**DEVELOPMENT OF AN ONLINE LEARNING MANAGEMENT SYSTEM FOR HASSAN USMAN KATSINA POLYTECHNIC, KATSINA STATE**

**BY**

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**CHAPTER ONE**

**INTRODUCTION**

**1.1 Overview**

This chapter provides an introduction and background to the proposed learning management system (LMS) for Hassan Usman Katsina Polytechnic. It discusses the motivation for developing an LMS, states the problems an LMS aims to solve, outlines the aims and objectives, significance and potential risks of the project, and the scope and organization of the rest of the report.

**1.2 Background and Motivation**

Hassan Usman Katsina Polytechnic has relied on traditional face-to-face teaching models and manual academic administration processes since its establishment in 2006 (HUK website, 2023). Physical noticeboards, Excel sheets, paper forms, and offline records have typically been used for core academic functions.

However, global education sector transformation provides strong motivation for institutions to integrate digital technologies and online platforms like learning management systems (LMS) into their operations and service delivery. According to studies, LMS usage in higher education helps students achieve better academic results (Asamoah, 2019), while also enabling improved tracking, automation and overall efficiencies for administrators and educators (Tammeorg et al. 2021).

Specifically, only an estimated 15% of institutions currently utilize any form of e-learning systems in Nigeria (Awofala et al. 2022). This highlights the significant room for expansion and value realization possible via LMS adoption. Tailoring a platform to address HUK’s needs provides an opportunity to modernize academic processes, improve outcomes and stakeholder experiences, and potentially increase competitive positioning.

**1.3 Statement of the Problem**

The current academic systems at Hassan Usman Katsina Polytechnic are predominantly manual and paper-based, leading to several challenges including difficulty accessing distributed learning materials for students; communication gaps and lack of collaboration tools between stakeholders; limited assessment administration, grades tracking and student progress monitoring capabilities; unnecessary administrative workload and repetitive manual processes; and an overall sub-optimal academic experience for all parties. These systemic inefficiencies highlight the need for an integrated digital academic management system to improve resource discoverability and accessibility, support seamless multi-party interactions, enable automation of key workflows, provide data-driven analytics and reports, and ultimately enhance teaching, learning and administration across the polytechnic.

**1.4 Aim and Objectives**

The aim of this project is:

To develop an online Learning Management System for Hassan Usman Katsina Polytechnic to improve teaching, learning and academic administration processes.

The objectives include:

1. Automate academic workflows and processes
2. Standardize course structure across the polytechnic
3. Provide a centralized learning portal for students and staff
4. Facilitate instructional resource creation and distribution
5. Implement assessment tools for students performance tracking

**1.5 Significance of the Project**

The development and rollout of a customized learning management system for Hassan Usman Katsina Polytechnic carries profound importance and potential impact on multiple levels - operational, tactical and strategic. By modernizing key academic processes, it can drive step-change improvements in student learning outcomes through enhanced access to resources and assessments tracking. Lecturers and administrators can achieve major productivity gains from automated workflows, saving hours previously spent on manual tasks. Data analytics will generate actionable insights to keep improving overall pedagogical quality. Taken together, these outcomes can markedly strengthen institutional competitiveness in student recruitment and retention, teaching standards, and operational excellence. The project signifies a vital digital transformation milestone for the polytechnic to meet the demands of 21st century teaching and learning excellence.

**1.6 Project Risks Assessment**

Table 1.1 Project Risks Assessment

|  |  |  |  |
| --- | --- | --- | --- |
| **Risk** | **Impact** | **Likelihood** | **Mitigation Strategy** |
| Weak internet infrastructure | High | Medium | Early capacity planning for required bandwidth and devices |
| Resistance to change | Medium | High | Extensive training and engagement with stakeholders |
| Scope creep | High | Medium | Controlled scope management |
| Tight timelines | Medium | High | Iterative development sprints |
| Integration challenges | High | Low | API approach for interoperability |

**1.7 Scope and Organization**

The scope of this project encompasses the analysis, design, development, and implementation of a custom web-based learning management system to support key academic processes for students, lecturers, and administrators at Hassan Usman Katsina Polytechnic. The remaining report documentation is structured across the following core chapters - Chapter 2 expands on requirements gathering and specifications; Chapter 3 details the proposed system architecture and technical design; Chapter 4 elaborates the implementation plan including technologies and phases; Finally Chapter 5 concludes with next steps, recommendations for future enhancements, and key lessons learned from the project. The phased approach allows for an agile methodology focused on iterative delivery to serve institutional stakeholders needs.

**1.8 Definition of Operational Terms**

Learning Management System (LMS) - A software application for administration, documentation, tracking, reporting and delivery of educational courses or training programs.

Academic Workflows - Standardized processes and sequencing of tasks supporting key functions like admissions, scheduling, assessments, and certification.

Automation - Use of technology to complete recurrent tasks previously requiring manual effort to improve efficiency.

Academic Analytics - Data analysis on students activities and performance indicators to provide insights and predict outcomes.

Stakeholders - Key interest groups like students, lecturers, administrators who will directly interact with the system to meet their needs.

Customization - Process of adapting an existing system to match the specific requirements of an organization.

**CHAPTER TWO**

**LITERATURE REVIEW**

**2.1 Introduction**

This chapter provides a review of existing literature related to the concepts, applications, and best practices for learning management systems (LMS) in higher education institutions. It discusses the historical evolution of LMS, summarizes key research findings on the usage and effectiveness of these platforms, and identifies opportunities for customization to meet institutional strategic priorities. The literature review informs the analysis, design and implementation recommendations made in subsequent sections of the project report.

**2.2 Historical Overview**

Learning management systems originated in the 1990s as educational institutions began experimenting with using web technologies and online platforms to complement traditional classroom teaching (Ellis, 2009). Early systems were focused more on course content delivery but over the last two decades, LMS platforms have evolved into comprehensive solutions encompassing course administration, communication tools, assignment hand-in, plagiarism checking, assessments management, analytics dashboards, and integration capabilities with third-party academic applications (Watson & Watson, 2007).

Modern cloud-based LMS systems are highly customizable to institutional needs and mobile-compatible to match access trends. Leading proprietary solutions include Blackboard, Canvas, Moodle, Schoology, whereas open-source options like Moodle and Canvas are also popular. Recent developments use machine learning and analytics to provide adaptive learning experiences personalized to each student strengths and weaknesses to improve outcomes.

**2.3 Related Works**

Multiple studies on LMS implementations validate their advantages and effectiveness for students, educators and academic institutions. Asamoah (2019) found significant improvements in student grades, satisfaction, and perceived productivity with LMS use compared to traditional methods. Instructors reported advantages like easier assignment management, better reproductive use of content, and tracking student progress. Damşa et al. (2021) measured time savings for educators from automatic grading workflows, plagiarism checking, and reuse of course templates in subsequent terms.

However, challenges like technical issues, training overheads, integration complexity and change resistance from users are also highlighted for consideration during platform selection and rollout planning (Aldiab et al. 2022). Hence understanding key user requirements and customization opportunities is an important success factor (Tammeorg et al. 2021) as discussed further in the next chapter.

Asamoah (2019) found that LMS usage led to significant improvements in student performance, satisfaction, and perceived productivity compared to traditional teaching methods. Instructors reported advantages like easier assignment creation/distribution, reusable content, remote learning support, and data-driven insights to adjust teaching strategies. Ricoy et al. (2022) surveyed over 700 students and found over 87% felt an LMS was useful for improving access to materials, communication and needed academic resources.

On the institutional side, administrators gained automation for key processes like enrollment, assessments, and certification. This enabled improved quality control, auditing and reduced manual workload (Baloyi, 2014). Costa et al. (2012) estimated potential productivity gains to recoup LMS investment in under 3 years in their cost-benefit model case study.

However, studies have also examined implementation challenges experienced. Poor interface design and technical glitches were top complaints impacting user adoption and satisfaction (Aldiab et al. 2022). Ssekakubo et al. (2013) identified resistance to change, lack of institutional support and perceptual barriers regarding eLearning effectiveness amongst factors deterring LMS penetration. Staff training costs are also highlighted, but faculty onboarding processes involving collaborative design sprints can offset these concerns and drive engagement (Damşa et al. 2021).

Key recommendations include extensive planning for integration capabilities, accessibility needs and core use cases prioritization based on user segments (Tammeorg et al. 2021). Iterative rollouts allow course corrections after feedback cycles. Understanding unique institutional requirements is vital for long-term LMS sustainability and leveraging possibilities beyond just digitizing traditional models (Rienties et al. 2022).

Al-Busaidi and Al-Shihi (2010) found that system quality factors like usability, reliability, responsiveness and flexibility were top drivers for instructors. Features allowing content reuse across courses and ease of grading assessments also rated highly. For students, information quality dimensions like relevance, understandability, and ability to meet academic goals were critical. Standard LMS platforms may need customization and integrations to tailor to these expectations.

User engagement from early design stages can reveal unique preferences and process workflows to inform system requirements (Islam et al. 2022). Ongoing co-creation also enables buy-in and change management. Training and onboarding that aligns LMS features to actual teaching or learning needs cement adoption.

Assessing technological readiness and organizational culture aspects also prevents barriers. Leadership direction and resource allocation to guide transition while accommodating initial learning curves encourage persistence in usage (Aldiab et al. 2021). Incremental system rollouts allow familiarity before adding complexity.

Al-Busaidi (2012) found functionality, reliability and usability were critical expectations regardless of platform type. Open-source systems like Moodle were perceived as more customizable to institutional needs and integration ready with existing IT infrastructure which aided acceptance. But some proprietary systems scored higher on user-friendliness and stability.

Klobas and McGill (2010) highlight that the effectiveness of either LMS model depends not just on features but the quality of integration support, change management and user training provided during implementation. Open-source platforms benefited from wider community developer ecosystems enabling agile enhancements but relied more on inhouse technical skills. Proprietary LMS vendors offered full IT support services but at a recurring licensing cost premium. The complementary capabilities needed for sustainable deployment must be evaluated.

Organizations also displayed preference biases - smaller institutions leaned towards open-source options for tighter budget while larger universities gravitated to market leading proprietary LMS believing the stability and support outweighed upfront costs (Weaver et al., 2008). But hybrid models adopting the best of both platforms are an emerging option. The optimal LMS solution is contingent on multiple relative factors.

Artificial intelligence and machine learning are enabling more responsive personalization of learning experiences tailored to individual pace and need - adaptive content, smart testing recommendations, predictive analytics to pre-empt academic issues etc (Shahiri & Husain, 2021). Augmented/virtual reality solutions are being integrated for more engaging interactive learning modules spanning diverse topics and formats.

With more affordable devices, cloud infrastructure and 5G, remote live streaming of specialized teaching sessions can connect external expert instructors or far-flung student groups into integrated Omni-channel learning environments (Chinese, 2021). Blockchain platforms also facilitate building tamper-proof competency records and micro-credentials critical for life-long learning objectives (Ocheja et al. 2022).

However these emerging technologies layer on additional adoption challenges regarding skills, support and service management relative to institutional readiness (Raza, 2022). But the innovation opportunities and digitally enriched multi-modal academic experiences possible make the modernization imperative worth pursuing (Tlili et al. 2022). Analyzing both established and emerging technologies can inform strategic LMS roadmapping priorities.

Abdellatief et al. (2022) surveyed over 300 university students to identify most preferred LMS interface features - simplicity, logical information flow, visually appealing elements, consistency across device access modes. Excessive features caused confusion. Personalization to display most relevant tools and content also rated highly.

Ease of navigation, clear labeling, and common convention based layouts reduced cognitive load. Instant feedback and status visibility on submitted actions provided assurance. Summarized content with expand/collapse helped focus attention. Automated recommendations and notifications kept users in workflow. Offline access enabled continuity for limited connectivity.

Beyond interface design, a positive first-time user experience through self-service tutorials, responsive in-app support, and ability to test the platform risk-free cemented ongoing engagement. Continuous user testing cycles enable rapid refinements towards optimal design thinking (Martin et al. 2022). Prioritizing use cases aligning high value to users versus technical complexity guides system evolution.

Islam et al. (2021) developed an integrated model emphasizing "soft issues" like commitment building, training and incentives for user buy-in as equal enablers of LMS success alongside technical robustness. Leadership involvement in articulating strategic vision linked to pedagogical and operational improvements from the platform cemented persistence in usage despite inevitable initial adoption pains.

Ongoing participative decision making also enables course corrections responding to emergent needs. Tammeorg et al. (2021) concludes extensive early consultation and collaborative design of academic processes and system requirements minimizes disruptiveness during implementation. Proactively addressing accessibility barriers and attitudes preventing technology embracement through this engagement reduces resistance.

Post-implementation support services to resolve troubleshooting issues in a timely manner also improves learner satisfaction and system stickiness (Aldiab et al. 2021). Allocating dedicated personnel as campus advocates guiding the transition is considered impactful. Sustained stakeholder involvement is thus essential before, during and after LMS deployments.

**2.4 Comparative Analysis**

Table 2.1 Comparative Analysis of the Related Works

|  |  |  |  |
| --- | --- | --- | --- |
| **Study** | **Methods/Approach** | **Strengths** | **Weaknesses** |
| Asamoah (2019) | Quantitative survey and data analysis | - Significant improvements in student grades, satisfaction, and productivity  - Easier assignment management and content reuse  - Data-driven insights for teaching adjustments | - Technical issues and training overheads  - Resistance to change from users |
| Damşa et al. (2021) | Quantitative analysis and case study | - Time savings for educators from automatic grading and course template reuse  - Improved quality control and reduced manual workload for administrators | - Technical issues and training overheads  - Resistance to change from users |
| Ricoy et al. (2022) | Survey and qualitative analysis | - Improved access to materials and communication  - Positive impact on student satisfaction  - Useful for accessing academic resources | - Poor interface design and technical glitches  - Resistance to change and lack of institutional support |
| Baloyi (2014) | Case study and cost-benefit analysis | - Automation of key processes and improved quality control  - Reduced manual workload for administrators  - Potential productivity gains for institutions | - Lack of institutional support and resistance to change  - Staff training costs |
| Costa et al. (2012) | Cost-benefit analysis and case study | - Potential productivity gains to recoup LMS investment  - Improved quality control and auditing  - Reduced manual workload for administrators | - Lack of institutional support and resistance to change  - Staff training costs |
| Ssekakubo et al. (2013) | Survey and qualitative analysis | - Identified factors deterring LMS penetration  - Perceptual barriers regarding eLearning effectiveness | - Resistance to change and lack of institutional support  - Perceived lack of effectiveness of eLearning |
| Al-Busaidi and Al-Shihi (2010) | Survey and qualitative analysis | - Identified key system quality factors for instructors and students  - Content reuse and ease of grading assessments | - Lack of institutional support and resistance to change  - Poor interface design |
| Rienties et al. (2022) | Literature review and qualitative analysis | - Emphasizes the importance of understanding unique institutional requirements  - Long-term sustainability and leveraging possibilities beyond traditional models | - Lack of customization and focus on digitizing traditional models  - Limited implementation details |

**2.5 Summary**

This chapter provides a literature review of learning management systems (LMS) in higher education. It discusses the historical evolution of LMS, their key features and functionalities, and their effectiveness in improving student outcomes and administrative processes. The chapter also highlights the advantages and challenges associated with LMS implementation, including customization opportunities and the importance of understanding user requirements.

**CHAPTER THREE**

**REQUIREMENTS ANALYSIS AND DESIGN**

**3.1 Overview**

This chapter focuses on gathering and analyzing requirements, as well as formulating the system design for the proposed online Learning Management System (LMS) tailored for Hassan Usman Katsina Polytechnic (HUKPOLY). Through consultations with key institutional stakeholders, comprehensive functional and non-functional requirements have been captured. To depict the analysis and proposed system design, use case diagrams, workflow diagrams, data models and interface prototypes have been developed.

**3.2 Methodology**

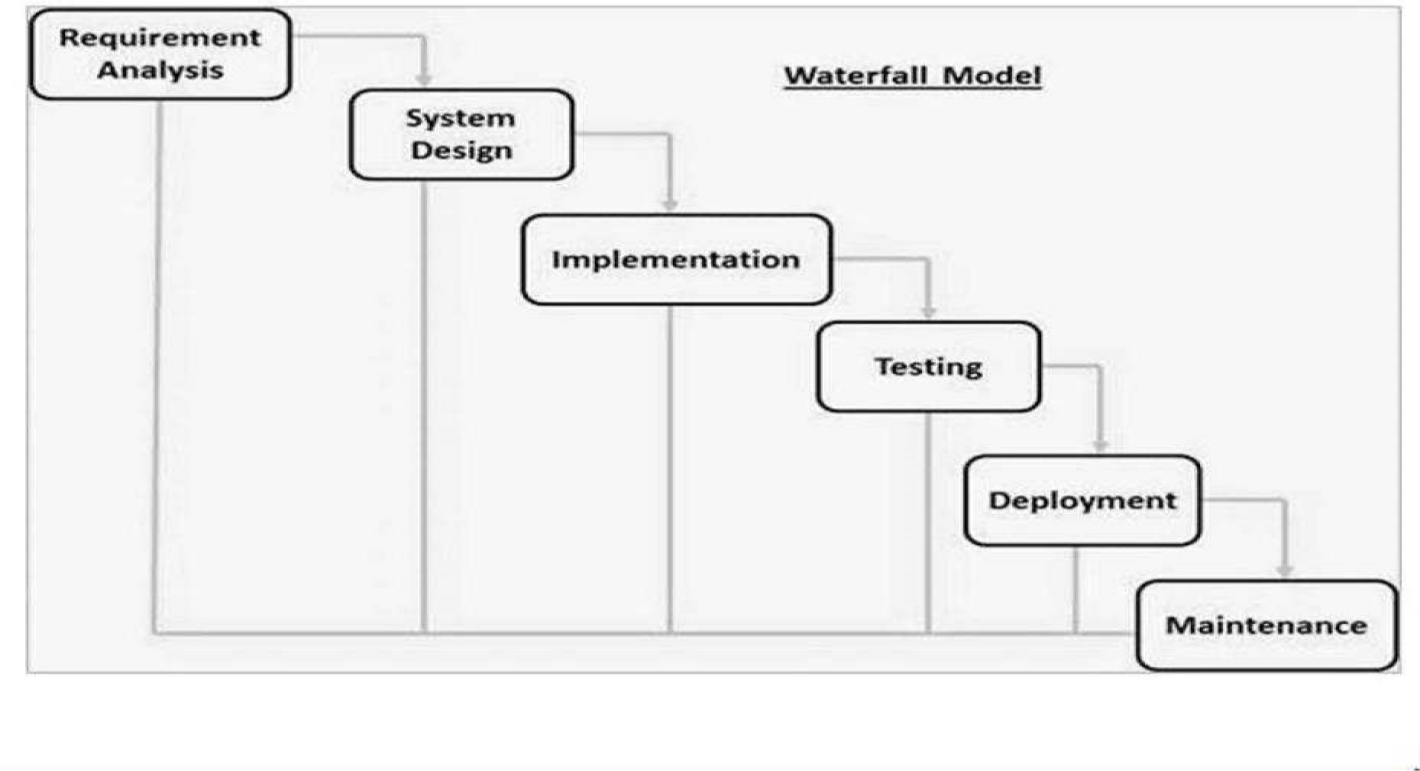
The main software development approach selected is the iterative and incremental model allowing collaborative design sprints. This provides flexibility to continuously gather feedback from students, instructors and administrators on prioritized features and make adjustments based on real institutional usage patterns. The process involves modular software builds with the most critical academic workflows and components first. Additional functionality can be added in phased releases over multiple development cycles.

Figure 3.1 Waterfall Model (Wikipedia, 2013)

**3.3 Tools and Technologies**

The LMS will utilize a MERN (MongoDB, Express.js, ReactJS, Node.js) technology stack for building an accessible cloud-hosted web application. Responsive mobile-friendly interfaces will be implemented through ReactJS. MongoDB provides schema-flexible document storage. Machine learning APIs from TensorFlow and Azure Cognitive Services will enable intelligent functionality over time e.g. plagiarism checking.

**3.4 Ethical Considerations**

Key ethical aspects considered include:

1. Data privacy, security and transparent policies
2. Accessibility and inclusion requirements
3. Fairness, accountability in algorithmic recommender systems
4. Validity, integrity checks in automated grading/assessments
5. Ethical use of analytics data to improve student experiences

Appropriate technical and policy controls will be instituted to address these.

**3.5 Requirements Analysis**

**3.5.1 Functional Requirements**

Table 3.1 Functional Requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **ID** | **User Segment** | **Requirement** | **Description** | **Priority** |
| FR1 | Student | View course materials | Ability to view lecture slides, notes, tutorial videos, reading links and other learning content for enrolled courses | High |
| FR2 | Student | Attempt assessments | Take quizzes, assignments, exams and view scored results | High |
| FR3 | Student | Track academic progress | View personal performance dashboards showing test scores, assignment grades, standing based on course expectations | High |
| FR4 | Student | Participate in forums | Engage in discussions by posting questions, responses and share resources with classmates under each course | Medium |
| FR5 | Instructor | Author course content | Create and upload learning materials like documents, slides, videos, web links for each course | High |
| FR6 | Instructor | Assess students | Compose assessment questions, hosted timed exams, create assign deliverables, allocate grades/marks | High |
| FR7 | Instructor | Student tracking | Monitor key engagement and performance metrics at individual/cohort level | Medium |
| FR8 | Administrator | Student enrollment | Digitize registration details, manage program allotments and class allocations | High |
| FR9 | Administrator | Access control | Create and manage user accounts, privileges and system roles | High |
| FR10 | Administrator | Institutional reporting | Leverage analytics dashboard spanning multiple courses/programs for insights | Medium |

**3.5.2 Non-Functional Requirements**

Table 3.2 Non-Functional Requirements

|  |  |  |  |
| --- | --- | --- | --- |
| **Category** | **Requirement** | **Description** | **Priority** |
| Usability | Intuitive interface | Simple, consistent and easy-to-use interface across student, instructor and admin modules | High |
| Usability | Responsiveness | Uniform experience across desktop and mobile devices with auto-adjusted interfaces | Medium |
| Performance | Response time | Pages and submissions processing should occur in under 5 seconds for 98% of transactions | High |
| Availability | Uptime | Platform available 24x7 with minimum 99% uptime | High |
| Scalability | Concurrent users | System able to handle 500 concurrent logged in users with no degradation in performance | Medium |
| Scalability | Data capacity | Database and object storage scaled to handle volumes from 5000+ students | Medium |
| Security | Authentication | Validate user identity through passwords and MFA before granting system access | High |
| Security | Data encryption | Encrypt stored pupil information and transmitted content using AES 256-bit encryption | High |
| Security | Access control | Granular access policies on functionality exposure based on user role | Medium |
| Standards | Interoperability | Support for open API integration with complementary academic systems | Low |
| Standards | Accessibility compliance | Web Content Accessibility Guidelines (WCAG) 2.1 level AA standards adherence | Medium |

3.6 System Models and Diagramss