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Enhancing Curriculum Delivery: Virtual Learning Environment Deployment in Katsina State Institute of Technology and Management

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A B S T R A C T

The development of advanced education system now is depending on the increased of Virtual Learning Environment (VLE) technology utilization. Educational Institution communities are encouraged to adopt a variety of VLE technology to support the process of teaching and learning. The virtual learning environment is a system constructed through internet which incorporates a number of same virtual models for tests, home works, classes, classrooms, and academic fields. These provisions are creating the "virtual campus". It is this technology that supports on-line communications between learners and instructors and supports them to develop portrayals and descriptions of the solutions they are up to. This research paper discusses the benefits and capabilities of deploying VLE in Katsina State Institute of Technology and Management (KSITM), such as providing flexible learning experiences, organizing class materials, and enhancing communication and collaboration among students and lecturers/teachers. The objectives of the research include deploying a VLE, facilitating access to educational resources, promoting active learning, and evaluating the impact on student engagement and academic performance. The expected outcome of the research is transformative changes in teaching and learning processes. The paper also highlights the importance of technological literacy and preparedness in the digital era. The challenges faced by educational institutions and the need for a robust VLE are emphasized. The benefits of VLEs over traditional teaching methods are mentioned, including the ability to track student engagement, facilitate communication, and provide centralized access to course information.

Keywords: Virtual Learning Envrionment, virtual campus, moodle, academic performance, technological literacy

1. Introduction

With the growth and spread of Information and Communications Technology (ICT), a massive interest has developed in how computers, other devices and Internet tools can benefit and improve educational processes and foster the use of technology in language classrooms (Haleem et al., 2022). One resource offered by ICT is online learning platforms (OLPs), also known as learning management systems (LMSs), course management systems (CMSs) or virtual learning environments (VLEs), as they have been referred to in this study. A virtual learning environment (VLE) in educational technology is a Web-based platform for the digital aspects of courses of study, usually within educational institutions. They present resources, activities and interactions within a course structure and provide for the different stages of assessment. VLEs also usually report on participation; and have some level of integration with other institutional systems (Al Samarai et al., 2019).

VLEs are virtual spaces that teachers and students can use to present and share resources and activities and interact with one another. These platforms can be used to teach a complete online course or as a supporting feature for face-to-face courses. VLEs provide a means to manage the learning experience, communicate the intended learning experience and facilitate tutors' and learners' involvement in the experience (Sneha, 2016). The main goal of this paper is to ease, motivate and provide learning experiences that go beyond the classroom. Authors such as (Dominguez., 2013) claim that VLEs boast a wide spectrum of research showing positive impacts across different contexts.

There are many open-source or free Virtual Learning Environment, such as Moodle, Coursework, A tutor and Interact. Moodle is one of the popular open source LMS for online learning and usage of information technologies (Kil, 2018). Moodle was an acronym for Modular Object-Oriented Dynamic Learning Environment, which is a popular open-source course management system (Moodle.org) and mostly useful to programmers and education theorists (Belanger, 2018). Moodle is a tool to enhance the teaching process rather than provide a free learning management system that enables to create powerful, flexible, and engaging online learning experiences. This research work focuses on the deployment of Moodle Virtual Learning Environments (VLEs) in Katsina State Institute of Technology and Management (KSITM).

2. Literature Review

A Virtual Learning Environment (VLE) is a learning management system that is designed to support teaching and learning in an educational setting over the network from remote locations. It enables the delivery of course contents and management. It provides the ability for users to communicate easily. It

also integrates the student information systems and authentication protocols to control who access what via user name and password (Goslin, Hofmann & Gray, 2013). A VLE could be linked to the university administrative systems enabling the access to students' records ensuring accurate student data.

Virtual Learning Environments are a term frequently overheard and debated among educational technologists today. Actually, the term VLE covers a lot of territory. VLE, in its comprehensive sense, means graphics, music, sound effects, voice, video, and animation, in any grouping, in the same program or presentation. It can be described as a combination of VLE elements (audio, video, graphics, text, animation, etc.) into one synergetic and symbiotic whole that results in more benefits for the end user than any one of the media elements can offer separately. These can be defined commonly as any grouping of two or more media such as sound, images, text, animation, and video. On behalf of educational technology resolutions, VLE refers to network-based systems that use associative connections to let users to direct and possess materials and data stored in a combination of text, sounds, graphics, video, movies, music, lighting and other media as for education. VLEs have presented radical pedagogical change in the learning experience. Using VLE could reinforce and support face-to-face traditional teaching and learning in higher education. It adds many options for both learners and tutors. Moreover, it encourages collaborative learning through online engagement between students and their tutors or peers. The focus is on the enhancement of the student learning experience, rather than the adoption of technology as the key driver of change (Beastoll & Walker, 2017).

Most higher education institutions are using or planning to use a VLE, for one reason or another, whether for distance or blended learning VLE offers a range of learning tools and functions that aid in delivering, communicating, and managing the course. For instance, communication facilities such as e-mail and discussion board; announcements and a bulletin board facility; assessments and testing facilities; scheduling/calendar; assignment submission; integrated web 2.0 tools such as wikis, blogs, whiteboard, and authoring tools; polls; and many other features. It also allows the sharing and reuse of resources (Weller, 2007). Modern mass higher education presents many challenges for both learners and educators as it has brought larger classes, more diverse students, and higher interest in teaching quality and graduate attributes. Many research papers conclude that students and academics in higher education institutions around the world were positive towards VLE. They found that VLEs are very useful and had made a significant contribution to the learning experience adding significantly to the learning opportunities of 21st century students (Crosling, 2009).

2.1 The Concept of Virtual Learning Environment

The Virtual Learning Environment (VLE) is a technology that supports learning through face-to-face and virtual meetings. VLE is characterized by an environment based on computers, use of the intranet and internet, interaction between users, exchange of views and access to users to obtain various useful materials. Moreover, users could be in the same room but do not experience any physical contact. Furthermore, the VLE enables collaborations as well as learning activities through games. VLE is a software tool that supports the management of education and teaching by using the Intranet and internet (Escobar-Rodriguez & Monge-Lozano, 2012).

The VLE concept is more comprehensive compared to computer-aided instructions (CAI) as it contains the communication dimension as well as interaction and discussions between teachers and students or among students (Galle S.A, 2021). In other words, VLE is a web-based learning platform, which is a reality in the education world, that integrates the conventional education concept with the virtual method. Laeeq & Memon (2018), referred VLE as an online classroom and a social space in schools that contains a calendar, social networks, shared workspace and online assessment.

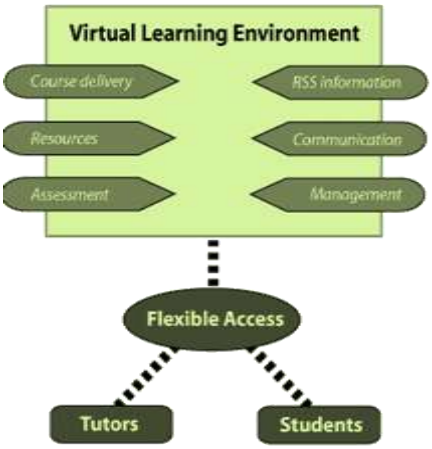

Fig1 – Concept of Virtual Learning Environment (VLE)

2.2 Benefits of Virtual Learning Environment

VLEs have a lot of benefits as opposed to classical teaching methods. For instance, teachers can track if learners are engaging with the internet-based communication and related materials by submitting evaluations online and providing quick feedback. The message services can inspire teamwork and communication both between instructor and learner and learner and learner. Teacher and learner can also involve more enthusiastically in a course at a time and place that is suitable for both (Van Beek, 2011). Moreover, Course information such as past exam papers, timetables, and administrative

information can all be found in one place, and are accessible from one authoritative source. Careful signposting (such as including links with course material) can provide extra care for learners, or inspire learners to study at an intensive level.

Other benefits and capabilities of Virtual Learning Environment are:

- It provides the learners the flexibility of getting the learning experiences at the time, place and rate of assimilation.
- Virtual classroom can help in good class organization. The operational documents, assignments, class notes and other related information in the internet can be readily categorized for easy accessibility for the teachers and students. The information posted on the internet could be easily revised and updated for more effective teaching and learning.
- Virtual Learning Environment provides the learners with the opportunity of gaining learning experiences 24 hours of every 7 week days without tampering with the learners leisure time.
- The system has the capability of employing the services of most experienced personnel in different areas of need which is not possible in traditional classroom setting.

Another educational value is the intellectual and social partnership created by the technology of virtual Learning Environment. Students in their use of technological equipment cultivate the habit of leadership role in relation to other students (Bower et al, 2020). The implication is that the technology used increases group cohesion and mutual support more especially inn remote classrooms. E-Learning System involves a systematic process of plan-ning, design, development, evaluation, and implementation to create an online environment where learning is actively fostered and sup-ported. The process of e-Learning can be represented by e-learning process model depicted in Figure 2.

- **Skill analysis**:- The learning manager analyses the learner's present skill and skill that is set as a learning goal, and obtains the necessary material information. The manager then searches for the related ma-terial (registered for the search).
- **Material development**:- The developer creates exercise questions and the material structure (table of contents) linked with explanatory pages.
- **Learning**:- The learner engages in learning that is suited to the need, that is, individual learning for knowledge acquisition, or collab-orative learning for workshop-type learning.
- **Evaluation:**- The learner carries out exercises and takes examina-tions using questions designed according to the learning goal. The learning manager makes the evaluation of each learner, using results of exercises and examinations.

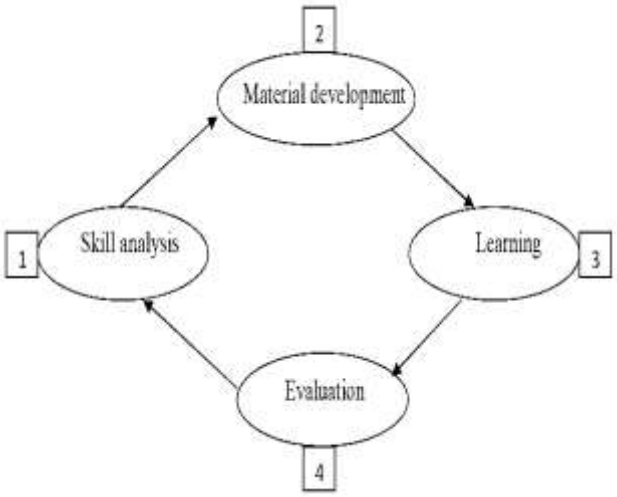

Fig 2 – e-Learning Process Model

There are a lot of VLE systems available such as Web Board, WebCT, Blackboard, Moodle, and Sakai. Similar finding by Cavus (2007) mentioned that there are several learning management systems (VLE) commercially available on the market such as Blackboard, WebCT and Desire while there are also many open-source or free Virtual Learning Environment, such as Moodle, Coursework, A tutor and Interact. Moodle is one of the popular open source LMS for online learning and usage of information technologies (Muhsen et al., 2013). According to Ahmad & Al-Khanjari (2011), Moodle application is an Open Source (OS) Learning Management System (LMS), is also known as a Virtual Learning Environment (VLE), Web-based Management system or Course Management System (CMS). It has become very popular among instructors around the world as a tool for creating online dynamic portal for their students.

Moodle was an acronym for Modular Object-Oriented Dynamic Learning Environment, which is a popular open-source course management system (Moodle.org) and mostly useful to programmers and education theorists (Dougiamas and Taylor, 2003). Moodle is a tool to enhance the teaching process rather than provide a free learning management system that enables to create powerful, flexible, and engaging online learning experiences. Most of institutions use it as their platform to conduct fully online courses, while some use it simply to augment face-to-face courses. It is a platform that is

very useful and good for LMS (Dougiamas and Taylor, 2003). In addition, this application allows teachers to monitor and manage all the features of the course content and delivery of a single integrated system.

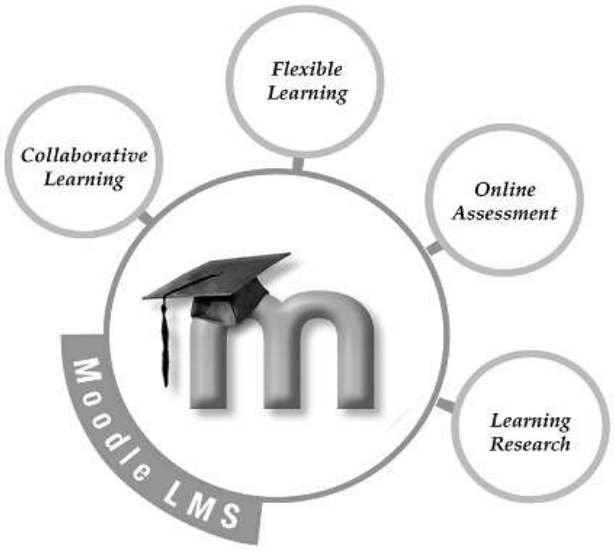

Fig 3 – Moodle Learning Management System

2.3 Related Works

Sam K. P. and Rung-Tsong (2009) developed a Virtual Learning Environment (VLE) that facilitates effective communication between learners and instructors without requiring advanced technical expertise. Utilizing advanced internet technologies, the VLE offers users comprehensive guidance and support, enabling learners to achieve significant progress across various courses and programs. In essence, the VLE creates an interactive and dynamic educational hub tailored to meet the needs of a modern learning environment.

Hazem and Nikos (2009) designed an integrated intelligent e-learning system characterized by its open, adaptive, and multi-subject capabilities. The system employs intelligent agents to perform learning tasks on behalf of teachers, students, and administrators, enabling students to participate in interactive activities and maintain open communication with their instructors. This approach was utilized to design a learning platform for an online university. The system also incorporates features for business continuity management and learning management. Furthermore, the study addresses security considerations in e-learning environments.

Rabiman et al. (2020) developed an LMS-based e-learning system specifically designed for a Mechanical Engineering Education class employing Microteaching techniques. Their work was guided by the Hannafin and Peck design model, which involves distinct phases: needs analysis, design, development, and implementation. The system underwent rigorous testing by media and content experts to ensure it met predefined quality standards. The study involved 15 college students aged 22 to 25, with data collection methods including questionnaires and direct observations. Evaluation criteria encompassed LMS usability, functionality, visual communication, instructional design, content quality, and language effectiveness. The results indicated that the LMS-based e-learning system was "highly viable" for implementation. Furthermore, the study demonstrated that using an LMS significantly enhances both learner satisfaction and the overall quality of the educational experience, making it a valuable tool for modern teaching and learning environments.

In Nigeria, efforts to introduce e-learning models in higher education institutions have primarily centered on theoretical frameworks for collaborative learning. Ajadi et al. (2008) explored the theoretical foundations and significance of e-learning within the context of distance education at the Open University, discussing its potential benefits and the challenges faced by the institution. Similarly, Awodele et al. (2009) proposed an e-learning framework emphasizing active and open collaboration, integrating supplementary services to support the learning process. This framework aimed to create an extended and enhanced learning environment interconnected with other systems within the local context through theoretical analysis. A noteworthy advancement in this field is the e-learning model developed through the University of Jos's ICT initiatives. This innovative model became a pioneering approach in the country, gradually adopted and integrated into the institution's educational framework over time.

3. Methodology

This section provides an in-depth discussion on the system design and modeling of the proposed Virtual Learning Environment (VLE). System design serves as the blueprint for translating functional requirements into a structured and implementable framework, while modeling helps visualize the interactions and components of the system in a clear and concise manner.

To facilitate a comprehensive understanding of the VLE's architecture and functionality, the Use Case model is presented.

3.1 Use Case Diagram

The use case diagram captures the functional scope of the VLE by illustrating how different users, referred to as actors, interact with the system to accomplish specific tasks. These actors typically include:

- Institutional Administrators, responsible for managing users, configuring system settings, and generating reports.
- Teachers, tasked with creating and managing courses, assignments, and other learning resources.
- Students, who engage with course content, complete assignments, and participate in interactive activities such as forums or quizzes.
- IT Support Teams, who ensure the system remains operational, secure, and scalable.

The diagram provides a high-level representation of these interactions through various use cases, such as "Enroll Users," "Create Courses," "Access Learning Materials," and "Submit Assignments." By mapping these interactions, the use case diagram highlights the core functionalities of the VLE and helps identify the system's key requirements. It serves as a communication tool between stakeholders, ensuring alignment on the system's intended features.

A Use Case Diagram is a fundamental tool in system modeling that visually represents a user's interaction with the system, highlighting the relationship between the user (referred to as an actor) and the various use cases they are involved in. This type of diagram provides a high-level overview of the functionalities offered by a system, making it easier to understand the system's requirements and the roles of different stakeholders. In the context of a Virtual Learning Environment (VLE) for a tertiary institution, the main users are the Institutional Admin, Teachers/Lecturers, and Students, each interacting with the system in specific ways according to their roles.

The Institutional Admin serves as the system's overseer, managing user accounts and ensuring the platform aligns with institutional policies. Their responsibilities include creating and modifying user accounts, such as those for teachers and students, configuring system settings, and monitoring the system's performance. Additionally, the admin generates reports on system usage, course progress, and other metrics critical for institutional operations. To maintain a secure environment, they also manage access rights and data privacy, ensuring compliance with institutional and legal requirements.

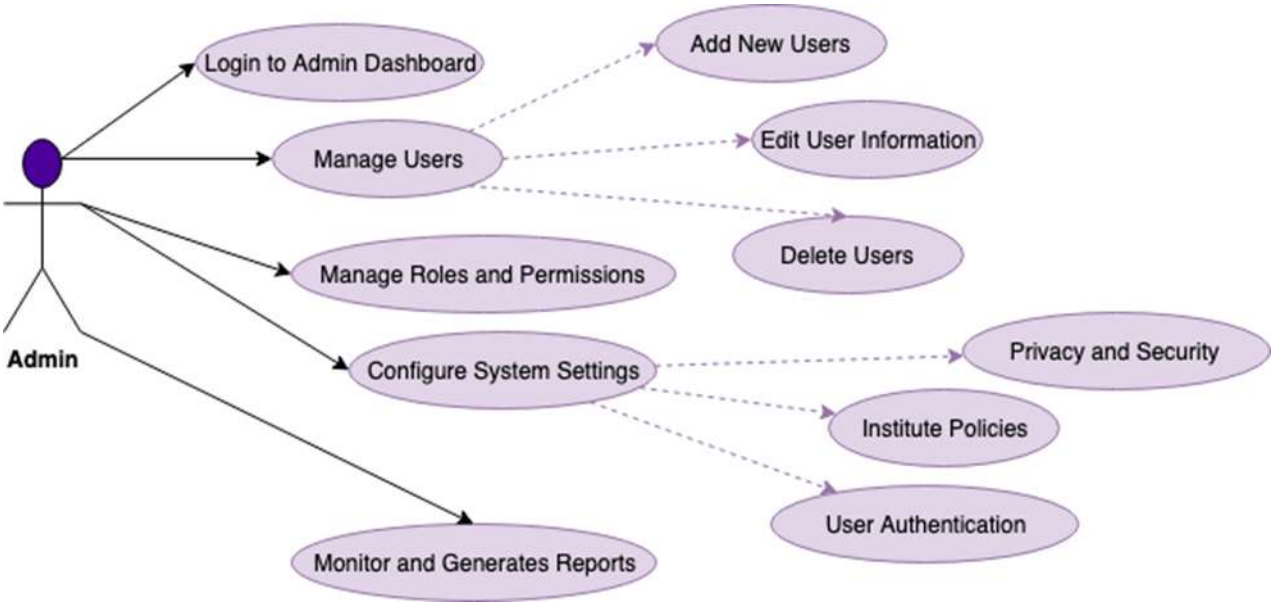

Fig 4 – Admin Use Case Diagram

The Teachers or Lecturers play a pivotal role in course administration and student engagement. They are responsible for creating and managing courses, uploading learning materials such as videos, PDFs, and courseware, and updating or removing outdated content. Teachers also facilitate student assessments by posting assignments and quizzes and providing timely feedback and grades. Beyond course administration, they engage with students through discussion forums, collaborative activities, and live or pre-recorded lectures. To access these features, teachers must first register on the platform by providing essential details, such as a username and password. Once registered, they can create and manage classes by specifying course details like syllabus, schedule, and student enrollment options.

For Students, the VLE offers a platform for accessing educational resources and engaging in various learning activities. Students can enroll in courses provided by their institution or assigned by their lecturers. Through the VLE, they can download lecture materials, submit assignments, and participate in forums or group projects. They also complete quizzes and other assessments while tracking their progress through the grades and feedback provided by their instructors. This seamless access to resources and interactive learning activities ensures an enriched educational experience.

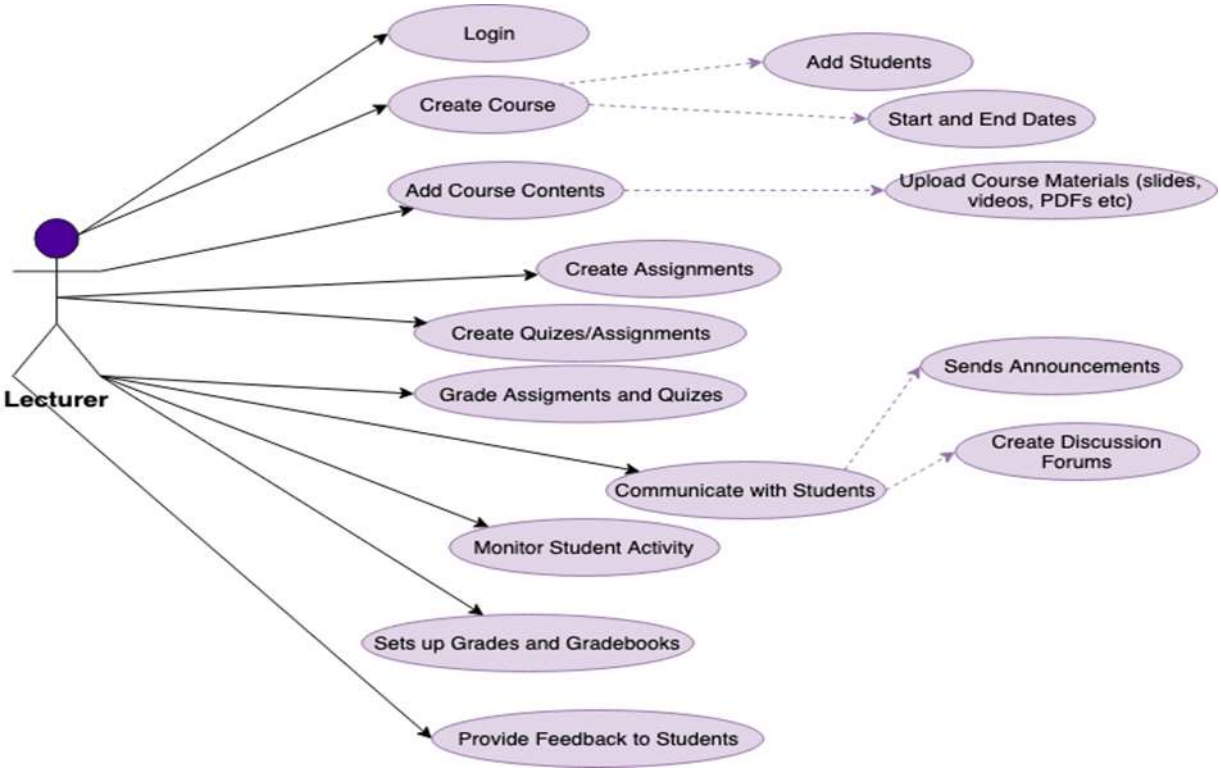

Fig 5 – Teacher/Lecturer Use Case Diagram

Creating a class within the VLE involves a straightforward process for teachers. After registering on the platform, they can set up courses by providing key details such as the course name, syllabus, and enrollment criteria. These classes then become available for student access, facilitating a smooth start to the academic process. Teachers' ability to easily manage these aspects of their classes underscores the system's user-friendly design. The Use Case Diagram, as illustrated in Figure 4, visually organizes these interactions, providing clarity about the relationships between users and system functionalities. It serves as a communication bridge between stakeholders—such as developers, educators, and administrators—ensuring that the system's design meets institutional goals. By highlighting the roles and responsibilities of Institutional Admins, Teachers, and Students, the diagram emphasizes the collaborative ecosystem required to support effective online education in a tertiary institution.

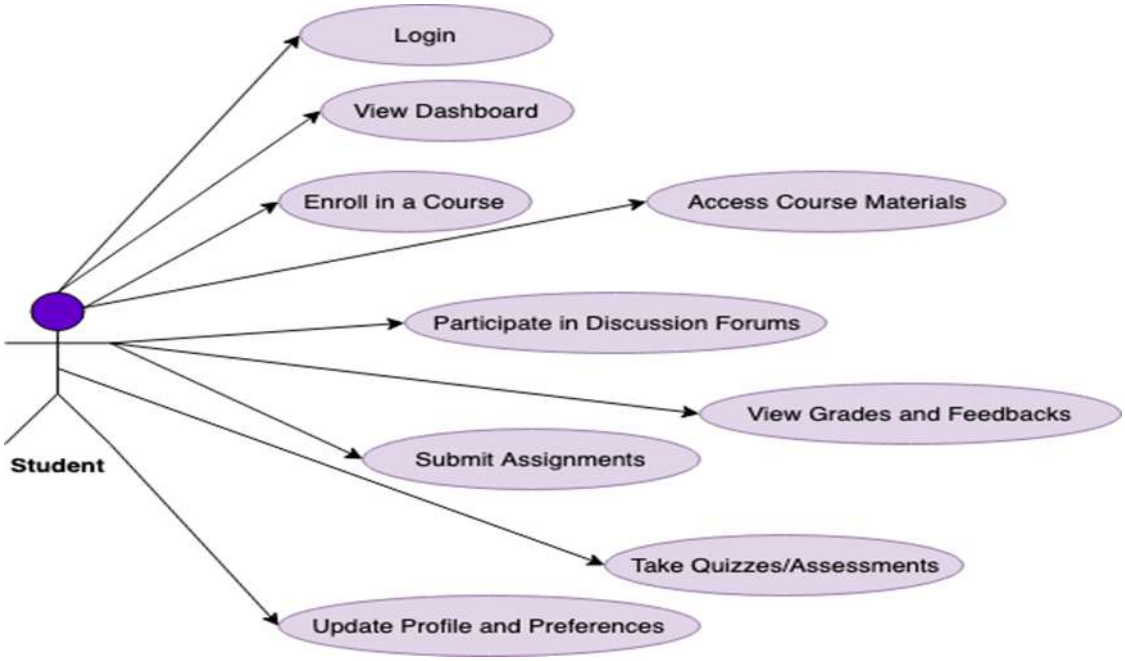

Fig 6 – Student Use Case Diagram

4. System Implementation

The system was implemented using a multi-layered architecture, leveraging various technologies to ensure efficiency, scalability, and ease of maintenance. The front-end of the application was built using HTML (HyperText Markup Language), which provides the structure and layout of the web pages. HTML allows the system to display content, such as text, images, and links, and is essential for creating the user interface (UI). This enables users to interact with the system through web browsers, where they can view and interact with educational content. On the server side, PHP (Hypertext Preprocessor) was chosen as the programming language. PHP is a powerful server-side scripting language widely used for web development, particularly for applications that require dynamic content generation. It processes requests from the user, interacts with the backend database, and sends appropriate responses back to the client's browser. PHP facilitates features like user authentication, handling forms, and processing data from the user input, all of which are essential for the functioning of a Virtual Learning Environment (VLE).

For middleware Layer, Apache HTTP Server was used. Apache is an open-source web server that serves as an intermediary between the front end (client-side) and the backend (server-side). It processes incoming requests from users, directs them to the appropriate PHP scripts for processing, and returns the results to the user. Apache is well-known for its reliability, performance, and support for various web technologies, making it an ideal choice for handling the web traffic in the system.

Finally, the backend database was implemented using MySQL, a relational database management system (RDBMS). MySQL stores all the data associated with the VLE, such as user information, course content, assignments, grades, and discussion posts. It uses Structured Query Language (SQL) for efficient data storage, retrieval, and manipulation. The use of MySQL ensures that the system can handle large amounts of data while maintaining fast query performance and data integrity. The database is integral to ensuring that the system operates smoothly, with secure, reliable access to student and teacher data. This combination of HTML, PHP, Apache, and MySQL provides a robust, scalable, and dynamic solution that supports the full functionality of the Virtual Learning Environment, ensuring that both students and educators have a seamless and interactive experience. The technologies are well-established, ensuring compatibility, security, and ease of integration for future improvements or enhancements.

4.1 Home Page

The Home Page serves as the central hub for users after logging in, providing access to key sections of the Virtual Learning Environment (VLE). For students, it typically displays an overview of the courses they are enrolled in, upcoming assignments, recent grades, and other relevant notifications. Teachers and administrators see a different layout, often featuring tools for course management, course creation, and access to administrative functions. The home page may also feature a site-wide calendar, showing upcoming events, deadlines, and institutional announcements, which helps users stay informed about key dates.

Fig 7 – Home Screen

4.2 Login

The login page is the entry point for users to access the Virtual Learning Environment (VLE). It features essential fields for username and password, along with a login button to authenticate users. The page also offers links for users to recover their password if forgotten and, in some cases, to register a

new account. Moodle supports various authentication methods, including standard login, Single Sign-On (SSO), OAuth, and LDAP, making it flexible for different institutions. Additionally, optional security features like CAPTCHA can help prevent unauthorized automated login attempts, while a language selection option allows users to customize their experience.

Once users submit their credentials, the system verifies them against the database and either grants access or displays an error message for failed login attempts. For added security, SSL/TLS encryption ensures that credentials are transmitted securely. Upon successful login, users are redirected to their dashboard or course page, with access customized based on their role (student, teacher, or administrator).

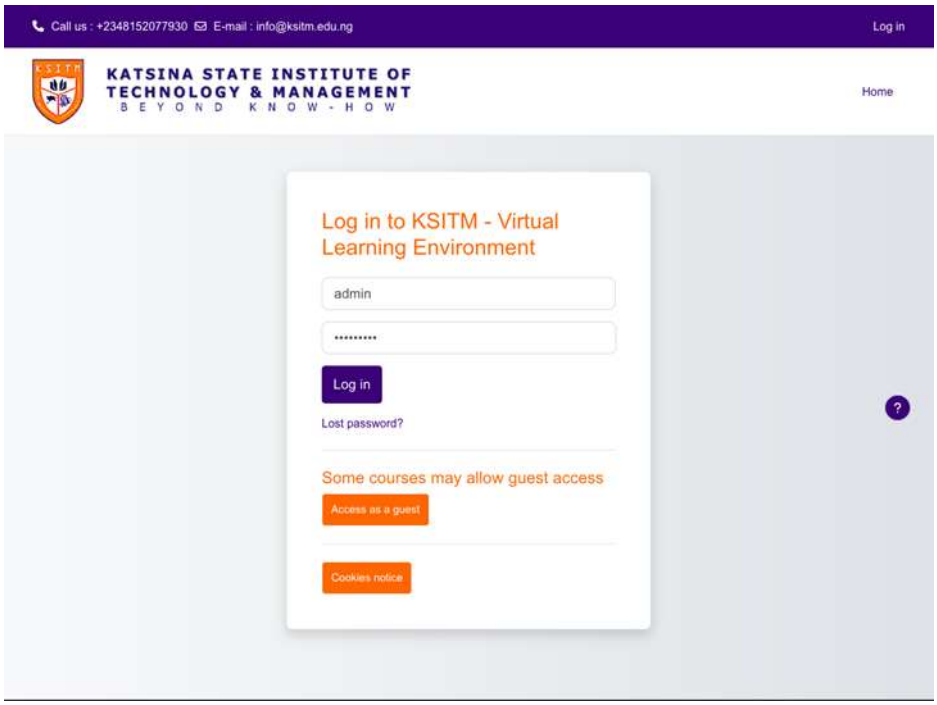

Fig 8 – Login Screen

4.3 Dashboard

Dashboard is a personalized workspace designed to provide users with an overview of their courses, tasks, and notifications. It offers a Course Overview section where users can see their enrolled or managed courses, track progress, and quickly navigate to specific course pages. The dashboard also includes a timeline or calendar to highlight upcoming deadlines for assignments, quizzes, and events, along with notifications about new forum posts, grades, or system updates. This layout helps users stay organized and ensures they are informed of their responsibilities.

For students, it provides access to assignments, grades, and forums, while teachers can manage courses and track student performance. Administrators benefit from tools for system configuration and user management. Overall, the dashboard enhances efficiency and usability by centralizing essential tools and information in an accessible, user-friendly interface.

4.4 Courses

The Courses Page is a centralized hub where users can view and access their enrolled or managed courses. It provides a well-organized list of courses, often grouped by categories such as current, past, or future courses, along with search and filter options to help users quickly locate specific courses. Each course is displayed with a clickable link, a brief description, and visual identifiers, making navigation intuitive. Students can track their progress through indicators like completed assignments or percentage progress, while teachers can monitor student engagement and manage course content efficiently.

By clicking on a course, users are redirected to its dedicated page, which contains detailed materials such as lessons, quizzes, forums, and assignments. Teachers can upload resources, schedule activities, and communicate with students, while administrators have options to manage enrollments and configure access settings. The Courses Page simplifies navigation and enhances productivity by organizing essential learning and teaching resources in one accessible location, ensuring a seamless experience for all users.

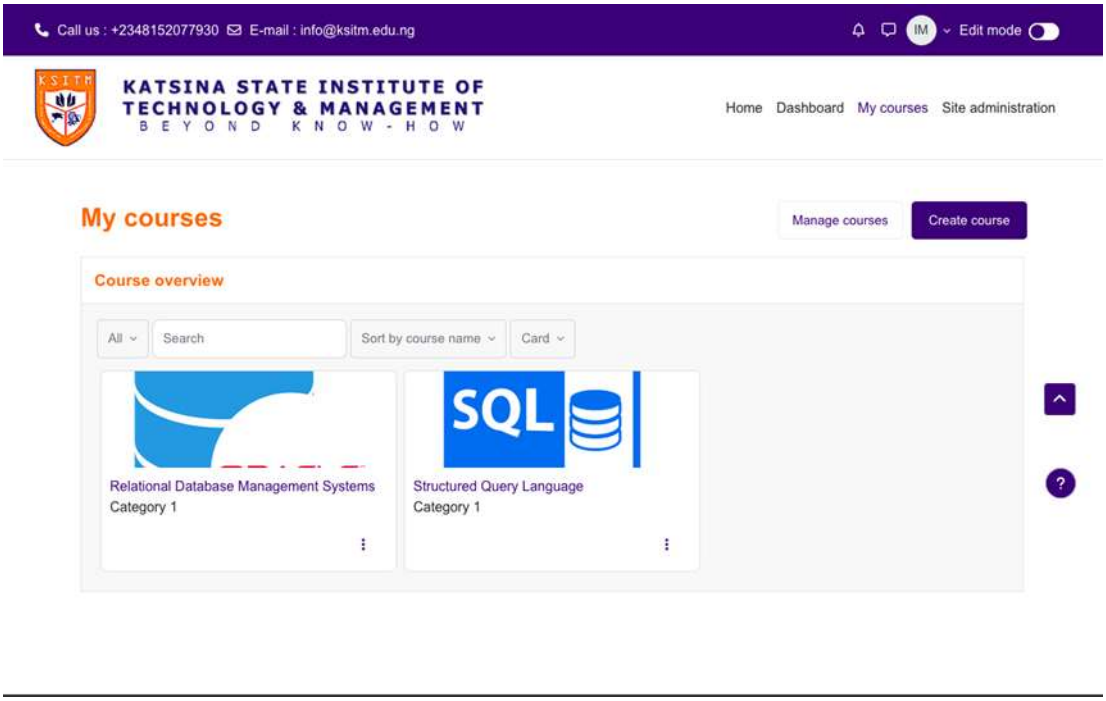

Fig 9 – Courses Screen

5. Conclusion

The deployment of a Virtual Learning Environment (VLE) at the Katsina State Institute of Technology and Management marks a significant milestone in leveraging technology to enhance curriculum delivery and foster academic excellence. This initiative demonstrates the institution's commitment to modernizing its educational framework, addressing the challenges of traditional learning models, and preparing its students for a technology-driven world. Through the VLE, students and instructors gain access to a dynamic platform that facilitates seamless interaction, resource sharing, and adaptive learning. The integration of this system has streamlined the dissemination of learning materials, enabled personalized instruction, and fostered greater student engagement. Moreover, it has bridged the geographical and temporal gaps that previously hindered learning, providing an inclusive and flexible education model.

The deployment process highlighted key insights, including the importance of stakeholder involvement, robust technical infrastructure, and comprehensive training programs to ensure adoption and usability. Despite initial challenges such as resistance to change and infrastructure limitations, strategic planning, continuous support, and capacity building proved instrumental in achieving a successful implementation. Moving forward, sustained efforts are necessary to maintain the VLE's relevance and efficiency. Regular updates, user feedback incorporation, and alignment with global educational trends will ensure the platform remains a transformative tool for the institution. Additionally, expanding the system's features to include advanced analytics, AI-based personalized learning pathways, and integrations with other educational technologies will further enhance its impact.

In conclusion, the VLE initiative underscores the transformative potential of digital education tools in reshaping academic delivery. Katsina State Institute of Technology and Management has set a precedent for adopting innovative educational solutions, demonstrating that with vision, strategy, and dedication, institutions can effectively transition into the digital age to offer quality education for all.

Acknowledgements

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