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Using Learning Management Systems to Scaffold Collaborative and Interactive Teaching and Learning

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Abstract

The Sustainable Development Goal 4 of the United Nations advocates for inclusive and equitable quality education for all despite the unique circumstances faced by the learners and the teachers. Such circumstances could be economic, social or natural such as the COVID-19 Pandemic, which led to disruptions on the school calendar. Although several institutions of Higher Learning transited to online teaching using Learning Management Systems (LMS), the use of technology in ensuring interactivity and collaboration, which are crucial aspects of learning, needs to be examined more closely to establish its effectiveness. Given the fact that COVID -19 will be with us in the unforeseeable future, online teaching is here to stay. It is thus imperative to improve it so that the quality of education is not compromised. Previous research has shown the importance of Technology, Pedagogy and Content knowledge in effective delivery. LMS and related tools have been used to change the view of technology in the classroom, and the facilitator's role is being re-evaluated. Successful facilitators look for innovative ways to scaffold the learning process. Instructional scaffolding is the process of supporting students in order to enhance learning and aid in the mastery of tasks. The aim of this study was to establish how LMS tools are used to improve collaboration and interaction in online teaching. The objectives were to establish which LMS tools are used to aid in interactivity and collaboration, how these tools are used to scaffold the teaching and learning process and how different elements interact to complete the scaffolding process. This study used a qualitative methodology where two virtual focus groups consisting of faculty and students in online graduate courses were used to review the scaffolding process. The findings were analyzed qualitatively, and the results indicate that synchronous and asynchronous tools found in LMS and their plugins are used to scaffold collaboration and interaction. LMS tools were found to improve learning outcomes and to build a sense of community. The need for flexibility and the ability for LMS to be integrated with other tools and plugins was identified as crucial. The study established the need for both learners and faculty to be trained on the use of the tools was proposed as an additional requirement for the success of the scaffolding process.

Keywords

Scaffolding; Collaboration; Interactivity. Learning Management System; Information Communications Technology.

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1.0 Introduction

Technology has revolutionized the way we teach and learn, and Learning Management Systems (LMS) have been used to enable the teacher to reach out to the learners remotely, providing a platform for content dissemination, discussions and collaborations, assessment and course evaluation. One important element of the teaching process is the ability for interaction between the learner and the content, the learners and their peers and the learners and the facilitators as identified in educational theories such as Constructivism (Vygotsky, 1978). Early onset of technology in education proponents visualized a situation where the technology would basically replace the teacher. Research has however shown that the anticipated disruption was basically a sustainable solution where teachers would use technology to enhance delivery and especially interactivity and collaboration. Online learning differs from face to face learning in that whereas the former is technology-mediated and perceived to be lacking quality interaction the latter allows learners to have contact during live sessions. On the flipside, online learning is flexible, since learning can take place anytime from anywhere and this allows for enhanced learning experiences by combining synchronous and asynchronous modes.

Many theories of learning, including constructivism (Vygotsky, 1978) and Problem Based Learning (PBL) emphasize on the need for collaboration and interaction for effective learning to take place. Barrows (2000) defines BPL as an instructional approach that expects learners to study collaboratively in groups to solve problems and reflect on their own learning. For effective PBL to take place, there should be some element of support or scaffold to aid the learners in the learning process. The theory of scaffolding (Wood et al., 1976) indicates that such scaffolds are usually expert facilitators in a traditional classroom, but today we have computer-based scaffolds to support online learning (Saleh et al; 2018). Most online learning is carried out via LMS, and such systems have tools to support collaboration in synchronous and asynchronous environments (Magnisalis, Demetriadis & Karakostas, 2011). Models such as TPACK seek to establish the relationship between Technology, Pedagogy and Content.

Modern day online learning has been precipitated by the COVID19 Pandemic, whereas containment measures, requirements for social distancing and travel restrictions saw some Universities being forced to hurriedly introduce online learning. One of the major outcomes of this hurried move was the disregard for collaboration and interactivity, which are important aspects of any learning situation (Rugube et al., 2020). A lot of this learning was done through LMS such as MOODLE, Blackboard and CANVAS, and their tools and plugins. Such tools include videoconferencing facilities such as Zoom, the BigBlueButton, Microsoft teams amongst others. Where such tools are used appropriately, the pedagogical distance is reduced, interaction and collaborations are enhanced and the content delivery and the learning outcomes are achieved, resulting in quality education that can enhance sustainable development.

Success and failure stories and experiences in the education sector, mapped to learning theories, provide practical and insightful guidance that can help Universities to establish best practice. While technology exists and is also growing and changing fast, there is need to focus on the application rather than just providing the resources.

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There are myriad teaching and learning resources including kindles, tablets, LMS, digital books, articles, videos, and podcasts that are now widely and sometimes freely accessible, shareable and even transferable with advanced technology, including mobile computing. Learning and teaching processes such as examining, supervising, giving assessment feedback, and individualized learning are now possible through technology use. There are current and sometimes successful attempts to simulate the tradition teaching with such tools. The aim of such attempts is to provide highly interactive content, learners and learning outcomes mapped with autonomy or independency driven educational activities. Modern approaches such as synchronous and asynchronous teaching, automated feedback and enhanced learning, and imagery provoking educational activities are some of the expected benefits of Learning Management System (Tuma, 2021).The use of Open Educational Resources (OER) allows learners to access common content and thus the sharing of content across and within disciplines (Kumar, 2021) and these allow collaborative learning. These are normally accessed via ICT and many faculty will point their students to access such as supplementary material, hence enriching the Learning Management System and enhancing collaboration.

The need for technology that strengthens or mirrors the traditional teacher in the online mode remains to be met fully. It is therefore important to evaluate existing and emerging technologies and how they are used to in a bid to establish best practices and approaches that can improve the learning outcomes. This study looks at LMS and how they support collaborative and interactive education in online environments for higher education, and how this support can be strengthened.

1.1 Purpose/Objectives:

The overall objective of this study was to establish how LMS tools are used to improve collaboration and interactivity in online learning.

The specific objectives were to:

1. Establish which LMS tools are used to aid in interactivity and collaboration,
2. Review how these tools are used to scaffold the teaching and learning process
3. Establish how different elements interact to complete the scaffolding process and improve learning outcomes.
4. Propose the critical success factors for online scaffolding of collaboration and interaction

This study thus reviewed the literature behind collaboration and interactive learning and established how technology can be used to scaffold this mode of learning, based on the experiences of graduate faculty and students in online courses and then identified the critical success factors necessary to improve learning outcomes.

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2.0 Literature Review

2.1 Constructivist Learning Theory

Lev Vygotsky (1896–1934) proposed the Constructivist Learning Theory and defined the learning process in social interaction, language, and cultural aspects and then concluded that human beings learn best through interaction as a learning technique (Vygotsky & Cole, 2018). The theory explains that students working collaboratively in interactive group activities can actively construct their own knowledge, which increases engagement and improves the learning outcomes. This is the essence of teaching. Constructivism is construed to be a synthesis of multiple theories and an assimilation of behaviorialist and cognitive ideals (Mvududu & Thiel-Burgess, 2012). It is perceived as an approach to probe for children's level of understanding and to show that that understanding can increase and change to higher level thinking, and it describes the way that the students can make sense of the material and also how the materials can be taught effectively. Interactivity and collaborative learning are therefore recommended for effective learning (Caffarella & Meriam, 1999) and thus there is an explicit need to ensure that this takes place in both face- to- face and online learning situations. The coupling of the Cognitive Learning Theory and Constructivism guides educators to provide demonstrations, stimulations of mental processing of information, and detailing of real-world scenarios. According to Amineh and Asl (2015), facilitators may create appropriate instructional activities to achieve learning outcomes, and as such, collaborations and interactions may be scaffolded using information technology.

2.2 Collaboration and Interaction in Pedagogy

The role of social learning and collaborative learning supported by technology cannot be underestimated, and is viewed by UNESCO as a strategy that can lead to sustainable education (Santovena & Fernandez, 2020). Collaborative learning can therefore be defined as learning that takes place through organized groups that work cooperatively towards specific shared objectives and interacting to obtain a learning outcome. It involves at least two or more individuals (can be learners and instructors) working together, is most often than not synchronous, who work together to construct shared meaning or acquire new knowledge towards a shared goal (Chen at al., 2018).Collaborative learning is aimed at transforming how people learn and therefore enable a degree of autonomy; improve information analysis, synthesis, and expression capabilities; The said transformation requires a particular methodology implemented , and digital collaborative learning favors effective learning processes (Sobko et al., 2020; Oxford, 1997).

Theories of learning suggest that collaboration and interaction play an important role in the learning situation. Three terms namely cooperative learning, collaborative learning and interaction are used to describe situations where learners work together. While Cooperative learning alludes to a classroom technique used to nurture cognitive and social development through learner interdependence (Oxford, 1997), Collaborative learning, which is social constructivist in nature, contextualizes learning as construction of knowledge in a social context and in order to bring together learners into a learning community. It refers to a group of learners working together in smaller groups towards achieving a common goal, with increased interest and eventually taking responsibility for their own learning (Oxford, 1997). Interaction is associated with personal communication facilitated by group dynamics, willingness to communicate, language skills, and style differences.

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The term pedagogy refers to a combination of special abilities of content and pedagogical knowledge that is formed over time and increasing teaching experience and is viewed as a concept that connects several variables with the teacher's basic professional knowledge. To this effect, collaboration is viewed as beneficial even when learning is taking place online (Stahl et al., 2006).

The use of ICT improves the quality of the learning outcomes by assisting the users in collection, manipulation, presentation and dissemination of content using computers, laptops, smartphones, software applications and other connectivity software and applications such as Wi-Fi and videoconferencing (Susanto et al., 2020).

2.3 Technology, Pedagogy and Content

Koeher and Mishra (2009) developed the Technological Pedagogy and Content Knowledge Framework (TPACK) after considering the role played by technology in teaching. They argue that teaching with technology in itself is a difficult thing and therefore propose that technology, content and pedagogy in a given teaching/learning contexts play a role in the achievement of learning outcomes either individually or when acting together as shown in Figure 1 below.

They suggest that for successful teaching with technology to occur, educators must dynamically establish and reengineer an equilibrium of these factors. They identify the three key connections as knowledge of content, knowledge of teaching and knowledge of the technology. The framework is useful for highlighting the relationship between the different elements. While the role played by the teacher in pedagogy is highlighted, the needs of the student are not outlined in TPACK.

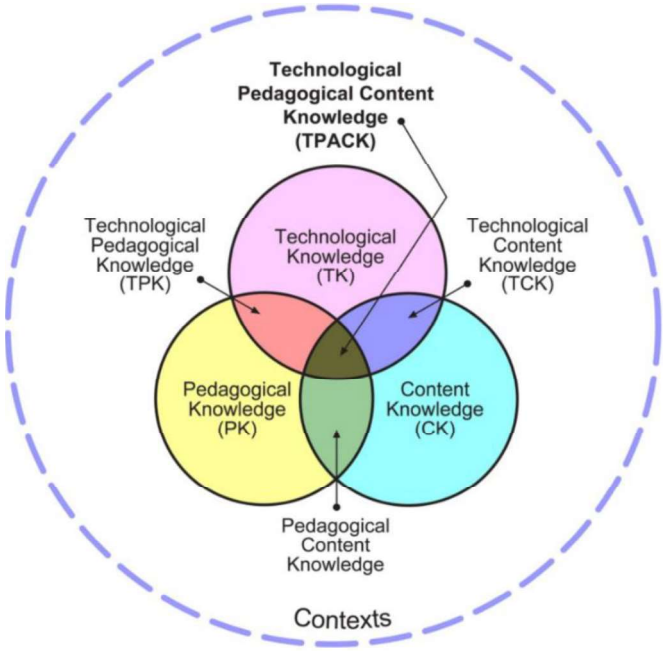

Figure 1: The TPACK Framework

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2.4 Instructional Scaffolding and Online Learning

According to Wood, Bruner and Ross (1976), scaffolding refers to "a process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts" (p.90). Scaffolding refers to support provided so that the learner can engage in activities that would otherwise be beyond their abilities (Jackson et al., 1998), and it is also the support provided by experts enabling learners to accomplish outcomes that would naturally be beyond their current ability (Belland, 2017; Christie et al. ,2004; Kim & Hannafin, 2011; Wood et al., 1976).

A good instructional scaffold should have three distinct features: a) Contingency, which refers to the ongoing assessment of students' abilities in dealing with specific tasks so that the teacher can provide the scaffold (Pea, 2004; Belland 2017; Wood et al., 1976) and describes the teacher's ability to adapt or calibrate support to the individual student in order to calibrate the support to the individual student (Van de Pol et al., (2010). b) Inter Subjectivity, which aims to create a shared or common understanding amongst the learners in solving a problem (Belland, 2017; Hannafin et al., 1999) and c) Transfer of Responsibility, otherwise known as fading, (Van de Pol et al.,2010) which allows learners to take charge of their own learning (Belland , 2014; Wood et al., 1976). The outcome of scaffolding is therefore measurable as the scaffold reduces with time. The theory of scaffolding is based on Social Constructivism as generated by Lev Vygotsky (1978) who allude that social interaction with peers, instructors, parents and others led to better learning outcomes under a concept known as the Zone of Proximal Development, which is a midway zone between what the student can do on their own and what they can't do; This zone is characterized by what the learner can do with support. In traditional face to face teaching, scaffolding was done by expert teachers, but in online learning, this can be provided using modern tools such as those found in many modern Learning Management Systems. The process of scaffolding implies that the tutor introduces the concept, then give the learner feedback on performance; then monitor progress and give hints to the learner, instruct them on how to improve the process and ask questions on performance (van de Pol et al., 2010).

Over the last decade, there has been a massive increase in online learning as well as a growth in respective technologies. Although learners have more learning opportunities, recent surveys and research findings also decry concerns about online learners such as poor engagement and low-quality instruction (Liseno & Kelly, 2020) This can be mitigated using instructional scaffolds to encourage learners to construct their own meaning. Doo, Bonk and Heo (2020) carried out a meta-analysis of the effects of scaffolding on learning outcomes in an online learning environment in higher education in 8 countries from 2010-2019 using data published in 18 journal articles and concluded that Computers as a scaffolding source in an online learning environment were also more prevalent than were human instructors. This indicates that although original scaffold studies focused on human expertise, computer technology is emerging as a popular alternative. Liseno and Kelly (2020) allude that scaffolding in online learning produces significant change in learning outcomes. The main challenge in scaffolding online collaboration is access to the LMS, leading to establishment of informal groups which may be difficult to monitor (Lazareva, 2017), and as such, the need for flexibility must be carefully balanced with legitimate participation to allow decentralized participation in hyperlinked environments (Park, 2015; Zackariasson, 2019).

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2.5. Learning Management System Tools

LMS can be described as a form of sustainable innovation in education as they assist the learners and the instructors to achieve the learning outcomes despite the challenges of time and zonal differences. This innovation has come in handy in times of the COVID 19 pandemic as the issues of social distancing and travel restrictions have been addressed. LMS may be open source or commercial. Some of the most common ones include Moodle, Blackboard, ATutor, Edmodo, Sakai and Canvas LMS have several common features (Al-Hunaiyan et al., 2020) such as file sharing, interactive lessons, quizzes, wikis, chats portfolios, assignments, announcements, shared folders and other plugins that allow many activities to be carried out online and also facilitate interaction, collaborations and communications amongst students and faculty. They also allow links to various URLs and some even allow advanced features to carry out anti plagiarism tests before turning in assignments.

Others have plugins that allow them to be linked up with video conferencing facilities with breakaway rooms that allow group discussions which are effective for collaborative and cooperative learning (Moreillon, 2015). The rich multimedia facilities of such systems have made it possible to almost mirror the traditional face to face class (Karchmer-Klein et al., 2019: Park, 2015) and as such, there is need to ensure that faculty and students are able to use these tools to achieve the desired collaborative learning.

2.6. Synchronous and Asynchronous Teaching

Over the last two decades, there has been an increase in online teaching (Almusharraf et al. 2020), but there is a marked shift to blended learning due to the need for interaction and to mirror the traditional classroom. Many educators have turned to blended modes where the use of synchronous and asynchronous methods is used concurrently.

Synchronous teaching mirrors the traditional class and is normally offered via live links such as live chats and videoconferencing tools that require real-time communication and collaboration as if the participants were in the same place at the same time, providing real time engagement. Asynchronous tools, on the other hand, are designed for communication and collaboration over a longer period of time where participants may in in different places and different time zones, through a "different time-different places, allowing them to connect together at their own convenience and schedule (Moorhouse &Wong, 2021). Such tools are meant to sustain interaction and collaboration over time using resources and information that are instantly accessible throughout the study period. They are also designed to keep an audit trail of the interactions of a group, allowing documentation of cumulative knowledge that can easily be shared and distributed.

Online learning, especially as driven by the COVID19 Pandemic has seen learners having to study without being in a specific place at a specific time, and hence both synchronous and asynchronous tools have become important. These must be supplemented by quality materials, instruction, interactions and activities that create effective learning. Both the learners and teachers must understand the tools for enhanced pedagogical and accessibility issues. Asynchronous tools can save time as you can record the lecturers for reuse as they are built to provide better tools for recording and measuring participation by individuals. Students do not have to keep writing notes as they can complement the audio and the video. (Lowenthal et.al, 2020),

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If well blended, synchronous and asynchronous tools may allow for easy posting of interactions in situations where text and notes would be slower or cumbersome. Asynchronous methods allow introverted students who don't like sharing in public to share their submissions and ease the pressure of interacting in a live session, especially when resources such as internet connectivity and clarity of communication is compromised. Some of these tools allow students to preview/edit their discussions before submitting them, similar to text-based discussions. The main challenge is for faculty to strike the right balance between asynchronous and synchronous modes for different contexts (Lowenthal et al, 2020). However, online teachers require awareness of technological tools and online instructional approaches if they are to teach online effectively (Cleveland-Innes & Garrison, 2012; Cong, 2020).

3.0 Methodology

This study reviewed a group of faculty and students involved in an online graduate course to establish how LMS tools are used to scaffold collaboration and interaction in the teaching and learning process.

The study used a qualitative approach where the main method of data collection was the use of focus group discussion. A focus group is a qualitative research method where the interviewer or moderator presents a set of specific questions about a given concept (Wong, 2008). The advantages of a focus group include the fact that it is fast, efficient and economical (Krueger& Casey, 2002), provides for interactions and spontaneous responses. The method was selected because of its suitability in sharing and comparing experiences, developing and generating ideas and exploring issues of common importance (Colm et al. 2011; Tremblay et al., 2010).

The participants were recruited through random sampling after announcements made in two graduate faculty WhatsApp groups from two private Universities in Kenya and two graduate students WhatsApp Groups from the same Universities. The participants volunteered to participate in the study. All the faculty and students were taking a purely online course, but had also done face to face courses. A total of 24 participants took place in the study. The Participants participated in 4 virtual 1-hour long focus groups in groups of six faculty members and six students respectively. The moderators asked similar questions to the groups as indicated below:

1. When do you use LMS tools to assist collaboration and interaction?
2. What is the impact of using these tools on collaboration and interaction?
3. How do you ascertain that you and your peers/students are able to interact freely?
4. Which tools do you prescribe/use for interaction and collaboration?
5. Is there anything connected with online collaboration and interaction via LMS tools which has not been discussed that you feel strongly about and would like to bring up now?

3.1 Data Collection and Analysis

The participants were divided into 4 groups of six participants each and invited for virtual meetings via Zoom, a video conferencing application. Each group of six met for three sessions of one hour each, resulting in twelve meetings. The focus group meetings were recorded using the Zoom Recording facility.

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The Video and Audio recordings from the focus group meetings were transcribed verbatim and analyzed thematically by two different coders working manually and separately. To minimize subjectivity, an inter-coder reliability of 95% was used.

4.0 Findings and Discussion

4.1 The Use of Tools to Scaffold Collaborative Learning and Interaction

The participants identified common tools used in the process to include Chat, email, common whiteboard, videoconferencing, wikis, blogs, discussion forums, breakaway rooms, URLs, Antiplagiarism tools, WhatsApp, Facebook, Instagram, wikis, blogs, discussion forums, audio conferencing. The use of these tools is summarized in Table 1 below.

Many of these tools are used to help learners interact with their peers and their lecturers to create communities of learning. Apart from Chats, forums, wikis and video and audio conferencing, other tools such as white boarding allow learners to work collaboratively on a document, while the analytic tools are used to measure actual engagement in terms of hours spent interacting and the number of posts. This helps to scaffold the interaction process until the learners are able to initiate, hold and complete discussions without additional prompts as they can now monitor themselves.

Table 1: Common LMS Tools and Support for Collaborative and Interactive Learning

Common Tools	Support for Collaborative Learning and Interaction
Discussion boards	Discussing topical issues usually out of live session
Wikis and Blogs	Deliberating and sharing ideas
Email	Sharing content for one to one and one to many communications
Streaming audio/Streaming video	Communicating and sharing recorded clips and simulations
Social Media tools such as WhatsApp, Instagram Facebook, Tik Tok, Twitter, Snapchat and Telegram	Chatting and instant messaging and keeping in touch, getting updates. Information sharing of low-complexity issues/Ad hoc quick communications
Surveys and polls	Voting, gaining consensus, capturing information and trends
URLs and Web site links	Joint and collaborative searches and analysis, Providing resources and references
Audio conferencing such as Skype	Discussions
Video conferencing such as Zoom and Microsoft Teams	Sharing presentations and information, discussions, interactions, breakaway rooms
White boarding	Collaborative design and Co-development of ideas
Virtual Learning Environment Analytic Tools e.g., Intelliboard/Blackboard Learn/Engagement Analytics/Moodle Google Analytics	Tracking and improving learner and Instructor Engagement Identifying disengaged learners Learner Self-Management and activity Participation
Antiplagiarism tools	Checking authenticity and originality of presentations

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4.2. Interactions and Critical Success Factors

Using the analysis of the recorded focus group interviews of both faculty and students. The analysis derived 5 themes as outlined in Table 2 below:

Table 2: Inductively Derived Themes

Objectives	Focus Discussion Prompt	Summarized categories	Themes
1. Establish which LMS tools are used to aid in interactivity and collaboration,	When do you use LMS tools to assist collaboration	Blended learning Interactivity and collaboration Different time zones and places	Synchronous and asynchronous uses
2. Review how these tools are used to scaffold the teaching and learning process	What is the impact of using these tools on interaction	Better Learning Outcomes Improved interactions	Improved learning outcomes Transfer of Responsibility
3. Establish how different elements interact to complete the scaffolding process and improve learning outcomes.	How do you ascertain that users are able to interact freely	Transfer of responsibility allows learners to choose their own tools	Flexibility
	Which tools do you prescribe for interaction and collaboration	Formal tools as found in LMS Informal tools found in social media	Use of plugins to enrich learning experiences
4. Propose the critical success factors for online scaffolding of collaboration and interaction	Is there anything connected with online collaboration and interaction which has not been discussed that you feel strongly about and would like to bring up now?	The need to map the tools to content and pedagogy Careful selection of tools	The relationship between the students, faculty, content and technology

4.2.1. Synchronous and Asynchronous Uses

When prompted to indicate when they use LMS tools, the faculty and the students agreed that they use them in live lectures and out of class. The faculty had this to say: 'We use the tools in the classroom for active participation of the learners, and also give them assignments outside the class for group discussions" while the students observed the following: "We use the tools when attending a live lecture but more so outside the classroom to consult our peers and write our projects and term papers" and "We use the tools to catch up with our faculty and peers when we need clarification or when we feel isolated from the class".

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All the four groups of participants agreed that LMS tools are important for assisting interaction and collaboration for both synchronous and asynchronous learning situations. This finding support Moorhouse &Wong (2021) and Lowenthal et al., (2020) who allude to the fact that there are tools to support the teaching and learning process both in and out of class. The lecturers found that synchronous tools were important for introducing concepts, while the student groups found the asynchronous tools important for follow-up and for helping with assignments and term papers. The student groups indicated that apart from classroom learning, the tools helped them feel part of the class and removed the feeling of remoteness and isolation.

4.2.2. Improved Learning Outcomes and Transfer of Responsibility

When asked about the impact of the LMS tools on interaction the Faculty stated that "We find that the students participate better in discussions" and "It is usually easier to reach a bigger group of students" as well as "Students turn in better assignments after online discussions". The students' response to the same question returned the following responses: "We get a chance to express ourselves through wikis and blogs" and "We do not need to compete for the lecturers' attention" and "It is easier to submit your thoughts in an online forum" as well as "We find that we eventually do not need the lecturer to prompt us"

The lecturer groups felt that learners turned in better assignments although they were not able to pinpoint if all the students had participated. All the groups felt that the learning was much better and that eventually, the students required no prompt to interact and collaborate, and therefore if used appropriately, the LMS tools afforded for transfer of responsibility and thus the scaffold effect worked well. These finding resonate well with Moreillon (2015) who indicated that learners indicate improve indicate improved interactivity online, and Park (2015); Belland (2017) and Hanafin (2011) all who concluded that online tools can improve the learning outcome, create learning communities and produce independent learners.

4.2.3. Flexibility

When asked how they ascertain that there is free interaction, the Faculty stated that "When we find that users can use their own tools without consulting us, or when they hand in a group assignment that shows clearly that all users participated", while the students responded by saying "We feel free to use the tools when the lecturer does not dictate the tools to use "and "We interact more freely when the lecturer is not in the group, so we create our own independent groups"

All the four groups agreed on the need to allow the students to eventually select the tools, although the two lecturer groups indicated that at the start, there is a need to dictate the tools and the type of interaction but gradually fade this support. LMS in their nature require substantive responsibilities and as such, instructors require technical skills to use them effectively. Universities must thus train students and faculty on how to use them and exploit their immense capabilities (Al-Hunaiyyan et al., 2020). Furthermore, Sobko et al., (2020) had also raised the issue of independence and flexibility in ensuring that learners can chose their tools, albeit with some guidance.

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4.2.4. Use of Plugins to Enrich Learning Experiences

On responding to the tools they would prescribe for online interaction and collaboration, the Faculty responded that "We commonly use Chat, email, common whiteboard, videoconferencing, wikis, blogs, discussion forums, breakaway rooms, URLs, Antiplagiarism tools and analytics to ensure engagement "and they appeared to use just what is provided. The Students on the other hand observed that "We commonly use Chat, email, WhatsApp, Facebook, Instagram, wikis, blogs, discussion forums, videoconferencing and other tools not in the traditional LMS"

The two lecturer groups indicated that the LMS tools were more often than not suitable for collaborative learning and interaction but concurred that they sometimes allowed the learners to use whatever tools were available and sometimes also asked for friendlier plugins such as the BigBlueButton and Microsoft Teams. The students felt that that there were many tools in the market with emerging features that fitted their budgets and experiences and there is need to integrate these with the LMS. For effective use of LMS tools, instructors should ensure that students are comfortable with the tools in order to create learning communities that allow collaboration, interaction and engagement with the content, the instructors and the peers, thus agreeing with Dlamini and Ndzinia, (2020).

4.2.5. Relationship Between Students, Faculty, Content and Technology

When asked to raise other factors that are critical to online interaction and collaboration, the Faculty observed that "We need to understand how to use these tools as the students are ahead of us", and that "Using the tools made us re-evaluate the way we teach". The students responded that "They need to train us on how to use these tools as there are many of them" and that "Some of our lecturers don't know how to use the tools" and also observed that "We found that some of the tools were not suitable for collaborative practical content such as networking".

All the groups indicated that for effective interaction and collaborative learning to take place, the LMS tools must be matched to the content and the pedagogy. They also agreed that both faculty and students needed effective training on how to use the LMS tools in collaboration and interaction for better learning outcomes. The study confirms the continuous need of linking pedagogy, technology and context (Ustun et al., 2021) as stipulated in the TPACK model, as well as Karchmer-Klein et al., (2019) who observed the need for careful instructional design that include the needs of both learners and teachers, but also considers the pedagogy and the content.

5.0 Conclusions and Recommendations

Based on the findings from this study, LMS tools are important scaffolds for collaborative and interactive learning and, if used correctly, they can improve the learning outcomes to produce independent learners. The learners find them useful for building both learning and social communities that remove the sense of isolation common with online courses. They can be used effectively in both synchronous and asynchronous situations to improve the learning outcomes.

There are several tools and plugins in the market that can be utilized in both synchronous and asynchronous environments to enable the learners to interact with their peers and their instructors, and the list keeps growing as ordinary business tools are also converted for educational purposes.

There is need to provide some guidance on appropriate tools, but eventually the responsibility of selecting the tools and the mode of interaction should be left to the learners. The relationship between content, pedagogy and the LMS tools cannot be overlooked, and instructional designers should assist faculty in selecting the right tools and ensuring that the right training will be provided. Although most learners are flexible enough to explore new realms, the faculty should not assume that the learners automatically understand how to use the tools, but should provide some initial training.

This study had some limitations that need to be addressed. The findings from the small sample size of 24 participants from 2 private universities cannot be generalized. There is need to carry out future studies with alternative research methods, including those that are empirical in nature, with a larger sample size and a population that covers both private and public universities. The study also included a graduate theoretical course and future studies could include a practical course and may be undergraduate students who may present a different entry behavior or self-efficacy.

The outcomes of this study lead to a clearer understanding of how to select and use LMS tools to design a learning environment that that scaffolds collaborative and interactive learning. It also underlines the need for flexibility in use and selection, as well as the need to train both faculty and students on the use of the tools for better collaborative learning and interaction.

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