in the future. Through careful planning and the proper implementation of

technology, the LMS can become a solid foundation for a long-lasting and impactful pastoral learning program. With the LMS, the Catholic Church becomes a lifelong school of faith and spirituality.

3.3 Design and development

Software architecture represents the structure of a software system, including its components, relationships, and characteristics. Architectural methods help produce models based on requirement specifications. Software design focuses more on modularization and detailing of its supporting elements. To produce an appropriate architecture, a clear understanding of the problem, solution, and evaluation of the results is required [13].

Moodle's architecture is designed based on the principles of constructivism, which supports active, collaborative, and flexible learning [14]. Due to its great flexibility, Moodle is an excellent open-source platform to support personalized teaching. Moodle is particularly well suited for experimental research in learning and teaching theory because its plug-in-based architecture makes it easy for developers to add new features. With its pedagogical functions, the platform provides a continuously evolving virtual learning management system (VLMS) and collects data on teacher and student activity worldwide. Moodle has become the de facto standard in education and has contributed greatly to improving the quality of learning in educational institutions worldwide thanks to a software architecture designed to support collaboration between components [15]. Even with the development of the field of machine learning, several studies have attempted to integrate machine learning capabilities into Moodle [16].

Moodle uses PHP as its programming language, facilitating ease of learning and use. Its communication via the TCP/IP protocol ensures broad network compatibility. Moodle manages database interactions using ADODB, making it a self-sufficient platform compatible with various operating systems. The multiplatform design allows Moodle to function in diverse environments without significant changes, while its accessibility and open-source nature demonstrate a commitment to open education [17].

3.3.1 Architecture of the Stupa LMS model

The Business Diagram in Figure 3 is translated into the LMS model architecture in Figure 8. Below is an explanation of the architecture of the Stupa LMS model as shown in Figure 8.

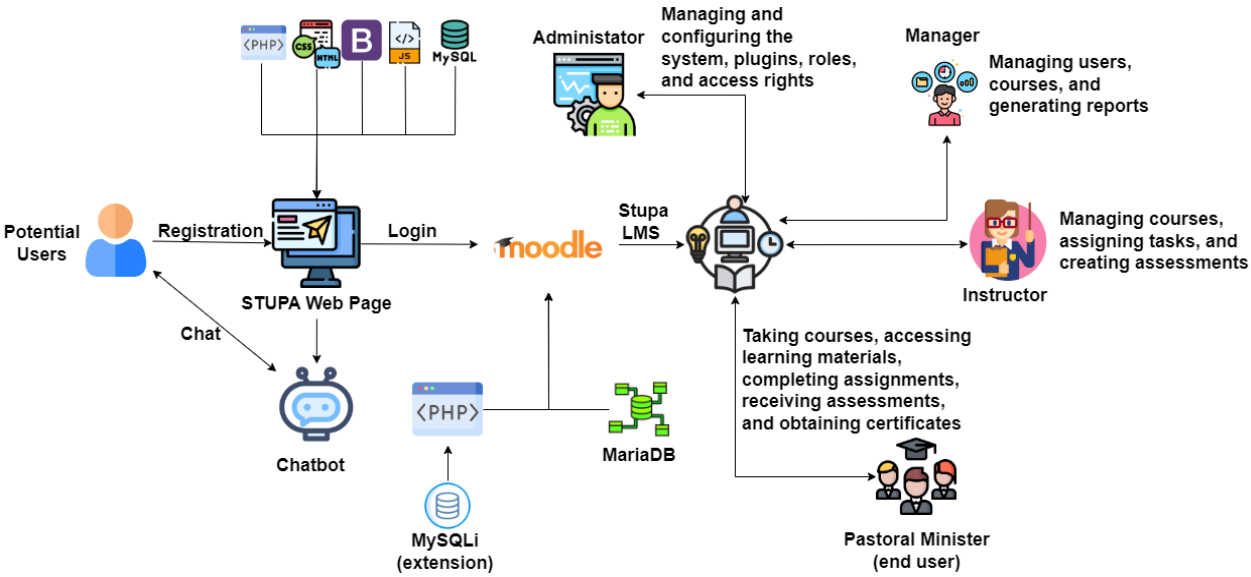

Figure 8. Architecture of the Stupa LMS model

1. Users first access the Stupa website, which is built using PHP, Bootstrap, JavaScript, HTML, and CSS. On this platform, they can either register a new account or log in to an existing one. For new users, their identity as pastoral ministers is verified by the admin before they are granted access. If the verification is successful, the admin creates a username and default password and sends these credentials to the user via email or WhatsApp. Upon first login, users are required to change their default password to enhance security. To ensure the security of this process, several measures have been implemented. Input validation is enforced to prevent SQL Injection and XSS attacks, ensuring that user-submitted data does not contain harmful code. Rate limiting is applied to the registration form to prevent spam and brute force attacks, restricting the number of submissions from a single IP address within a certain timeframe. OAuth 2.0 is used for secure authentication, eliminating the need for users to handle passwords directly if integrated in the future. All registration data is stored in Google Sheets, which is set to read-only mode for non-admin users, ensuring that no unauthorized modifications can be made. To monitor security risks, access logging is implemented, recording all user login attempts and admin actions for audit purposes. Additionally, admin accounts managing the system are protected with Two-Factor Authentication (2FA) to prevent unauthorized access. All data transmissions are secured using SSL/TLS (HTTPS) to encrypt sensitive information, and .htaccess restrictions are applied to protect important configuration files from being accessed directly.

2. Interaction with the Chatbot. On the homepage, users can also interact with a chatbot designed to answer questions and provide guidance on how to participate in the Stupa courses, the themes and learning materials, as well as general information about Diocese of Maumere. This chatbot is developed using JavaScript. To secure chatbot interactions, an API token-based authentication system is used to ensure that

only authorized requests can access chatbot services, preventing external abuse or hacking attempts. Access to chatbot logs and configurations is strictly restricted to admin users, ensuring that sensitive data is not exposed to unauthorized individuals. Additionally, all chatbot interactions are logged to monitor potential security threats or unusual activities. To prevent excessive or automated misuse, rate limiting is applied, restricting the number of interactions a user can have within a specific time period.

3. Access to LMS. After logging in or registering, users are directed to the LMS platform, which is the core of this learning ecosystem. Moodle provides various tools and features to support online learning. The Stupa LMS, managed through Moodle, functions as the framework supporting the entire e-learning ecosystem, connecting all roles and ensuring that all data is securely stored and documented in the database [18]. This project uses MariaDB with the MySQLi PHP extension [17, 19]. To ensure secure access, the system implements Multi-Factor Authentication (MFA) and Role-Based Access Control (RBAC), ensuring that each user role (Administrator, Manager, Instructor, and Pastoral Minister) has appropriate permissions. Additionally, all data transmission between users and the LMS is encrypted using TLS (Transport Layer Security) to prevent interception.

4. Course Management by Administrators: Administrators play a role in managing courses, users, and overall system configuration. They have full access to configure various aspects within the LMS. To enhance security, administrators have access to an audit log system that records all administrative actions, allowing for the detection of unauthorized modifications or suspicious activities. Additionally, access to administrative functions is restricted through privileged access management (PAM), ensuring that only authorized personnel can modify critical settings.

5. Course Management by Facilitators: Facilitators are responsible for managing the courses they teach, such as providing learning materials, creating quizzes and games, and giving assessments.

6. Learning Activities of Pastoral Ministers: As the end users of this platform, pastoral ministers participate in the available courses, complete the quizzes or games provided, and receive assessments and certificates if they pass the course. To protect user privacy and ensure data integrity, personal information and learning records are encrypted within the MariaDB database. Additionally, automated security audits and regular backups are conducted to safeguard data against loss or cyber threats.

Overall, this architecture provides a general depiction of the technologies or abiotic components that build the Stupa LMS ecosystem and how users or biotic elements interact with this online learning platform, from the registration stage to participating in Stupa through the management of Moodle within the Stupa LMS ecosystem [20].

3.3.2 Stupa website

Stupa website is an integral part of the Stupa LMS system, designed to provide general information pages and integrate a number of features to support the use of the system by a variety of users, including administrators and guests. Below are further details regarding the functions and components of the Stupa website:

a) Main Functions
   1) Information Page: Provides basic information about Stupa, including the goals and benefits of the system.
   2) Chatbot for User Assistance: The chatbot is designed to help users quickly get information or resolve issues they encounter while using the LMS.
   3) Registration Page: Allows new users to register and gain access to the features of the Stupa LMS.

b) User Roles and Activities
   1) Administrator

Page Management: Administrators are responsible for managing the content and structure of the website, including managing the data of users registered through this page.

Interaction with the Chatbot: They input and manage the database of questions and answers used by the chatbot to interact with users.

   2) Guest

Access to Information: Visitors or guests can access the Stupa website without needing to log in, allowing them access to general information and registration.

Limited Interaction: Although guests can access the page, they have limitations in accessing certain areas reserved only for registered users, such as administrators.

   3) Use Case dan Scenario

Content Management by Administrator: Managing content and user interactions through the chatbot, as well as updating relevant information on the website.

Access by Guest: Viewing information, registering through the available form, and interacting with the chatbot for general inquiries.

Web Stupa becomes a main gateway for users interested in finding information about LMS Stupa before registering or starting to learn. This Web Stupa provides an access point for those who want to register or start using the system (login). There is also an interactive chatbot feature that offers support to users to ask questions about the Diocese of Maumere and the Stupa program specifically.

3.3.3 Stupa LMS

Stupa LMS is designed and built to facilitate online education and course administration in the Weekend Pastoral Study program, Diocese of Maumere. Moodle as one of the top open-source e-learning system platforms, is used to build this Stupa LMS. The platform offers several features and tools to manage learning materials, improve communication between instructors and learners, and conduct monitoring and assessment. Here is an explanation of the various aspects of Stupa LMS:

a) Structure and Function
   1) Integration with the Stupa Website: This LMS is integrated with the Stupa website, allowing easy access for users who have registered through the registration page.
   2) Course Management: Administrators can manage courses, including the creation, modification, and deletion of courses. This includes the categorization of courses and the assignment of facilitators or instructors. While most courses do not have strict deadlines, some courses require structured learning within a set timeframe, leading to a potential increase in simultaneous access to the system. To ensure stable system performance during these periods, performance optimization strategies have been implemented.
   3) User Management: Adding and managing users, assigning roles like administrators, instructors, and participants, and managing user security and access privileges are all made easier by the LMS. In the Stupa

LMS, the division of roles is crucial to ensure the system operates efficiently and effectively. These roles define different levels of access and control over features and functions within the system. Details regarding user management can be seen in the illustration in Figure 9.

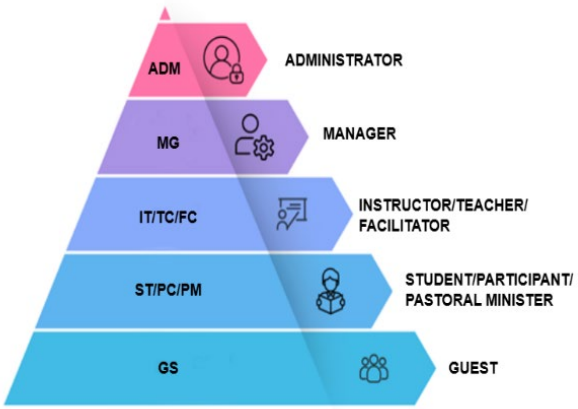

Figure 9. Role hierarchy of Stupa LMS

Below is a detailed explanation of the division of the main roles in the Stupa LMS based on Figure 9. This hierarchy helps define the different levels of authority and responsibility for users interacting with the system:

b) Administrator
   1) Manages the entire system, including server and database configuration settings.
   2) Adds and manages users, including assigning roles and access rights.
   3) Creates and manages courses, including assigning instructors and managing content
   4) Oversees system security, including monitoring activity logs and implementing security policies.
   5) Performs system data backup and recovery.

c) Manager
   1) Manages the operations of specific courses, including managing participants and instructors.
   2) Organizes learning materials and other resources used in the course.
   3) Conducts reporting and analysis related to course performance and participant engagement.
   4) Assigns user roles within the scope of the courses they manage.

d) Teacher
   1) Designs and implements the curriculum and learning materials.
   2) Manages course interactions, including discussion forums and Q&A sessions.
   3) Assesses participants' work and provides feedback.
   4) Monitors participants' attendance and engagement in the course.
   5) Creates and manages quizzes, exams, and other evaluation activities.

e) Student
   1) Participates in the course and engages in the designated learning activities.
   2) Takes part in discussions and other interactive activities.
   3) Completes assignments, quizzes, and exams.
   4) Provides feedback on the course and learning materials.
   5) Utilizes learning resources and support facilities provided within the LMS.

f) Guest
   1) Accesses general information and limited learning materials.
   2) Registers to become an official user if interested in the offered courses.

Each of these roles is designed to ensure that all operational and pedagogical aspects of the LMS run smoothly, enhancing the effectiveness of both learning and system administration.

a) Key Features
   1) Interactive Dashboard: Provides users with an intuitive visualization of the courses they are enrolled in, including recent activities, course calendar, and notifications.
   2) Learning Modules: Supports various types of content such as text, video, quizzes, and other interactive resources that can be easily added and managed by instructors. Since some users may prefer learning in their local dialect, course content can accommodate local languages, such as Sikka, in learning materials, particularly in audio or video formats. This approach ensures that the educational materials remain accessible and culturally relevant without altering the LMS interface language.
   3) Discussion Forum and Chat: Encourages interaction between participants and instructors, allowing for open discussions, Q&A, and collaboration. This feature is crucial for enhancing collaboration and feedback, elements that are often overlooked in the ecosystem [21, 22].
   4) Evaluation and Assessment: Provides resources for making games and quizzes, along with automated or human grading features that provide feedback. This allows for ongoing evaluation of the pastoral ministers' learning process and boosts course participation [22, 23].
   5) Reporting and Analytics: Provides comprehensive reports on participant progress, attendance, and evaluation results, which can be accessed by instructors to monitor and improve the learning process.
   6) Support for Offline Learning Mode [24]:
   7) Providing downloadable course materials in formats compatible with Moodle Mobile offline mode, such as PDFs, audio, and embedded video files.
   8) Enabling offline quiz attempts where possible, ensuring that quizzes without time limits and with sequential navigation can be accessed offline.
   9) Utilizing Moodle Mobile's built-in synchronization to allow users to complete activities offline and automatically update their progress once reconnected.
   10) Ensuring that critical activities such as assignments and discussions are structured to support offline access where feasible.
   11) Specifically for the use of the Stupa website, users experiencing unstable network connections can also register via the Pastoral Service Group WhatsApp of the Diocese of Maumere, where the admin will manually enter user data into Google Sheets. For general information, users can directly access the Stupa LMS to view the homepage as guests, while

registered users can log in immediately.

b) Administration and Management
   1) Security: Utilizes the latest security protocols to protect user data and course information, including data encryption and multi-layer authentication.
   2) Customization and Scalability: Stupa LMS supports extensive customization based on the specific needs of organizations or educational institutions, with scalability to handle large numbers of users. Although the LMS is designed for a limited number of pastoral ministers in the Diocese of Maumere, the system is optimized for stable performance even if multiple users access it simultaneously. Performance optimization strategies include caching mechanisms (Redis, OPCache), MariaDB query optimization, and server resource monitoring via Moodle Analytics. Load balancing options can be considered in the future if there is an unexpected surge in concurrent users.
   3) Data Backup and Recovery: Provides a backup and recovery system to ensure data security and continuity of learning without disruption.
c) Interactivity and Support
   1) Help and Support: Includes comprehensive documentation and technical support to assist instructors and participants in effectively utilizing all LMS functions.
   2) Accessibility: Designed to meet accessibility standards, ensuring that all users, including those with special needs, can access and use the LMS. Since the majority of users speak Bahasa Indonesia, the LMS interface supports both Bahasa Indonesia and English as primary languages. Moodle's built-in multilingual features allow users to switch between these languages. Meanwhile, local dialects, such as Sikka, are accommodated within course content rather than in the LMS interface, ensuring both usability and inclusivity.

Stupa LMS provides a complete pastoral education technology solution in accordance with the requirements desired by its stakeholders, namely Pastoral Center of the Diocese of Maumere, thus enabling effective and efficient learning management and enriching the experience for facilitators and participants by utilizing the convenience offered by e-learning technology.

3.4 Demonstration

3.4.1 Stupa website

Here is the demonstration flow for the Stupa Website section:

a) Creating the Main Website Page
   1) Technology: PHP, HTML, CSS, JavaScript, Bootstrap.
   2) Purpose: To provide an interface for potential users, such as a home page, User registration form, and Button to log in to Stupa LMS.
   3) Additional features: Chatbot integrated with the main page.
b) Implementation of Registration Form
   1) Purpose: Providing a form for registering new users.
   2) Integration with Google Forms: Data filled in the registration form is sent to Google Sheets via JavaScript script. Ensure the form includes validation columns, such as Full Name, WhatsApp Number or email, and Parish or pastoral servant information.
   3) User data process: Data sent to Google Sheets will be verified by the admin and manager.
c) Verification by Admin and Manager
   1) Verification Process: Admin and manager access data from Google Sheets to verify whether the user is a parish delegate or pastoral servant. If verified, the manager will add the user as a Stupa LMS user.
   2) LMS Account Creation: The manager creates an account in the LMS with the default username and password. Login information is sent to users via email or WhatsApp.
d) Storing User Data in MySQLi
   1) Purpose: Storing successfully verified user data to the main database of Stupa LMS using MySQLi.
   2) Process: User data, including username and password, is moved from Google Sheets to the Stupa LMS MySQLi database.
   3) Security: Ensure data is encrypted before being stored.
e) Admin and Chatbot Management
   1) Separate Database for Admin and Chatbot: Built using MySQL to store admin and chatbot data.
   2) Special Admin Page: Successfully logged-in admins can access a special page to Add or delete other admins and add, edit, or delete chatbot data. PHP and JavaScript are used to display data from the database dynamically.
   3) Security: Only authenticated admins can access this page.
f) Chatbot Functions
   1) Integration and interactive: The Chatbot is connected to the chatbot database via PHP, MySQL and JavaScript.
   2) Function: Answering user questions regarding registration and login guide to LMS.
   3) Chatbot Data Management: The admin manages chatbot data, such as questions and answers provided, through a special page.
g) LMS Access Through the Stupa Website
   1) Purpose: Provide access to the Stupa LMS for registered users.
   2) Process: Users with a username and password can switch to the login form on the Stupa LMS via the login button on the Stupa website.

3.4.2 Stupa LMS ecosystem

With the advancement of technology, the learning ecosystem continues to grow, encompassing a variety of learning methods and standardized information gathering. This ecosystem must be designed to enhance the skills of all parties involved, including pastoral caretakers, facilitators or instructors, administrators, managers, and stakeholders.

a) Administrator: Administrators are users with the highest access rights who can manage almost all aspects of the LMS system. Features available to administrators include:
   1) User Management: Administrators can add, remove, and manage users, assign roles, set access rights, and export and import user data.
   2) Course Management: Create and manage courses, add learning materials, assign instructors, and enroll students in courses.
   3) System Backup and Restore: Administrators can

back up system data and restore it when necessary.
4) System Security: Configure and manage site security, such as firewalls and encryption.
5) Notifications and System Logs: Manage notifications and view audit logs to monitor system activities.
6) System Updates: Administrators can perform system updates and upgrades for new features.

b) Manager: Managers are responsible for managing courses and users within the scope of the course. Key features managed by the manager include:
1) Course Category Assignment: Assign categories to the courses within the LMS.
2) Course Creation: Create new courses and add course materials, such as modules, videos, and documents.
3) Course Material Management: Upload, edit, or delete course materials.
4) Student Enrolment: Enrol students into the courses they manage.
5) Role Assignment: Assign user roles as facilitators, learners, or other roles as needed for the course.
6) Report Access: Access reports on course performance and user activities.

c) Facilitator: Facilitators are responsible for conducting learning activities with the following features:
1) Course Creation: Facilitators can create and design new courses and publish them.
2) Learning Materials: Add and manage learning materials, including quizzes, games, and discussion forums.
3) Guidance and Discussion: Provide guidance to students and facilitate discussions through forums or Q&A features.
4) Certification: Prepare and print certificates for students who complete the course.
5) Direct Interaction: Participate in video conferences or chat discussions with students.

d) Pastoral Ministers (Students): Pastoral ministers are users who participate in courses and are engaged in the learning process. Features available to them include:
1) Course Access: Enrol in and attend courses assigned by facilitators.
2) Completing Quizzes and Games: Students can complete quizzes and participate in learning games to test their understanding.
3) Participating in Discussions: Join forum discussions and ask questions through the chat feature.
4) Certificate Printing: Upon completing a course, students can print a certificate as proof of completion.

e) System Integration Plan: To enhance usability and efficiency, Stupa LMS can be integrated with other church management systems, namely the official website of the Pastoral Center of the Diocese of Maumere and the Biduk system (Diocesan Parishioner Data Integration System) through the following approaches:
1) Integration with Biduk:
- Biduk, as the diocesan parishioner database system, will be used as a verification tool during registration.
- When new users register in Stupa LMS, their information will be matched with Biduk data to ensure that they are active members of the diocese.
- This integration will guarantee user authenticity and prevent unauthorized access to the LMS system.

2) Integration with Puspas website:
- The official website of the Pastoral Center of the Diocese of Maumere will be linked to Stupa LMS to display course announcements, updates, and relevant pastoral news.
- This allows broader dissemination of information to the entire parish community and church stakeholders.

With a clear ecosystem, the Stupa LMS ensures a smooth, effective, and efficient learning process. In addition to helping deliver learning content to pastoral caretakers, the Stupa LMS also enables timely and accurate communication between participants, facilitators, and other institutional stakeholders during the learning process, thus encouraging the formation of a cohesive educational environment [25].

3.5 Evaluation

3.5.1 Evaluation process and criteria

With the results of this evaluation, it can be seen which important aspects need to be addressed immediately and periodically. The evaluation process of the Stupa LMS that was developed began by introducing the model to pastoral workers, continued by allowing them to use it and then testing it according to the indicators provided. Here, the experience during the socialization and training for the participants played a major role in determining the extent to which the use of Moodle was its intent and purpose [21]. As a note, the testing focused on the course experience of pastoral servants, considering that the purpose of this study was to provide a learning experience for them in an effort to empower and educate pastoral servants who are the end users of the Stupa LMS. These pastoral ministers are given student access rights to explore the features and functions of the LMS, from basic navigation to advanced features. Feedback from the pastoral ministers is collected through questionnaires based on ISO 25010, which are distributed to them [26, 27].

The user evaluation from the Black Box Testing results serves as the foundation for the further development of the Stupa LMS. This evaluation helps identify the system's strengths and weaknesses and formulates strategies to improve performance and user satisfaction. The suitability of the LMS to the needs of the community in the Diocese of Maumere is a priority to ensure its relevance and positive impact on the learning and pastoral development process. This evaluation is essential for the continuous development of Stupa, making it responsive to the needs of its users. Meanwhile, the questionnaire questions that adhere to ISO standards were adapted from the questionnaire instrument [28]. There are 8 factors and 34 sub-factors, with 34 questions aligned with the sub-factors. Below are the factors and sub-factors:

1) Functional Suitability: Includes functional completeness, functional correctness, and functional appropriateness.
2) Reliability: Includes maturity, availability, fault tolerance, and recoverability.
3) Usability: Includes appropriateness recognizability, learnability, operability, error protection, interface aesthetics, accessibility, supportability, and searchability.
4) Performance Efficiency: Includes time behaviour, resource utilization, and capacity.
5) Compatibility: Includes coexistence and interoperability.
6) Security: Covers confidentiality, integrity, non-repudiation, accountability, authenticity, and

achievability.

7) Maintainability: Includes modularity, reusability, analysability, modifiability, and testability.
8) Portability: Includes adaptability, compatibility, and performance [28].

Functional suitability in Table 1 evaluates whether the features provided meet the users' needs completely, correctly, and appropriately. Reliability in Table 2 measures how reliable the system is, including its resilience to errors and its ability to recover. Usability in Table 3 evaluates how easy the system is for users to achieve their goals with effectiveness, efficiency, and satisfaction. Compatibility in Table 4 evaluates the system's ability to exchange information with other systems. Maintainability in Table 5 assesses the system's ability to be modified, tested, analyzed, and used as needs grow. Portability in Table 6 evaluates the system's ability to be used in different environments [29, 30].

Performance efficiency in Table 7 refers to how the software utilizes available resources (such as time and hardware) to provide the best results under the conditions or requirements set. The security characteristic in Table 8 helps ensure that the system or product operates securely, is protected from threats, and avoids unauthorized access or data misuse [30]. The questionnaire uses a Likert scale, defining the sample, collecting data, performing data analysis, and determining the results. Data analysis begins with a validity test using a correlation coefficient value of 0.3 as the standard. Several studies in the healthcare field also adhere to the same standard values for correlation coefficients [31, 32]. All questionnaire items with a correlation value greater than 0.3 are declared valid. Next, a reliability test is conducted using Cronbach's Alpha, where items with a value of 0.787 are considered reliable, while those below 0.787 are considered unreliable. Once the validity and reliability tests show valid and reliable data, the analysis continues with descriptive analysis to calculate the feasibility percentage and classify the feasibility of the model built using the Likert scale [33].

The validity test was conducted with 30 respondents consisting of pastoral ministers and Stupa admins who participated in the training and used the LMS. The sample from the validity test results showed a correlation coefficient greater than 0.3, as shown in Table 9, indicating that the data used is valid.

Table 1. List of questions for functional suitability

Sub-Factor Code	Question
Functional completeness-FS1	Does the Stupa LMS provide all the features you need for pastoral learning?
Functional correctness-FS2	Are the results of quizzes and other activities in the Stupa LMS always accurate and in line with your expectations?
Functional appropriateness-FS3	How well do the features in the Stupa LMS help you achieve your learning goals?

Table 2. List of questions for reliability

Sub-Factor Code	Question
Maturity-RL1	Does the Stupa LMS function well and remain stable while you are using it?
Availability-RL2	How often is the Stupa LMS available when you need it?
Fault tolerance-RL3	Does the Stupa LMS continue to function well despite technical issues?
Recoverability-RL4	How quickly does the Stupa LMS recover after experiencing disruptions or errors?

Table 3. List of questions for usability

Sub-Factor Code	Question
Appropriateness recognizability-US1	Did you immediately recognize the Stupa LMS as the right tool for your learning?
Learnability-US2	How easy was it for you to learn how to use the Stupa LMS?
Operability-US3	How easy is it for you to use and control the features in the Stupa LMS?
Course error protection-US4	How well does the Stupa LMS prevent you from making errors?
Course interface aesthetics-US5	How appealing is the user interface of the Stupa LMS to you?
Accessibility-US6	Are you able to easily access the Stupa LMS in various situations?
Supportability-US7	Does the Stupa LMS provide sufficient help and guidance when you use it?
Searchability-US8	How easy is it for you to find the information you need in the Stupa LMS?

Table 4. List of questions for compatibility

Sub-Factor Code	Question
Co-existence-CO1	How well does the Stupa LMS work without issues when you use other software on your device?
Interoperability-CO2	How well does the Stupa LMS work with other applications or tools you use, such as email or other communication tools?

Table 5. List of questions for maintainability

Sub-Factor Code	Question
Modularity-MN1	Does the Stupa LMS have modules that facilitate ease of use and maintenance?
Reusability-MN2	How easy is it for you to reuse materials or features from other courses in the Stupa LMS?
Analyzability-MN3	How quickly can the Stupa LMS detect and fix issues you report?
Modifiability-MN4	How easy is it for you to notice updates or changes in the Stupa LMS without experiencing any issues?
Testability-MN5	Do you feel that the new features in the Stupa LMS work well the first time you use them?

Table 6. List of questions for portability

Sub-Factor Code	Question
Adaptability-PO1	How easy is it for you to use the Stupa LMS on various devices (e.g., computer, tablet, or smartphone) without experiencing technical issues?
Compatibility-PO2	How compatible is the Stupa LMS with the various browsers (e.g., Chrome, Firefox) that you use?
Performance-PO3	How quickly can the Stupa LMS be accessed and used across different devices and internet networks?

Table 7. List of questions for performance efficiency

Sub-Factor Code	Question
Time behaviour-PE1	How quickly does the Stupa LMS respond to your commands?
Resource utilization-PE2	How efficiently does the Stupa LMS utilize available resources?
Capacity-PE3	Can the Stupa LMS handle a large number of users and data without any issues?

Table 8. List of questions for security

Sub-Factor Code	Question
Confidentiality - SC1	Does the Stupa LMS maintain the confidentiality of your information effectively?
Integrity-SC2	How well does the Stupa LMS prevent unauthorized access and changes to data?
Non-repudiation-SC3	Can the Stupa LMS verify the actions you have performed?
Accountability-SC4	How well does the Stupa LMS track and report your activities?
Authenticity-SC5	How well does the Stupa LMS verify your identity when logging in?
Achievability-SC6	How well does the Stupa LMS store and protect your learning records for future reference?

Table 9. Data validity test

Code	Pearson Correlation	Validity
FS1	0.489	Valid
FS2	0.487	Valid
FS3	0.353	Valid
RL1	0.661	Valid
RL2	0.709	Valid
RL3	0.700	Valid
RL4	0.422	Valid
US1	0.576	Valid
US2	0.407	Valid
US3	0.638	Valid
US4	0.330	Valid
US5	0.496	Valid
US6	0.454	Valid
US7	0.342	Valid
US8	0.426	Valid
PF1	0.379	Valid
PF2	0.424	Valid
PF3	0.579	Valid
CP1	0.454	Valid
CP2	0.404	Valid
SC1	0.375	Valid
SC2	0.584	Valid
SC3	0.329	Valid
SC4	0.482	Valid
SC5	0.454	Valid
SC6	0.453	Valid
MN1	0.410	Valid
MN2	0.375	Valid
MN3	0.324	Valid
MN4	0.490	Valid
MN5	0.374	Valid
PO1	0.382	Valid
PO2	0.417	Valid
PO3	0.388	Valid

Similarly, as shown in Table 10, the reliability test using Cronbach's Alpha resulted in a Cronbach's Alpha value of 0.885, which means the data is considered reliable because it is greater than 0.787.

After validity and reliability testing, the questionnaire data is calculated to obtain the achievement percentage using the following formula:

$$Percentage\ eligibility = \left(\frac{Score\ obtained}{Expected\ score}\right) \times 100\%$$

Based on the evaluation results referring to the feasibility standards in Table 11, the Stupa LMS is overall rated Feasible with an average feasibility percentage of 77.01%, as shown in Table 12. According to the ISO 25010 approach, which takes into account a number of important factors that affect an e-learning system's quality, including content, design, usability, and organization, this shows that the Stupa LMS has achieved a fairly excellent quality standard [34].

Table 10. Case processing summary

Cronbach's Alpha	N of Items
0.885	34

Table 11. Feasibility percentage standard

Percentage	Feasibility
81%-100%	Highly Feasible
61%-80%	Feasible
41%-60%	Fairly Feasible
21%-40%	Not Feasible
0%-20%	Highly Not Feasible

Table 12. Feasibility indicator percentage

Indicator	Percentage (%)	Feasibility
Functional Suitability	79.11%	Feasible
Reliability	78.33%	Feasible
Usability	74.08%	Feasible
Performance Efficiency	71.56%	Feasible
Compatibility	78.33%	Feasible
Security	77.44%	Feasible
Maintainability	78.53%	Feasible
Portability	78.67%	Feasible
Average Percentage of Achievement (%)	77.01%	Feasible
Eligibility Classification		Feasible

As part of the experimental evaluation, the cross-platform compatibility of Stupa LMS has been tested across multiple devices, including PCs, tablets, and smartphones. This evaluation, aligned with ISO 25010 under the Portability category (PO1, PO2, PO3) in Table 6, confirms that the system functions efficiently across different operating environments. Furthermore, browser compatibility tests were conducted to ensure optimal performance on Chrome and Firefox. The overall feasibility score for Portability (78.67%) indicates that Stupa LMS is sufficiently adaptable and accessible across platforms, meeting the required standards for cross-platform usage.

3.5.2 User acceptance testing (UAT) based on age groups

The respondents who conducted the evaluation were pastoral ministers who attended and participated in the socialization of the Stupa LMS usage. This evaluation was conducted using the same dataset employed in the system feasibility test above, which was assessed through Black Box Testing. The average score, calculated based on user responses within each age group, enables the identification of user experience patterns in the Stupa LMS, allowing for an analysis of variations across different age groups.

The 21-30 age group has diverse experiences but a very small number of respondents (3). Learnability (US2) (2.33) varies, while recovery (RL4) (4.33) and reusability (MN2) (5.0) remain highly rated, indicating LMS supports material reuse well. The 31-50 age group has the most respondents (22), providing stable assessments. Operability (US3) (4.13) and Modifiability (MN4) (3.86) remain strong, showing ease of use and adaptability to LMS changes. The >50 age group has fewer respondents (5), so results should be interpreted with

caution. Reliability (RL1, RL2, RL3) (2.6) shows some variation, but Modifiability (MN4) (4.2) and Learnability (US2) (3.8) remain positive, indicating adaptability.

Respondent imbalance affects data interpretation. The 31-50 age group (22 respondents) provides stable averages, while the 21-30 (3 respondents) and >50 (5 respondents) groups show greater score variability. This will be a key consideration in further development and future research.

3.5.3 Financial feasibility and sustainability

To ensure the long-term sustainability of the Stupa LMS, an analysis of operational costs was conducted, focusing on server maintenance, system updates, technical support, and training expenses. The estimated costs are structured as follows:

1) Estimated Annual Costs: The estimated operational cost components for Stupa LMS are summarized in the following Table 13:

Table 13. Estimated Annual Operational Costs of Stupa LMS

Cost Component	Estimated Annual Cost (USD)	Description
Hosting & Server Maintenance	$100-$300	Hostinger VPS plan, SSD storage, bandwidth, SSL security
System Maintenance & Updates	$200-$500	Moodle updates, bug fixes, database optimization
Training for Admin, Managers, and Facilitators	$400-$700	Combined training on LMS management and course facilitation
Miscellaneous & Contingency	$200-$500	Unexpected costs, system expansion
Total Estimated Annual Cost	$900-$2,000	Adjusted to reflect actual needs

These cost estimates provide a comprehensive projection of the financial requirements for maintaining and improving the LMS over time.

2) Sustainability Strategies: To maintain financial feasibility, the Diocese of Maumere has implemented the following strategies:
   a) Diocesan Support: The initial costs are covered by the Pastoral Center of Diocese of Maumere (PUSPAS), ensuring administrative and technical staff support without additional salary expenses.
   b) Integrated Training Approach: Training sessions for admins, managers, and facilitators are conducted together, reducing operational costs while ensuring consistent knowledge dissemination.
   c) Potential External Funding: While the LMS remains free for pastoral ministers, future sustainability may involve grant applications or collaborations with Catholic educational institutions.

This financial assessment ensures that Stupa LMS remains a cost-effective, sustainable, and scalable solution for pastoral education.

3.5.4 Implications, challenges, and future directions

The successful analysis and positive evaluation results of the LMS lead to several key implications:

1) Increased accessibility: Stupa LMS allows participants in remote areas to access learning materials and activities without geographical limitations, which is an important issue in the Diocese of Maumere, where parishes are spread far from the place where face-to-face meetings are held.
2) Flexible learning: Stupa LMS allows pastoral workers to choose courses, access materials, and start learning according to the needs of the parish and congregation and provides the flexibility they need due to time constraints caused by time conflicts, work, or personal interests.
3) Better Interaction: Stupa LMS supports a variety of interactive learning methods, such as discussion forums, chats, quizzes, and other interactive media in the form of games, which enrich the learning experience and deepen participants' understanding.

This research provides new insights into how technology can be used in distributing religious knowledge and teachings in the Catholic Church, so that slowly with adequate understanding and knowledge, the performance and service of pastoral servants in the Diocese of Maumere meet the synod's expectations. The implementation of the LMS at Diocese of Maumere can serve as a model for other religious institutions facing similar challenges in pastoral education and training. Although the results are promising, there are some limitations to consider, including:

1) Low Feasibility Criteria: Although the evaluation results meet the feasibility criteria at 77.01%, this achievement is still relatively low compared to the maximum standard (highly feasible), which is 81%-100%. Therefore, several improvements and enhancements are needed for the application in accordance with ISO 25010 standards.
2) Dependence on Technology: Unequal access to stable internet connectivity can limit the effectiveness of the LMS.
3) Participants' Technological Readiness: Variations in participants' technological readiness and comfort levels may affect how effectively they can use the system.

Future research can focus on developing strategies to overcome barriers in pastoral education and explore methods for further integrating technology into this field. Additionally, training and socialization should be expanded by increasing the number of participants, which should include not only end users, such as pastoral ministers as learners, but also administrators, managers, and facilitators. This effort must be complemented by deepening the material to ensure that evaluation results can be more optimal in the future. Follow-up studies could also examine the long-term impact of hybrid learning on spiritual development and community growth in Diocese of Maumere.

3.6 Communication

The first form of communication created is further socialization through LMS usage training at the diocesan level. Academically, the documented results are published to expand the impact of the research among academics and practitioners in the Catholic Church ministry.

4. CONCLUSION

This research confirms that integrating technology, such as the LMS, into pastoral education not only enhances

accessibility and flexibility but also significantly contributes to the effectiveness of learning and participant interaction. Diocese of Maumere has demonstrated that with the appropriate application of technology, traditional barriers in religious education can be overcome, paving the way for a more inclusive and adaptive approach to pastoral and faith education.

To ensure the long-term sustainability and continuous development of the Stupa LMS, a structured maintenance and upgrade plan is required, including:

1) Regular System Updates
   a) Ensuring that the LMS remains up-to-date with the latest features and compatible with evolving educational technologies.
   b) Maintaining system security to protect against potential cyber threats.
2) System Evaluation and Performance Optimization
   a) Conducting regular system monitoring to ensure optimal performance.
   b) Identifying and addressing potential technical issues in advance.
3) Technical and User Support
   a) Establishing a support team to monitor the system, resolve technical issues, and assist users.
   b) Collecting user feedback to improve LMS functionality.
4) Regular Training
   a) Providing training for administrators and facilitators to ensure effective LMS utilization.
   b) Adjusting training programs to align with the evolving needs of pastoral education.
5) Expanding the Scope of User Testing:
   a) Increasing the number of users participating in UAT to obtain broader and more representative feedback.
   b) Ensuring a more balanced age range distribution among test participants to increase the reliability of evaluation results.

This study also highlights the need for strategies that continue to evolve and adapt to new technologies to support the long-term sustainability and effectiveness of pastoral education. With a clear maintenance and development strategy, the Diocese of Maumere can ensure that the Stupa LMS remains a sustainable solution for pastoral training, supports continuous learning, and strengthens the Church community.

REFERENCES

[1] Mouratidis, K., Papagiannakis, A. (2021). COVID-19, internet, and mobility: The rise of telework, telehealth, e-learning, and e-shopping. Sustainable Cities and Society, 74: 103182. https://doi.org/10.1016/j.scs.2021.103182

[2] Sabaté Gauxachs, A., Albalad Aiguabella, J.M., Diez Bosch, M. (2021). Coronavirus-driven digitalization of in-person communities. Analysis of the catholic church online response in Spain during the pandemic. Religions, 12(5): 311. https://doi.org/10.3390/rel12050311

[3] Hasulie, H.T., Role, Y.H. (2023). Keuskupan Maumere: Beriman, Sejahtera, Solider dan Membebaskan Dalam Terang Sabda Allah: Rencana Strategis Pastoral 2023-2027. Pusat Pastoral Keuskupan Maumere, Maumere. https://tabgrafika.com/keuskupan-maumere/.

[4] Lumen gentium (Terang Bangsa-Bangsa): Konstitusi dogmatis tentang gereja. In Seri Dokumen Gerejawi, Jakarta: Departemen Dokumentasi Dan Penerangan Konferensi Waligereja Indonesia, 1990, 7. https://www.dokpenkwi.org/wp-content/uploads/2020/11/Seri-Dokumen-Gerejawi-No-7-LUMEN-GENTIUM.pdf.

[5] Espinosa, K.A., Magbag, A. (2020). A mobile application for the Liturgical planner-Calendar of a Roman Catholic Diocese in the Philippines. International Journal of Research Studies in Education, 9(2243-7703): 25-33. http://doi.org/10.5861/ijrse.2020.5808

[6] Caciora, T., Herman, G.V., Ilieș, A., Baias, Ș., Ilieș, D. C., Josan, I., Hodor, N. (2021). The use of virtual reality to promote sustainable tourism: A case study of wooden churches historical monuments from Romania. Remote Sensing, 13(9): 1758. https://doi.org/10.3390/rs13091758

[7] Allal-Chérif, O. (2022). Intelligent cathedrals: Using augmented reality, virtual reality, and artificial intelligence to provide an intense cultural, historical, and religious visitor experience. Technological Forecasting and Social Change, 178: 121604. https://doi.org/10.1016/j.techfore.2022.121604

[8] Barbosa, J.C.C., Zymla, H.G. (2024). "The Spanish Cathedral", a prototype of mobile application for the access to the religious cultural heritage of gothic Hispanic cathedrals. ACM Journal on Computing and Cultural Heritage, 17(2): 1-25. https://doi.org/10.1145/3640456

[9] Gamage, S.H., Ayres, J.R., Behrend, M.B. (2022). A systematic review on trends in using Moodle for teaching and learning. International Journal of STEM Education, 9(1): 9. https://doi.org/10.1186/s40594-021-00323-x

[10] Peffers, K., Tuunanen, T., Gengler, C.E., Rossi, M., Hui, W., Virtanen, V., Bragge, J. (2006). Design science research process: A model for producing and presenting information system research. arXiv Preprint arXiv: 2006.02763. https://doi.org/10.48550/arXiv.2006.02763

[11] Vom Brocke, J., Hevner, A., Maedche, A. (2020). Introduction to design science research. In Design Science Research. Cases, Springer, Cham, 1-13. https://doi.org/10.1007/978-3-030-46781-4_1

[12] Dashti, M.T., Basin, D. (2020). A theory of black-box tests. arXiv Preprint arXiv: 2006.10387. https://doi.org/10.48550/arXiv.2006.10387

[13] Souza, E., Moreira, A., Goulão, M. (2019). Deriving architectural models from requirements specifications: A systematic mapping study. Information and Software Technology, 109: 26-39. https://doi.org/10.1016/j.infsof.2019.01.004

[14] Suartama, I.K., Setyosari, P., Sulthoni, S., Ulfa, S. (2020). Development of ubiquitous learning environment based on Moodle learning management system. International Journal of Interactive Mobile Technologies (iJIM), 14(14): 182-204. https://doi.org/10.3991/ijim.v14i14.11775

[15] Campo, M., Amandi, A., Biset, J.C. (2021). A software architecture perspective about Moodle flexibility for supporting empirical research of teaching theories. Education and Information Technologies, 26(1): 817-842. https://doi.org/10.1007/s10639-020-10291-4

[16] Bognár, L., Fauszt, T., Nagy, G. (2021). Analysis of conditions for reliable predictions by Moodle machine learning models. International Journal of Emerging Technologies in Learning (iJET), 16(6): 106-121.

https://doi.org/10.3991/ijet.v16i06.18347
[17] Bi, X., Shi, X. (2019). On the effects of computer-assisted teaching on learning results based on blended learning method. International Journal of Emerging Technologies in Learning, 14(1): 58-70. https://doi.org/10.3991/ijet.v14i01.9458
[18] Pataleta, J. (2024). Technical requirements. Moodle. https://moodledev.io/docs/4.5/gettingstarted/requirements.
[19] Yuan, Y., Lu, Y., Zhu, K., Huang, H., Yu, L., Zhao, J. (2023). A static detection method for SQL injection vulnerability based on program transformation. Applied Sciences, 13(21): 11763. https://doi.org/10.3390/app132111763
[20] Nguyen, L.T., Tuamsuk, K. (2022). Digital learning ecosystem at educational institutions: A content analysis of scholarly discourse. Cogent Education, 9(1): 2111033. https://doi.org/10.1080/2331186X.2022.2111033
[21] Esnaola-Arribillaga, I., Bezanilla, M.J. (2020). Levels of Moodle use to support university face-to-face teaching. IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, 15(3): 129-137. https://doi.org/10.1109/RITA.2020.3008376
[22] Hasan, H.F., Nat, M., Vanduhe, V.Z. (2019). Gamified collaborative environment in Moodle. IEEE Access, 7: 89833-89844. https://doi.org/10.1109/ACCESS.2019.2926622
[23] López-Tocón, I. (2021). Moodle quizzes as a continuous assessment in higher education: An exploratory approach in physical chemistry. Education Sciences, 11(9): 500. https://doi.org/10.3390/educsci11090500
[24] Moodle. Moodle app offline features 2024. https://docs.moodle.org/405/en/Moodle_app_offline_features.
[25] Turnbull, D., Chugh, R., Luck, J. (2020). Learning management systems, an overview. In Encyclopedia of Education and Information Technologies, Springer, Cham, pp. 1052-1058. https://doi.org/10.1007/978-3-030-10576-1_248
[26] Keibach, E., Shayesteh, H. (2022). BIM for landscape design improving climate adaptation planning: The evaluation of software tools based on the ISO 25010 standard. Applied Sciences, 12(2): 739. https://doi.org/10.3390/app12020739
[27] Buntak, K., Mutavdžija, M., Kovačić, M. (2021). Differences of E-learning systems with the focus on Moodle and blackboard systems. International Journal of E-Services and Mobile Applications (IJESMA), 13(1): 15-30. http://doi.org/10.4018/IJESMA.2021010102
[28] Peters, E., Aggrey, G.K. (2020). An ISO 25010 based quality model for ERP systems. Advances in Science, Technology and Engineering Systems Journal, 5(2): 578-583. https://doi.org/10.25046/aj050272
[29] Krouska, A., Troussas, C., Virvou, M. (2019). A literature review of social networking-based learning systems using a novel ISO-Based framework. Intelligent Decision Technologies, 13(1): 23-39. https://doi.org/10.3233/IDT-190362
[30] Pratama, A.A., Mutiara, A.B. (2021). Software quality analysis for halodoc application using ISO 25010: 2011. International Journal of Advanced Computer Science and Applications, 12(8): 383-392. http://doi.org/10.14569/IJACSA.2021.0120844
[31] Silva, M.F., Petrica, J., Serrano, J., Paulo, R., Ramalho, A., Lucas, D., Ferreira, J.P., Duarte-Mendes, P. (2019). The sedentary time and physical activity levels on physical fitness in the elderly: A comparative cross sectional study. International Journal of Environmental Research and Public Health, 16(19): 3697. https://doi.org/10.3390/ijerph16193697
[32] Lussier, F.Z., Pascoal, T.A., Chamoun, M., Therriault, J., Tissot, C., Savard, M., Kang, M.S., Mathotaarachchi, S., Benedet, A.L., Parsons, M., et al. (2020). Mild behavioral impairment is associated with β-amyloid but not tau or neurodegeneration in cognitively intact elderly individuals. Alzheimer's & Dementia, 16(1): 192-199. https://doi.org/10.1002/alz.12007
[33] Saputra, E., Banowosari, L.Y. (2021). Quality analysis of e-office application pt. kai (persero) use method ISO 25010. International Research Journal of Advanced Engineering and Science, 6(1): 96-100.
[34] Muhammad, A.H., Siddique, A., Youssef, A.E., Saleem, K., Shahzad, B., Akram, A., Al-Thnian, A.B.S. (2020). A hierarchical model to evaluate the quality of web-based e-learning systems. Sustainability, 12(10): 4071. https://doi.org/10.3390/su12104071