



## Evaluating the Effects of Online Learning Platforms on the Information Technology (IT) Curriculum Delivery at Botho University

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**Abstract.** The integration of online learning platforms into higher education significantly reshaped the pedagogical landscape, particularly in Information Technology (IT) education. This study evaluated the effectiveness of Blackboard and Virtual Laboratory (V-Lab) in delivering the IT curriculum at Botho University (BU), focusing on pedagogical utility, practical skills acquisition, and student engagement. A mixed-methods approach combining quantitative and qualitative data was used, combining faculty and student surveys, and curriculum content analysis. The population of the study included 55 students and 5 faculty members. Findings indicated that Blackboard supported content delivery and asynchronous learning effectively but offered limited interactivity for practical engagement. In contrast, the Virtual Laboratory enhanced hands-on technical competencies, especially in networking and system-based modules. However, both platforms were hindered by challenges such as inconsistent internet connectivity, limited real-time collaboration, and insufficient user training. Student engagement improved when online platforms incorporated collaborative tasks, timely feedback, and active instructor presence which aligns with Constructivist Learning Theory and the Technology Acceptance Model (TAM) framework. The study recommended ongoing digital literacy training for faculty and students, infrastructure improvements, and the integration of more interactive features such as real-time simulations and scalable infrastructure. Additionally, aligning platform capabilities with specific learning outcomes was advised to optimize delivery, particularly in practical modules. These strategies aim to strengthen the role of online platforms in delivering a comprehensive and skills-oriented IT curriculum in higher education.

**Keywords:** Online learning, IT curriculum delivery, digital pedagogy, practical skills acquisition, student engagement.

# 1 Introduction

## 1.1 Introduction

The rapid rise of online learning platforms has transformed higher education globally, this has been accelerated by the COVID-19 pandemic (Akpen, et al., 2024) (Dhawan, 2020). In IT education, which relies on both theory and hands-on practice, platforms such as Blackboard and V-Lab influence student engagement and curriculum delivery. This study evaluates their impact on IT curriculum delivery at BU, focusing on pedagogical utility, practical skills acquisition, and student engagement.

Globally, research shows mixed outcomes: China and the U.S. highlight challenges replicating hands-on learning (Zhang & Cheng, 2023) (Xu & Wang, 2022), while Europe and Africa report reduced engagement, infrastructure barriers, and unequal access to interactive tools (Muller & Mildenerger, 2021); (Okonkwo & Nkambule, 2020). Regionally, studies from Namibia and Botswana underscore difficulties in simulating practical IT modules online (Hamunyela & Mapolisa, 2021); (Sebusang & Motshegwa, 2022). These findings reveal that while platforms enhance access, they often struggle to support collaborative, lab-based learning essential in IT education (Al-Enran, et al., 2023).

The study was anchored in the Technology Acceptance Model (TAM), which explores how perceptions of usefulness and ease of use affect platform adoption (Davis, 1989), and Constructivist Learning Theory, which emphasizes active, hands-on engagement (Vygotsky, 1978) (Jonassen, 1991). Together, these frameworks guide analysis of how online platforms shape learning experiences.

## 1.2 Problem Statement:

At BU, the shift from face-to-face delivery to online platforms raises questions about their effectiveness in developing practical IT skills, given challenges of reduced interaction and feedback (Mesuwini & Mokoena, 2024).

## 1.3 Objectives:

- Examine the current use of online platforms in IT curriculum delivery.
- Assess their effectiveness in supporting practical skills acquisition.
- Evaluate their effect on student engagement and interaction.
- Propose strategies for optimization.

## 1.4 Significance:

The study informs educators, administrators, and policymakers on best practices for integrating online platforms into IT education, offering context-specific recommendations for Sub-Saharan Africa.

### 1.5 Scope:

Focused on BU's IT department, the research examines platform use, engagement, and skill development in programming, system administration, and network administration modules.

### 1.6 Limitations:

These limitations constrain the external validity of the study, as the results may not reflect experiences beyond BU or across different academic periods. Future research that spans multiple institutions, employs mixed-methods approaches, and examines trends over extended timeframes would provide more comprehensive and transferable insights.

## 2 Literature Review

The integration of online learning platforms has transformed IT curriculum delivery globally, offering flexibility, accessibility, and opportunities for scaling education across diverse contexts. Studies highlight their effectiveness in supporting theoretical learning but raise concerns about their limitations in facilitating hands-on skills essential for IT education (Martin & Bolliger, 2018); (Bond, et al., 2021).

Globally, platforms such as Coursera, edX, and Udacity have expanded access to IT courses, with project-based and simulation-driven approaches enhancing skill acquisition (Ally, 2020); (Pappano, 2019). However, challenges remain, including limited replication of hardware-based tasks and varying instructional design quality (Selwyn, 2020). Across Africa, institutions increasingly adopt Moodle, Google Classroom, and Blackboard to widen access, though persistent issues such as internet connectivity, digital literacy, and inadequate infrastructure constrain their effectiveness ((Olabiya & Ilesanmi, 2021); (Mwangi, et al., 2021). Blended strategies that combine online and in-person techniques have the potential to lessen these difficulties (Sibiya, 2021).

In Botswana, the COVID-19 pandemic accelerated adoption of platforms such as Moodle, Microsoft Teams, and Google Classroom in universities. While these ensured continuity of learning, rural-urban disparities in internet access and limited faculty training hindered widespread effectiveness (Mogomotsi & Kgatlwane, 2021); (Molefe, 2020). Initiatives such as the Botswana Digital Education Program and Vision 2036 aim to address infrastructural gaps and enhance digital literacy (Tshipala, 2020); (Matlho & Gose, 2022).

A key concern across contexts is the effectiveness of online platforms in supporting practical IT skills. Virtual labs, coding simulations, and collaborative tools provide partial solutions, yet fail to fully replicate authentic lab-based learning, particularly in areas like networking and cybersecurity (Garrison & Kakuna, 2021). Student engagement is also mixed: while features such as discussion forums, synchronous classes, and peer collaboration increase interactivity, issues of isolation, self-discipline, and motivation persist (Jung & Rha, 2020); (Bates, 2019).

The literature recommends blended and hybrid models, integration of virtual labs, context-specific content, and faculty training to enhance online IT curriculum delivery (Selwyn, 2020); (Olaogun & Oyewole, 2020). However, significant gaps remain in evaluating the long-term impact of online platforms on skill retention, localized adoption in developing contexts, and platform-specific effectiveness. This study responds to these gaps by examining the impact of online learning platforms on IT curriculum delivery at BU, offering insights into student engagement, lecturer practices, and institutional readiness

### **3 Research Methodology**

This study employed a case study design to examine the integration and impact of online learning platforms on IT curriculum delivery at BU, focusing on experiences, challenges, and outcomes within the IT department. Guided by a pragmatic paradigm (Creswell & Creswell, 2018), the research adopted a mixed-methods approach, combining quantitative and qualitative data to provide a comprehensive understanding of the phenomenon.

#### **3.1 Data Collection**

Quantitative data were collected via structured questionnaires targeting IT students, measuring engagement, academic performance, and perceptions of platform effectiveness. Qualitative data were gathered through semi-structured interviews with both students and faculty, capturing experiences, challenges, and perspectives on online learning. Interviews were conducted face-to-face or via video conferencing, while survey design followed Dillman's (2014) guidelines for clarity and reliability.

#### **3.2 Population and Sampling**

The target population included all students and faculty affiliated with the Distance Learning campus enrolled in Managing Network Hardware 2 (NH2) and/or Operating Systems and Hardware (OSH) between July 2024 and June 2025. Full enrolment comprised 32 NH2 students, 23 OSH students, and 5 faculty members.

#### **Sample Selection:**

**Students:** A purposive sample of 20 students actively engaged in NH2, and OSH modules participated, reflecting practical constraints while capturing relevant experiences.

**Faculty:** All 5 faculty members teaching these modules were included, ensuring a complete view of instructional perspectives.

### **3.3 Validation and Reliability**

Triangulation of data collection methods, pilot testing of questionnaires, and member checking of interview summaries ensured validity (Taherdoost, 2016); (Creswell & Creswell, 2018). Reliability was assessed via internal consistency, test-retest, inter-rater, and split-half measures to confirm instrument stability and reproducibility.

### **3.4 Ethical Considerations**

The study adhered to the ethical guidelines from BU's Institutional Review Board. Informed consent, confidentiality, voluntary participation, and secure data storage were ensured throughout the research process (British Educational Research Association (BERA), 2018); (Babbie, 2020).

### **3.5 Data Analysis and Interpretation**

**Quantitative Analysis:** Descriptive statistics summarized student responses, and inferential statistics (e.g., t-tests, ANOVA) were considered where appropriate, though limited by sample size (Field, 2018).

**Qualitative Analysis:** Faculty interview transcripts were analyzed using thematic analysis (Braun & Clarke, 2006), following six steps: familiarization, coding, theme identification, review, definition, and reporting. Themes were illustrated with participant quotes.

**Integration of Results:** Quantitative and qualitative findings were combined using a narrative weaving method to contextualize survey trends with faculty insights, enhancing the explanatory power of the study (Tashakkori & Teddlie, 2010).

## **4 Presentations and Analysis of Findings**

### **4.1 Quantitative Results- Students**

The quantitative findings in this study reflect the perspectives of students enrolled in the NH2 and OSH modules at BU's Distance Learning campus. Data collected through structured questionnaires focused on demographics, platform usage, engagement, interaction, practical skill development, challenges, and proposed improvements. These findings provide measurable insights into how online learning platforms impact student learning, engagement, and skill acquisition in practical IT modules. The table below summarizes the key trends and observations from the student responses.

**Table 1.** Quantitative Findings- Students

Construct / Research Question	Key Findings	Summary Notes / Implications
<b>Demographics</b>	60% male, 40% female; 50% over 25 years; 45% Year 1 students	Older students prefer online learning for flexibility; newer students may have stronger opinions on adaptation.
<b>Platform Usage &amp; Frequency (RQ1)</b>	Blackboard (90%), Google Classroom (35%), Moodle (4.5%); frequent users report higher engagement	Frequent interaction with platforms improves engagement and learning outcomes.
<b>Effectiveness for Practical IT Skills (RQ2)</b>	Very Effective 35%, Moderately Effective 35%, Not Effective 22.7%	Online platforms support coding/simulations but have limitations for lab-based skills.
<b>Engagement &amp; Interaction (RQ3)</b>	54.5% agree online platforms enhance engagement, 27.3% disagree	Flexibility and self-paced study motivate engagement; lack of face-to-face interaction is a barrier for some students.
<b>Interaction with Instructors &amp; Peers</b>	Increased interaction 30%, Decreased 30%, No change 10%	Instructor-student interaction is maintained; peer-to-peer engagement is inconsistent.
<b>Challenges in Online Learning</b>	Technical issues 31.8%, Limited interaction 27.3%, Access to materials 27.3%, Lack of hands-on experience 13.6%	Connectivity, platform design, and limited practical opportunities hinder effective learning.
<b>Suggested Improvements (RQ4)</b>	Virtual labs (5 mentions), Live sessions (4), Better LMS design (3), Hybrid learning (5)	Students recommend enhanced virtual labs, live sessions, improved LMS, and blended approaches to strengthen learning.

**4.2 Qualitative Findings- Lecturers**

Five instructors from the Faculty of Engineering and Technology participated in semi-structured interviews between April and June of 2025. Each participant had postgraduate degrees and a great deal of expertise instructing online, guaranteeing knowledgeable and reliable suggestions. Eight main themes that were in line with the study's goals emerged from the thematic analysis of the qualitative data.

Theme 1: Integration of Online Platforms into Teaching- The findings reveal that online learning platforms are fully embedded in instructional practices. Lecturers reported aligning course design, lesson planning, and content delivery with platform functionalities. Learning management systems such as Blackboard, Moodle, and Microsoft Teams were consistently used to structure weekly content, facilitate

synchronous and asynchronous engagement, and support instructional continuity. These platforms were perceived as foundational to the effective delivery of distance education.

**Theme 2: Preferred Platform Features and Tools-** Participants identified assessment and communication tools as the most valuable platform features. Automated quizzes, discussion forums, and chat functionalities were frequently used to enhance content delivery, monitor student understanding, and provide timely feedback. Such tools were viewed as essential for maintaining instructional quality and promoting interaction in online learning environments.

**Theme 3: Student Engagement in Online Learning-** Lecturers reported that student engagement was strongly influenced by the level of interactivity and the relevance of learning activities. Interactive tools such as polls, breakout rooms, and real-world problem-based tasks were found to encourage participation and sustained involvement. Conversely, engagement declined when activities lacked practical relevance or interactive elements.

**Theme 4: Interaction Patterns in Online Environments-** The findings indicate that student to lecturer interactions, remains relatively strong in online settings, facilitated by direct communication tools within learning platforms. However, peer-to-peer interaction was perceived to be less frequent compared to traditional face-to-face environments. This suggests a shift towards more instructor-centered interaction patterns in online teaching contexts.

**Theme 5: Practical Skills Acquisition in IT Modules-** A major concern highlighted by participants was the limited effectiveness of online platforms in supporting practical, hands-on skill development. Lecturers noted that hardware-oriented subjects, such as networking and operating systems, require physical interaction with devices, which virtual environments cannot fully replicate. While demonstrations and simulations were useful for conceptual understanding, they were insufficient for comprehensive skills acquisition.

**Theme 6: Challenges in Delivering Practical Content-** Several challenges affecting practical instruction were identified, including inconsistent internet connectivity, limited access to appropriate hardware, and the instability of virtual laboratory tools. These constraints were reported to hinder both teaching effectiveness and student learning outcomes, particularly in skill-intensive modules.

**Theme 7: Recommendations for Platform Enhancement-** Participants recommended the integration of advanced features such as real-time simulation tools, remote laboratory access, and improved system responsiveness. Enhanced platform integration was viewed as necessary to bridge the gap between theoretical instruction and practical application in IT education.

**Theme 8: Capacity Building and Institutional Support-** The findings further emphasized the need for continuous professional development for lecturers, particularly in the use of advanced platform features and learning analytics. In addition, structured student support mechanisms, including orientation programs and ongoing technical assistance, were identified as critical for maximizing the effectiveness of online learning platforms.

## 5 Discussion and Conclusion

The results show that lecturers' and students' perceptions on online IT education both converge and vary. According to the body of research, consistent usage of learning management systems like Blackboard promotes efficient theoretical material delivery and increases learning flexibility. Participants reported less peer collaboration than in-person settings, although student involvement and interaction are still inconsistent. These patterns highlight the significance of structured instruction, social presence, and cognitive presence and are consistent with the Community of Inquiry concept. The results indicate that more thoughtful interaction design is required to maintain meaningful participation in online contexts, even while discussion boards and live sessions partially ameliorate isolation.

In terms of practical IT skills development, the research highlights ongoing limitations associated with fully online teaching. Both educators and learners indicated difficulties in developing hands-on skills due to insufficient access to virtual laboratories, limited support, and technological challenges. These results reinforce previous studies that advocate for the importance of experiential learning and the necessity for institutions to invest in scalable, industry-standard virtual lab environments. The research concludes that a blended learning approach, which integrates online theoretical learning with occasional in-person lab sessions, represents the most effective strategy for IT education. To enhance learning outcomes, it is vital to implement structured engagement strategies, provide improved faculty training in digital teaching methods, and establish comprehensive student support systems. Future studies should use longitudinal and cross-cultural methodologies while exploring the potential role of AI-driven tutoring systems in facilitating scalable and personalized IT education.

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