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Interaction via Moodle for teaching and learning: Perceptions of lecturers and students

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Abstract

The COVID-19 pandemic necessitated the use of technology such as Moodle in course delivery to facilitate student engagement. This research explored how lecturers delivered courses through Moodle and how students perceived interaction with instructors, content, and peers via Moodle and the influence on student satisfaction. This mixed-method research design utilized qualitative data from nine lecturers via interviews and quantitative data from 86 students via surveys. The qualitative data were analyzed using Nvivo 12 to derive codes and themes while SPSS 27 was used for the quantitative data to conduct Pearson correlations and multiple regression. The findings indicated that perceived usefulness and learner-instructor interaction were positive, significant predictors of student satisfaction. The study also revealed that lecturers were using the platform with varying degrees of expertise even as they experienced challenges and barriers to attempts to interact with students. These findings suggest that lecturers and students see the value Moodle provides for teaching and learning and may be used as a guide for strengthening the use of the resource toward improving the quality of student interaction and the degree of student satisfaction at higher education institutions.

Keywords: Moodle, interaction, learner-interface, learner-content, learner-instructor, and learner-learner, student satisfaction

Introduction

Learning management systems (LMSs) were introduced in higher education at the turn of the twenty-first century. Less than two decades later, 99% of higher education institutions (HEIs) in the United States (Dahlstrom et al., 2014) and more than 70% of the HEIs in Australia, the United Kingdom, and Canada had incorporated the use of LMSs (Coates et al., 2005). These systems facilitate online learning and enable HEIs to widen access to education. LMSs offer HEIs a way to manage courses better, improve communication between lecturers and students and between students and their peers, share lecture material and resources, and facilitate paperless assessments with submission deadlines convenient to students irrespective of their location. The expectation is

that using these systems will improve the teaching and learning experience (Al-Busaidi, 2012; Coates, 2005; Coates et al., 2005; Dahlstrom et al., 2014; Gillani, 2000).

LMSs enabled the rapid increase in online programs and courses offered by HEIs, which have capitalized on the opportunity to widen access and generate more income without increasing classroom infrastructure. Dahlstrom et al. (2014) noted that despite rapid adoption by HEIs, 58% of lecturers in the United States use LMSs primarily to share lecture material, and 41% use the collaborative features for interaction. This is an underutilization of the features of LMSs and does not foster engagement and/or satisfaction for either the lecturer or the student (Francis & Raftery, 2005).

Context of the Study

A robust body of literature contains findings to support a positive relationship between student engagement and improved teaching, learning, and student success in the traditional setting (Astin, 1984/1999; Kuh, 1995; Pascarella & Terenzini, 1991, 2005). More recently, research has focused on student engagement in the online environment and what it means for the classroom, whether virtual or campus-based (Chen et al., 2010; Coates, 2005, 2007; Coates et al., 2005; Commissiong, 2020; Dewan et al., 2019; Dixson, 2010, 2015; Martin et al., 2017). Coates (2005) emphasizes the importance of student engagement to improve learning by referencing Vygotsky's social constructivist approach and highlighting the importance of active and collaborative learning. Dixson (2015) reported that teachers who encouraged active and collaborative learning enabled students to build community, alleviating feelings of isolation often experienced by students online.

Woodall and Marius (2013) conducted research specifically for the Caribbean. They determined a 95% preference for propriety software, such as Blackboard, Desire2Learn, and eCollege, with Moodle and Sakai listed as open-source software in use in the region. Woodall and Marius (2013) also highlighted the University of the West Indies Open Campus (UWIOC) and its ability to provide 16 Caribbean territories, through its 42 sites, with access to education through this software. The UWIOC, launched in 2008, was engaging students via the Modular Object-Oriented Dynamic Learning Environment (Moodle). This was in response to concerns raised by the Organisation of Eastern Caribbean States Education Reform Unit (OERU) regarding the number of candidates undergoing tertiary education. The OERU, as part of its strategic plan 2001–2010, set a target of 17% attendance at tertiary institutions; however, this was possible only through improved access (Thomas & Soares, 2009). The opportunity to access tertiary education in a blended mode that utilized an LMS was preferred by 58.2% of students surveyed (Woodall, 2011). Martin et al. (2017), in their study on student engagement in the Caribbean, found that class participation was associated with higher academic achievement. This is supported by the research conducted by Commisiong (2020) on student engagement, self-regulation practices, success, and satisfaction in online learning environments among 352 students and 53 lecturers. The author found a strong positive relationship between student engagement and student satisfaction and found that student engagement, self-regulation, and satisfaction were predictors of perception of success.

The University of Guyana (UG) was introduced to online delivery through a Japanese-sponsored UNESCO-UWI project in 2003, which sought to build human capital through ICT. One of the project's objectives required participating universities to explore web-based technologies to facilitate course delivery and management (Marshall, 2005). Recognizing the value of this technology for course delivery across the campus, the university engaged the Ministry of Education and was included in a government of Guyana World Bank Improving Teacher Education Project (2011–2015; World Bank, 2010). The Improving Teacher Education Project introduced Moodle to the Faculty of Education and Humanities. In 2014, Vice Chancellor Jacob Opadeyi recommended its use to lecturers across the campuses. Moodle was advertised as a way for lecturers to better manage communication, share lecture material and resources, and improve feedback on assessments (World Bank, 2010). Technology adoption was slow, with 154 lecturers utilizing the platform in 250 courses by academic year 2017/2018 (University of Guyana, 2022). The coronavirus pandemic resulted in a 314% increase in the number of lecturers (N = 483) using Moodle, with a commensurate increase in the number of courses (N = 820) in academic year 2019/2020 (University of Guyana, 2022). The academic year 2020/2021 netted a further 144% increase in the number of lecturers (N = 696) with a further 215% increase in the number of courses (N = 1766; University of Guyana, 2022). Extensive training was provided only to the lecturers within the Faculty of Education and Humanities as part of the Improving Teacher Education Project. To address the need, the university established the Centre for Excellence in Teaching and Learning (CoETaL) in December 2018 to improve teaching excellence and increase student satisfaction. The university subsequently added the Tactical Online Services (TOS) unit in July 2020 in response to the pandemic. Their mission was to transform the delivery of education through the use of appropriate educational technologies. Together, CoETaL and TOS mounted the university's response to the pandemic, which resulted in the recording of professional development seminars, which allowed lecturers to be trained synchronously and asynchronously and allowed them to review the sessions whenever needed. Training, however, remains largely in the rudimentary use of technology rather than how to improve the quality of what is delivered. Students were offered an overview of the platform during their orientation program; however, no hands-on training was provided. The university indicated that, in the absence of training, videos, documents, and/or PowerPoint presentations would be provided to assist students.

The university has an opportunity to scale up excellence as the pandemic resulted in an overall 316% increase in lecturers using Moodle and pushed most lecturers into the virtual classroom (University of Guyana, 2022). Making use of its many active and collaborative learning features for course delivery has become a necessity; however, many may be struggling with the rapidity of the changes brought on by the pandemic. It also revealed that despite the incremental use of Moodle since 2014, there was an absence of documentation to show how the effective use of the technology was monitored and evaluated to improve teaching and learning, a situation highlighted and cautioned against by Black et al. (2007), who emphasized that universities' inadequate attention to implementation needs could affect how lecturers and students experience Moodle. Research at several HEIs has indicated a large percentage of lecturers underutilizing the features of Moodle (Cabero-Almenara et al., 2019; Francis & Raftery, 2005). Even in research that revealed success with the adoption of Moodle, it was noted that there is room for improvement through a

better understanding of the challenges impeding Moodle adoption (Cabero-Almenara et al., 2019; Walker et al., 2016). This research, therefore, explored engagement via the Moodle platform from the perspectives of lecturers and students at the University of Guyana. The specific research questions were the following:

RQ 1. How have lecturers used Moodle to foster interaction between learner-content, learner-instructor, and learner-learner?

RQ 2. Does perceived ease of use, perceived usefulness, computer self-efficacy, sex, age, faculty, and ethnicity predict a) learner-content, b) learner-instructor, and c) learner-learner interaction?

RQ 3. Does learner-content, learner-instructor, and learner-learner interaction via Moodle influence student satisfaction?

Literature Review

The literature is replete with definitions of student engagement that acknowledge the seminal definition by Astin (1984/1999), Kuh (2009), and many others along the way since then. Astin (1984/1999) used *involvement* rather than *engagement*, emphasizing active participation by students in their academics and indicating that performance was directly proportional to the level of involvement. He noted the importance of investment in time and effort studying and reviewing course content, participating in athletics and student government, and interacting with faculty and peers. Astin (1984/1999), therefore, defined student involvement as "the quantity and quality of the physical and psychological energy that students invest in the college experience" (p. 528). *Engagement*, however, was the preferred term by academics/researchers, and Kuh (2009) concretized this by expanding on the definition to expressly include the role of the institution's contribution to student development, which is widely used today. Most post-Kuh (2009) definitions focus on both the student and the institution, addressing classroom engagement and extracurricular engagement, such as participation in clubs and sports with peers that helps to build a sense of community, referred to as social engagement. This research focuses on technology-mediated teaching and learning experiences. It thus defines student engagement as the time and effort expended by both lecturers and students to actively interact with course content and each other via the Moodle LMS to achieve the desired learning outcomes to the mutual satisfaction of both parties.

Lecturers' uptake of LMSs primarily as a repository for course content (Carvalho et al., 2011; Kite et al., 2020) highlights the transactional distance between lecturers and students in the online environment. Moore (1993) indicated that this "profoundly affects teaching and learning" (p. 22), creating "a space of potential misunderstanding between the inputs of instructor and those of the learner" (p. 22). Moore (1989) advocates three types of interactions to bridge the transactional divide, which he categorizes as learner-content (L-C), learner-instructor (L-I), and learner-learner (L-L). Research affirms the interconnected and interdependent relationship among L-C, L-I, and L-L among university students, highlighting how pedagogical strategies foster improved interaction between students and LMSs (Olson, 2021; Williams & Whiting, 2016). Hillman et al.

(1994) concede that Moore's (1989) three types of interaction are essential for teaching and learning but suggest the need for a fourth type of interaction, that of learner interface (L-IF). The authors point out that Moore's (1989) interactions are mediated by technology. Thus, focus should be given to the student's ability to use the technology since it may determine the effectiveness of all other interactions in the online environment. Learner-interface interaction examines the student's ability to adopt the technology to perform the various tasks necessary for a course. Students who struggle to use the technology are likely to approach each task with anxiety and fear in comparison to confident students. Engagement at the L-C, L-I, and L-L levels may, therefore, be affected, which in turn may influence student satisfaction and motivation to perform well in their program. Therefore, the interactions between L-IF, L-C, L-I, and L-L formed the basis for the conceptual framework for this research (see Figure 1).

Figure 1
Conceptual framework of Hillman et al. (1994) and Moore's (1989) types of interaction
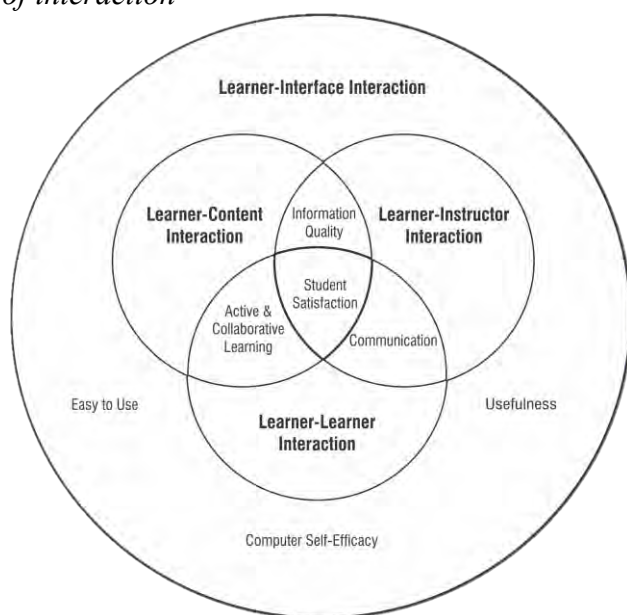
Learner-Content Interaction

Moore (1989) defines learner-content interaction as "the process of intellectually interacting with the content that results in changes in the learner's understanding, the learner's perspective, or the cognitive structures of the learner's mind" (p. 2). Moore (1989) highlights that content may be provided to learners via computer software applications such as an LMS, and Abrami et al. (2011) and Martin and Bolliger (2018) point to the various delivery modes for content in this environment, such as text material, audio and video files, and photographs. The Moodle platform enables instructors to share content in all these delivery modes, and the findings of research conducted by Ifinedo et al. (2018) and Pérez-Pérez et al. (2020) indicated that information quality on the LMS was a good predictor of student satisfaction. Pérez-Pérez et al. (2020) found that it explained 25.2%

of the variance in student satisfaction. Kumar et al. (2021) and Waheed et al. (2016) revealed that when course content was relevant and aligned with course assessment, it piqued students' interest and motivated them to engage with the Moodle platform.

Britt (2015) and Martin and Bolliger (2018) found that relatable examples or applications increased cognitive engagement among graduate students in the online environment. Britt (2015), Chen et al. (2019), and Stavredes and Herder (2014) noted that students were able to activate metacognition, integrate ideas critically, justify decisions, and generate new knowledge when assignments were relatable and well-designed, which contributed to their mastery of the content. Almasi and Zhu (2020), in their qualitative study of students' perceptions of cognitive presence in a blended online environment, found that real-world examples/applications, desire for a specific grade, scaffolding, and the quality of the content on Moodle were among the primary motivational factors for engaging with the platform.

Despite the aforementioned knowledge, researchers continue to lament that not enough focus is given to content delivery via an LMS and its effect on learning (Kite et al., 2020; Xiao, 2017). Zimmerman (2012) calls for more empirical research, while Al-Busaidi (2013) challenges higher education institutions to monitor and evaluate the adoption of LMS platforms to ensure that blended learning achieves high-quality learner content interaction that facilitates improved student learning. This was reiterated by Barbera et al. (2013), who found that course design and content delivery were among the most important factors identified by students as necessary for effective learning.

Learner-Instructor Interaction

Muir et al. (2019) and Turk et al. (2021) reported that undergraduate students ranked the lecturer's presence as very important, indicating that it helped build community and a sense of belonging online. Ally (2019), Martin and Bolliger (2018), Martin et al. (2019), Muir et al. (2019), Ragusa and Crampton (2018), Stone et al. (2016), and Young (2020) identified timely feedback, constructive comments, interactivity, clear guidance, and rubrics as critical for engagement. Martin and Bolliger (2018) and Schrenk et al. (2021) also found that well-designed discussion forums were preferred over unstructured discussions. Thus, researchers, such as Banna et al. (2015), Cai and Wang (2020), Hu and Li (2017), and Kaden (2020), emphasize the importance of planning and preparation of lectures, resource material, and assignments in the online environment.

The L-I interaction influences both the L-C and L-L interactions since the instructor mediates these interactions, setting the tone for the conduct of courses. Azevedo et al. (2008), Gašević et al. (2015), and Schrenk et al. (2021) found that students whose lecturers employed facilitated regulation scaffolding to online course assignments exhibited greater mastery of the content in comparison to self-regulated learners. Martin and Bolliger (2018) and Tawfik et al. (2018) noted the use of project and problem-based learning in enhancing critical thinking, application, and resolution skills in students pursuing courses in the online environment. Meyer (2014) observed that there was a need for adequate time to be allocated for students to demonstrate higher-order

thinking, and Almasi and Zhu (2020) concurred as they reported that students indicated that learning was negatively impacted when the time allocation was inadequate for them to fully derive the learning outcomes to be gained from group assignments.

According to Pérez-Pérez et al. (2020) and Martin and Bolliger (2018), clear guidance and rubrics were highly rated by undergraduate and postgraduate students, respectively. Martin and Bolliger (2018) found that grading rubrics were determined to be the second most valuable engagement strategy by postgraduates in the online environment. However, Bolliger and Martin (2018) noted that grading rubrics were not among instructors' most valuable engagement strategies; instead, they were rated at the bottom of the least valuable (N = 11) list of items. Bali and Ramadan (2007) and Gaytan and McEwen's (2007) findings were dissimilar to those of Bolliger and Martin (2018). Their research indicated that students and instructors viewed the grading rubric as an essential engagement strategy that allowed instructors to provide quality feedback and guidance for student improvement.

Communication via multiple mediums is encouraged to promote L-I interaction in the online environment. Damnjanovic et al. (2015) found a significant relationship between Moodle communication features and undergraduate students' perceived learning outcomes. Students indicated a desire for prompt acknowledgement and feedback in the online environment (Dixson, 2010; Shackelford & Maxwell, 2012). Mupinga et al. (2006) found similar results, with more than 75% of students defining prompt acknowledgement as occurring within 24 hours of receipt of correspondence and prompt feedback within 48 hours of submission of assignments. Pérez-Pérez et al. (2020) reported that using communication technology on Moodle facilitated feedback and allowed students to monitor their progress throughout the course, identifying areas of weakness that need additional support or attention to improve their performance. The authors indicated that this learner-instructor interaction was a strong motivator among students to achieve the learning outcomes (Pérez-Pérez et al., 2020). Dennen et al. (2007) noted that instructors communicating via emails needed to watch the tone and style of their responses since the engagement was negatively affected when lecturers were "distant" (Wimpenny & Savin-Baden, 2013, p. 8) with students.

Learner-Learner Interaction

Learner-learner interaction refers to dialogue between learners on a one-on-one basis or in groups that occur asynchronously via an LMS with or without the presence of an instructor (Moore, 1989). Huang et al. (2011), Kite et al. (2020), and Sher (2009) reported a positive significant relationship between L-L interaction and student learning and satisfaction. Gamage et al. (2022) and Martin et al. (2020) reported that the use of Moodle's active and collaborative features fosters learner interaction, and Beauchamp and Kennewell (2010) and Wu et al. (2010) found that interaction with an LMS improved student performance and satisfaction. Interaction via discussion forums, group assignments, chat sessions, wikis, blogs, and peer assessment fostered L-L engagement (Banna et al., 2015; Revere & Kovach, 2011; Robinson & Hullinger, 2008). Martin and Bolliger (2018), however, reported that discussion forums were rated among the least valuable engagement

strategies by some postgraduate students who felt that the quality of the interaction did not meet their learning styles, while others reported that discussion forums offered them the opportunity to process information and connect ideas and concepts before responding. Martin and Bolliger (2018) also reported negative ratings for group assignments from some students who did not view the collaborative process as worth the effort of attempting to match schedules with other group members. In addition, Cheung et al. (2008) noted that L-L interaction was affected by the time and effort required to review course content to engage in discussion forums. Familiarity with peers was another challenge for L-L interactions since students indicated discomfort with sharing or sharing only minimally because of the absence of a social connection with other learners (Deng & Tavares, 2013).

Learner-Interface Interaction

The L-IF is "a process of manipulating tools to accomplish a task" (Hillman et al., 1994, p. 34). Weidlich and Bastiaens (2018) found that the learner-interface interaction among undergraduate students using Moodle was the strongest predictor of student satisfaction. The authors used a transactional distance scale between student and technology that examined perceived ease of use (PEOU), perceived usefulness (PU), and computer self-efficacy (CSE) toward Moodle. Pérez-Pérez et al. (2020), in their study on factors affecting students' perceptions of learning outcomes with Moodle, found that the acceptance of the pre-cursors PEOU and PU positively affected students' satisfaction. Sabah (2020) also examined PEOU and PU in his study of undergraduate students' perceptions of using Moodle in blended learning. He found that PEOU motivated females to use Moodle, while PU motivated males. In addition, Carvalho et al. (2011), Damnjanovic et al. (2015), and Paragina et al. (2011) reported that limited technology competencies may inhibit one's ability to use Moodle, which may impede learning in the online environment.

CSE is "the confidence in one's ability to perform certain learning tasks using an e-learning system" (Pituch & Lee, 2006, p. 226). Students with high CSE are more likely to engage with Moodle more readily, particularly as it is said to be an intuitive technology. However, students with low CSE may hesitate to use Moodle or find any reason not to engage with the interface out of fear and anxiety that they will do something wrong or embarrassing, which may show that they do not know how to use it. Some students may experience a phobia toward technology because something always appears to go wrong when they use it. Low CSE may impact satisfaction with the online learning experience for some students. Alkhateeb and Abdalla (2021), in their study of the factors influencing student satisfaction toward using Moodle, found that the CSE of undergraduate students significantly influenced students' satisfaction. Jameel et al. (2022) found that CSE significantly impacted PEOU and suggested that students who were confident in their ability to use Moodle were more likely to navigate the interface with ease and engage readily with content in the online learning environment (Howard et al., 2016).

This research explored how the university addressed Moore's (1993) transactional distance to limit the disconnect between lecturer and student in the blended mode of delivery. Whether the interaction between the learner and Moodle mediates the L-C, L-I, and L-L interactions and

whether pedagogical approaches positively influence the L-C, L-I, and L-L interactions help to improve teaching and learning across the campus. This research, therefore, sought to explore how lecturers and students perceive the use of Moodle through the lens of L-IF, L-C, L-I, and L-L interactions.

Methodology

The mixed method research design explored how lecturers and students perceive using Moodle. This design was most appropriate since, according to Creswell and Guetterman (2019), the collection of one type of data could not adequately address the problem of practice being investigated. Research question one used qualitative data, while research questions two and three were answered using quantitative data.

Setting

The research was conducted at the University of Guyana. The sample population was taken from the two main campuses with representation from six faculties, one college, and one school that offers more than 100 programs in approximately 60 disciplines. Instructional strategies evolved from chalk-and-talk to PowerPoint at the turn of the twenty-first century. Early adopters incorporated online platforms, such as Edmodo and Moodle, in 2014. The COVID-19 pandemic, however, pushed even the laggards toward the use of Moodle, with a 467% increase in lecturers and a 580% increase in the number of courses using the platform between academic year 2018/2019 and 2020/2021 (University of Guyana, 2022). The realization that this is the new mode of delivery for higher education and the pedagogical challenges it poses for lecturers trained and practiced in face-to-face delivery prompted this research. Interaction across the transactional divide requires a different approach than in a face-to-face class. Understanding how lecturers met the challenge and whether the learning experiences it created engendered satisfaction among students is needed to chart the way forward for the university.

Participants

This study had two target populations: lecturers and their students. Without data on the number of lecturers who were full-time staff members actively using Moodle for at least two years, participants were recruited through an online survey. The recruitment survey had 13 items, including demographics, extent of Moodle use, and willingness to participate in the research. The survey was used to identify participants based on the following criteria: lecturers who had attended at least one Moodle training session hosted by the university, delivered at least one course per semester using the platform for the past two years or four semesters, and lectured a course between March 28 and July 23, 2022. Students who participated in the research were 18 years or older. The selection criteria aided the purposeful identification of the research sample. Purposeful sampling was deemed most appropriate since, according to Plano-Clark and Creswell (2015), it allowed the researcher to select participants who could best provide information on the central phenomenon under investigation. Improved work performance, often referred to as the Hawthorne effect

(Wickström & Bendix, 2000), was potentially a cause for concern because some lecturers may have viewed the research as an evaluation of their work and, to showcase how well they were using Moodle, may have used more features, reframed assignments, and devoted more time to student interaction. In an attempt to control for this, lecturers were encouraged to share past, present, and future use of Moodle, and thus, any changes or deviations from past use were noted in present usage.

The research sampled nine lecturers from the academic units at both campuses and their undergraduate students. Of the nine lecturers sampled, seven were female and two were male (M = 44 years, SD = 8.71). The lecturers were of Black (n = 5), East Indian (n = 3), and mixed (n = 1) ethnicity. Eight hundred and fifty-eight students were eligible to participate in the survey; however, 150 attempted the Qualtrics questionnaire. After data cleaning, the sample size was determined to be N = 86 as 15 questionnaires were more than 50% incomplete, 20 were 30% incomplete, and another 29 were 12% incomplete. The response rate was, therefore, 10%. The mean age of participants was 23 (SD = 6.15). Seventy-three percent of the respondents were female, with 23% male and 3% preferring not to say. The students were primarily of Black (n = 27), East Indian (n = 31), and mixed (n = 27) ethnicity. Students who responded were mainly from the Faculty of Natural Sciences (31%), the College of Medical Sciences (24%), Faculties of Social Sciences (11%), and Agriculture Forestry (10%), with less than 10% each for all other faculties. First-year students accounted for the largest portion (36%) of the respondents, with year four students second with 27%, and years two and three with 17% each.

Data Collection

Data collection commenced on June 8, 2022, and concluded on August 14, 2022. Interviews on the perceptions and experiences of lecturers with respect to their use of Moodle were utilized for data collection. The interviews were conducted one-on-one via Zoom for approximately one hour, and only audio was recorded. The interview protocol was designed based on Hillman et al. (1994) and Moore's (1989) types of interaction and included 21 questions, for example, "What were your teaching methods/strategies before using Moodle? How did they foster L-C, L-I, and L-L interaction? Tell me, how have your teaching methods/strategies changed since using Moodle?"

The survey items were adapted from previous studies (Abdelraheem, 2012; Andersen, 2013; Davis, 1989; Gefen & Straub, 2000; Pituch & Lee, 2006; Saadatmand et al., 2017; Sabah, 2020; Strachota, 2003; Weidlich & Bastiaens, 2018). Section I of the survey instrument examined the demographics with five questions to determine factors such as sex, age, and ethnicity of the participants. Section II consisted of the interaction scale items, which included seven questions with 64 5-point Likert scale (strongly agree to undecided to strongly disagree) items and two multiple choice items. The survey was administered to students electronically via Qualtrics, Provo, UT. Reliability was computed using Cronbach's alpha to ascertain the internal consistency of the seven Likert scale questions in the questionnaire (see Table 1). The reliability of all 64 items was good ($\alpha = 0.87$). All data collected as part of this study were in compliance with the permission granted by the Institutional Review Board of Arizona State University.

Table 1
Internal consistency of the questionnaire

Variables	No. of Items	Cronbach's Alpha
Perceived Ease of Use	8	.73
Perceived Usefulness	7	.86
Computer Self-Efficacy	7	.84
Learner-Content Interaction	13	.83
Learner-Instructor Interaction	12	.86
Learner-Learner Interaction	12	.87
Student Satisfaction	5	.80
All Items	64	.87

Data Analysis

Qualitative data were analyzed using the phenomenological process recommended by Creswell and Poth (2016). Transcripts were prepared, checked, and edited for accuracy. The transcripts were reviewed repeatedly for similarities and differences in the perspectives and experiences of lecturers using Nvivo 12. Codes were identified based on similarity and coding redundancy, and quotes were identified to reflect the codes (Creswell & Guetterman, 2019). Seven subthemes and 32 focused codes were determined to explore the results. Trustworthiness and transferability of the data (Walker et al., 2016) were ensured with member checking and direct quotes. Multiple regression analyses were done using the IBM Statistical Package for the Social Sciences 27 (IBM, 2020) to identify predictors of L-C, L-I, L-L and student satisfaction.

Results

Perception of Lecturers

Learner-Content Interaction

Lecturers used Moodle to share content with students. Content was shared in various formats, including Microsoft Word, PDF, PowerPoint (both text and audio), videos of lectures or resource materials, and links to reading materials. Lecturers highlighted the ability to share video lectures and commence or continue discussions of the content on Moodle using the forum. Sharing videos of lectures, they indicated, enabled more content to be delivered and heavier emphasis placed on application rather than knowledge and comprehension. Aaron indicated,

> I could have put videos on. Sometimes you know, like, for example, if you have holidays coming up and you'll know that you won't be able to meet with the students, you just tape a message or tape your lecture and basically have it available for the students, where they can go and download.

Using an example, Emma explained how she was better able to foster learner-content interaction,

Pre-Moodle it would be assignments like . . . for instance, skin conditions—we would send them all to research on the different types of skin conditions, look at the pathophysiology, look at the clinical presentations of it. So it's like a topic that you would teach but they're doing it as an assignment, but now you are able to deliver all of that interestingly via Moodle. You're able to deliver all of these topics, and you know you're not fighting for time to say, oh gosh, I have so many topics left back, no you're not. So, the assignments, for me, are more of a critical nature, so you're able to now give them case studies on particular skin conditions, using skin conditions as an example, so, and they are able to work through the cases. We just had them do a video of where they had to set up a Drug Information Centre and be able to counsel patients on particular conditions, so like a snake bite or a drug poisoning and these kinds of things, so I don't know if it's a case where we're thinking outside of the box more as lecturers, but the assignments are more of a practical nature.

Three lecturers sought to use the forum feature on Moodle to have students interact with the content. Emma said,

I use forum posts. I would give questions specific to the lecture, or a case study or . . . a primary article like a journal article and have them critique based on what I delivered in the lecture, so that helps. You know, because you can go to it anytime, right, rather than . . . live for both the lecturer and the students.

Chloe used forums differently; she explained, "I tried forums with them. So I would say 'this is your essay, this is the topic, this is what was taught, could you send me your first paragraph, your thesis statement? I'll provide feedback'." Chloe said, "I had to get feedback from them so it's not just putting the things up there and leaving it for them to read, and then giving them the test. I've got to monitor them along the way." On the other hand, Faye used the quiz feature to foster learner-content interaction. The students, she said,

would get, like, weekly quizzes. It wasn't a high-stake quiz. They were like 5% or something, but they seemed to think it was too much to be tested every week. Now, because they had a weekly quiz, then they have to engage with the material.

Gabrielle indicated that interaction was minimal and passionless when the content was theoretical and abstract; however, when the content was relatable, there was increased interaction. Gabrielle reported,

I find too when you have very interesting materials, you get more interaction, so perhaps it's making the learning a bit more fun and interesting. When I bring a lot of real-world case studies that they can understand and relate to, I find I get more interaction. For instance, in agricultural economics, I've given them videos to look at for India and Africa on credit financing for life and death, and I find they respond well to those. I don't know

if it's because they are practical and I think they understand and they're excited by the content. So, I think the content has something to do with the level of interaction.

Emma reported no negative feedback from her students; however, Chloe and Faye received several complaints that halted their attempts at learner-content interaction. Chloe reported,

> I hit a wall, right, and my head of department said, "Miss Chloe, this is not an online university." I said, "But I'm teaching virtually, and you've told me that I could use Moodle." And then I found out that maybe the intention was that you use Zoom for two hours delivering lectures one day, Zoom for another two hours, whether it's practical or not the University couldn't care less, and I do have a problem with how policies are allowed to just not develop and so without any kind of motivational encouragement from up there, it falls apart at the bottom. So, I reverted to just having them send me the assignments in the assignment slot.

Faye reported,

> The complaints were numerous. The students complained of anxiety and depression and all sorts of mental health issues, and given that we were in the height of a pandemic too, I don't think that it was useful to keep them doing that. I was trying to tell them, look, it's a small thing, we just want to see that you understand, so you get a 2% or 5%, but that meant nothing to them. Everything seemed like a big, big deal and they had to study, really, really hard, and so they felt pressured because this was happening for, you know, all of the courses, and so they were complaining there's way too many assessments on a weekly basis. So, I kind of reigned it in, and nothing was compulsory other than the assessments that were on the course outline.

Faye, cognizant that several other factors may have contributed, was convinced that consistent learner-content interaction improved student performance and thus sought to attempt another way of improving interaction via the platform. Faye indicated,

> I tried flip teaching. So I took the time to record videos and send it to them before. I tried to keep the videos short, because I know, nobody wants to listen to a long academic video. Trying to keep the videos short and then at class rather than going through the slides or giving a lecture or even a mini lecture I decided to go straight to an activity, so I incorporated Kahoot and well, that is, on Zoom, of course, but they got their videos on Moodle. We went to the Kahoot activity which had questions that came straight from the videos. If you looked at the videos, then you know you'd be able to answer these questions, and that exposed a lot. Several of them didn't look at the video. . . . It was on YouTube and I could see my views. Of the 360 students, you had like 90-something views for one and 20-something views for another, and so on. The activity of the course exposed a lot so that at this point, to be honest, I'm at a loss as to what else I can do.

Two lecturers indicated that no deliberate attempt was made to foster learner-content interaction via Moodle, and three migrated their face-to-face teaching and assessment methods online. When asked to describe some of the strategies employed to facilitate learner interaction with the content via Moodle, Aaron said, "I like that question, the only thing I can say is from time to time, I would check to see which students actually came on the platform, and when," and Brooke said, "To be honest, I've never used any activities there for that type of interaction." Similar responses were received in response to the question, How has the design of assignments/assessments changed since using Moodle? For example, Dakota reported, "I would have been able to continue using the same structure. Most of my assignments for my courses are research based and calculations based." Brooke indicated, "It was a smooth transition in the fact that the assignments were typed, you know, your tasks, what it is that you were asked to do, and it was sent to students by email prior to the use of Moodle." Gabrielle said,

> I haven't really done any tweaks in my approach, other than facilitating discussion forums, that's at group levels to monitor their progress and address any concerns that they may have as they progress on their assignments. That is the only thing that I've done. Otherwise, it's really the traditional approach where you assign them the question, you allow them to upload, and then you respond by giving them feedback.

Other lecturers indicated that they continued to use the virtual classroom for learner-content interaction with frustrating results; for example, Imani indicated,

> On Zoom, we have kind of an interactive discussion session, I say "kind of" because it's been very disappointing to me that, well, because of bandwidth issues and all that, they don't ever have the videos on. I do, but I can't see how they're responding to what I'm talking about so that element has completely disappeared where I was actually able to pick up on their responses, and so that's been missing. I don't know what they're thinking or I don't know if they are interested or have a thought. I don't even know if they are at their computers, and so sometimes when I ask questions, there's silence. I keep waiting, but I can't really out-wait them. I'll have somebody ask, "what was the question again," and so I'll repeat the question and maybe at that point, we will talk a little bit about it, but it's very different from what we had in the face-to-face sessions.

Harmony shared a similar experience,

> I have time allotted for questions and answers, there are no questions. I call upon them individually, because, thankfully, the courses I teach are third and final year courses, so they don't reach to 100. I call upon them individually, [but] nobody has a problem, okay, and so I continue. So the truth is that I don't have any feedback for them, because they don't utilize the time. They don't do the forward reading. I may pose a question and one student may attempt an answer, but then if they don't have any follow-up, then it comes to an abrupt end . . . so it ends very quickly. That section of my class tends to end very quickly.

Lecturers were using a variety of modes to deliver content via Moodle. Some lecturers who tried innovative ways to foster learner-content interaction via Moodle experienced a measure of success, particularly when content was relatable. Others experienced what appeared to be resistance from students and management, and a few persisted with interaction in the virtual classroom with limited success. The consensus among all participating lecturers was that students needed to interact with the content; however, ideas for how it should be done that would find favor with students and management appeared to be in short supply. As the university embraces virtual learning as one of the many ways in which it offers education, finding successful ways to improve learner-content interaction is essential.

Learner-Instructor Interaction

Lecturers viewed communication with students as important and sought to establish and maintain a teaching presence via Moodle; however, they indicated that this was not without its challenges in the virtual learning environment. Lecturers communicated with students via announcements (n = 8), chat (n = 8), messages (n = 4), and forums (n = 3). Brooke indicated that class notifications were sent via announcements and thus, "If I'm not able to attend class, that's put on the announcements, where they have a note of what's happening." Emma stated,

> If I post an assignment on Moodle, I would send an announcement to say "your assignment has been posted" because they don't get automatic messages from postings, right? . . . When you do an announcement, it goes to their email, so that's a feature I really like about it.

Lecturers used the chat and email functions to address students' queries and check in on those who may have been absent from classes regularly or from an assessment. Sometimes, chat sessions were done in groups to extend the conversation on a topic covered in class. Lecturers also used the forum to communicate with students while at the same time keeping the class au fait with the conversation; for example, Faye noted, "I used forums for students to indicate their choice in group assignments." The class could then see the assignments chosen and those available for selection. Lecturers indicated that response time ranged from immediate to 48 hours. However, it could be longer because of their schedule at the time or, in a few instances, a student may not receive a response; for example, Aaron indicated,

> A message will come to your email, and sometimes if you don't respond immediately it's overlaid with so many other messages, or you might have read it and you say [to yourself] "alright, when I go into Moodle next time, I'm going to respond," and you completely forget, so you don't respond to them. Then the student will follow-up, sometimes some students, not all, because I recognize that different students have different personalities. There are some students, they would write you once and if you don't respond to them, it's like they don't follow-up—they don't do that follow-up—whereas others, they would ensure that you respond.

Aaron also expressed concern about student feedback; he said, "You'll respond to the student with the hope and intention that . . . your response answers their question, but you don't know whether that was so or not because they didn't give you any feedback."

Annotated documents (n = 2), inline comments (n = 6), rubrics (n = 2), and the grade book (n = 8) were the ways lecturers provided feedback on assessments to students. Brooke used Moodle to provide feedback only on multiple-choice assessments; feedback on assignments was shared via emails outside of Moodle. A lack of awareness and knowledge of the features of Moodle to provide feedback efficiently appears to have contributed to this, as Brooke indicated that this was not possible via the forum feature since,

> If it's a group, I wouldn't want to mark and then send it back, because when I upload it back into [the] forum, the other students are going to view the grades and their feedback, so what I do [is] I send that by email, but I have to learn that process now as to how I can get that done and return it to them.

Harmony also indicated that assessment feedback was done via emails since Moodle was used "right now, only for posting announcements, posting assignments, posting handouts to supplement their main texts—that's it."

Rubrics were used to grade assessments, and lecturers shared them with students via the Moodle platform. However, only Emma and Faye used this feature in Moodle to grade assessments. This may be because of a lack of awareness of the feature and/or how it is operationalized; for example, Faye indicated, "The assignment feature where you can add your rubric, I found has become very useful during the last two years; in terms of marking, that has made things a lot easier." Gabrielle responded by saying, "Moodle can do that? I didn't know that one." Chloe explained,

> I get frustrated easily. So, if I find something else that works, I go with that. The Moodle rubric . . . the way they award the points, it's kind of difficult. If I do a quiz, it works because specifically number one is five marks, number two is that, and so my total is that, but when you want a range for the marks, it doesn't allow that.

The repository feature in Moodle was viewed as useful by lecturers, who indicated that it allowed them to provide more documented details to guide students. Brooke explained,

> In each assignment now I will put, . . . [for] a tutorial presentation, what is needed for your written, what is needed in the oral presentation, so you have a step-by-step guide for each, and similarly with written, if it's the debate, a rubric is posted. Prior to Moodle I never did that. I would only use it in the class and speak to them about it.

The average time frame for feedback on assessments was 28 days (see Table 2), with two lecturers, Chloe and Harmony, indicating that feedback was provided within seven days, and Imani

indicating seven to 14 days. Five lecturers needed at least 28 days to provide feedback in a 13-week teaching semester at the University of Guyana.

Table 2

Time frame for feedback on assessments

Lecturer	Time Frame for Feedback (days)
Aaron	28
Brooke	21
Chloe	7
Dakota	28–56
Emma	28–42
Faye	28
Gabrielle	28–42
Harmony	7
Imani	7–14

Lecturers cited the challenge of grading assessments on the computer. Aaron explained that with a class size of 84,

> It's easy for me to take a script, jump on my bed and sit down and mark, but when I have to go to the computer and stare at the screen, and flicking through the screen and stuff like that, it becomes difficult.

While some lecturers indicated that they download and read assignments, Emma, with a class size of 104, reported,

> This semester, however, I've asked students to submit physical assignments, but they also submitted it on Moodle because of my reading. I just need paper to read. I can't do too much more of the grading on the computer, you know. So, however, I am able to relieve my eyes—that's what I'm doing.

Emma also indicated,

> The thing is, I think it's easier on the students. It cuts back on printing and, I mean, those are simple things, but students no longer print their assignments. They submit them on the platform. It's a little bit more difficult on the lecturers to go through long papers, and so we have come up with ways to shorten it to two pages. Pre-Moodle I don't think we would have considered page limits.

Printed assignments and page limits were implemented to address the volume of reading required on the computer and to provide feedback sooner to students. Dakota and Gabrielle cited "family" as the reason for the delay in providing assessment feedback. Dakota explained,

> Sometimes we tend to procrastinate a lot, and then my daily schedule is very busy now that I have a family. Before, when I was single, everything was rapid feedback. Grades and everything was [*sic*] rapid because I didn't have much to do on the personal side. But now, I have another human being to take care [of]. I also have a spouse. We have a home to take care of, so I would say I'm yet to master the work-life balance.

Gabrielle indicated,

> Well, to be honest with you, in the last academic year (2020/2021) and the current academic year (2021/2022), the timing has not been what I would have wanted it to be. I would say, I give students feedback on assignments within a month to month-and-a-half, which is not ideal. They should be able to receive feedback in a much shorter time frame, but the challenges of having to deal with family and home, they say, working from home is convenient, but the truth is it has its challenges.

Lecturers were of the view that Moodle reduced their interaction with students. Lecturers reported that in the face-to-face mode, they interacted with students in the classroom, on the campus walkways, in their offices, and in general any space where they might come into contact with students; however, via Moodle, it was more heavily dependent on the student. Faye explained,

> In the face-to-face mode, I guess, or before Moodle, I was able to meet with them at tutorials, in the general lectures, and pull out those ones that are shy, those trying to hide in the back and, you know, have a conversation with them [to] see what's going on, what their challenges are. I can't seem to find a way to do that on Moodle or even on Zoom.

Gabrielle, on the other hand, said,

> I would say pre-Moodle, there was better interaction because students, after class, they would hold you down in discussions. They have your cell phone numbers, so they messaged you on WhatsApp, so Moodle allows you—maybe it's not a disadvantage, maybe it's a good thing—it contains the interaction a bit more. I send them a message. I could send everybody a message. I could send specific students a message, so I kind of control that situation, where before Moodle they can bombard you on the telephone with calls and messages for feedback on assignments, or if there's a problem or a question, they can use the chat feature in Moodle. So I think, yes, maybe I shouldn't view it as a disadvantage, it helps to contain them from being too excessive in reaching out to you because everything is there and I give you feedback.

Lecturers appeared to have embraced the variety of options Moodle offers for student communication but expressed concerns that Moodle reduced their interaction with students. Timeliness of feedback, whether it was to queries or assessments, was a concern for lecturers, and many acknowledged that their response times were not in the best interest of students and thus was

something they needed to improve in the future. Lecturers, however, emphasized the challenge of class size and grading via the computer for timely feedback and highlighted their efforts to mitigate the challenge.

Learner-Learner Interaction

Lecturers used discussion forums, group assignments, group chats, and peer assessments to foster student interaction, but most did not deem these activities successful. In response to student complaints regarding the number of group assignments and the lack of accountability for all group members to participate, Emma supplemented a few with peer assessment. She explained when asked how she fosters learner-learner interaction via Moodle,

> Mainly by looking at what we call peer assessments because a lot of students complain about working in groups. That's always an issue. So what we have added, particularly for this academic year, is peer assessments where they're given again, through the platform, they're given a bunch of questions to fill out where they reviewed their peers in terms of their contributions.

Faye incrementally increased group assignments for her year-one to year-three students, hoping that these assignments allowed them to build a sense of community before they were given multiple assignments to complete in groups. She explained,

> In my first-year course because they are freshmen, especially in this era where they haven't met on campus and they don't really know each other, I try not to give them too many group activities, but I do one, so that at least they can get together in small groups and begin to get to know some of their colleagues. I also make it a point not to place them in groups, but have them reach out to each other and make it happen.

Faye indicated that interaction must take place based on the nature of the assignment that is given. She said,

> They're typically assignments where they really have to present something, a verbal presentation, in which they need to make or create something that is digital and submit it, so they do have to interact a whole lot to get it done, and each person has to be a part of the oral presentation. So, it means that they have to collaborate. You can't just work, do your part, and send it to the other person and submit. It is not a written, seldom ever written, assignment. So it's something they really need to come together, plan, and strategize to see how they will utilize their time to get it all done in a creative manner.

Emma and Faye seem to have found assignments that motivated students and encouraged them to learn from each other. Gabrielle and Imani attempted to use forums but expressed dissatisfaction with the degree of interaction between students. Gabrielle reported,

> When you have a forum for the whole class, the truth is you don't get much energy from the students. It's a lot of prodding. The few that are at the top of the class may be the ones that may take the lead in engaging and responding and sharing views and so forth, but the bulk of the class tends not to be too critical or engaging on those open forums.

Imani shared a similar experience,

> One thing that keeps bothering me, though, is like, well, discussions, using forums, but then the students sort of end up talking . . . at each other and not really to each other. Everything that's written there is sort of written as though they're answering an exam question, so it's really sort of abstract in general and even when they respond to each other, it's just, "Oh yes, I agree with you on this." You know, there isn't as much debate as you would find in a face-to-face setting.

The diversity of ways active and collaborative learning could occur via Moodle was not readily visible to Brooke, who indicated, "I am not aware that Moodle has a feature to allow for that interaction. It's not like the Google Classroom that they will have everything they can post, you have your Meet, right there." The implication was that the learner-learner interaction was only possible in the face-to-face or virtual learning environment.

Attempts at learner-learner interaction via Moodle appeared to have varying degrees of success depending on the design of assignments. Lecturers tried to avoid the usual group assignments because of student complaints and the absence of a structure that made all students accountable for their participation. Lecturers who used forums believed students were going through the motions because it was a graded assignment. However, those who designed assignments that required the students to interact with the content shared by their peers or the creativity and ingenuity of colleagues to complete the assignments seemed to fare much better. Lecturers may need to revisit the design of their assignments if they remain in the virtual environment, and learner-learner interaction is considered critical.

Perception of Students

Predictors of Interaction

Multiple regression was conducted to predict a) learner-content interaction, b) learner-instructor interaction, c) learner-learner interaction, and d) student satisfaction. The predictor variables for the first three models predicting learner interaction with content, instructor, or other learners included gender, age, faculty member, ethnicity, perceived ease of use, perceived usefulness, and computer self-efficacy. For the student satisfaction model, the independent variables included all of the above, as well as the learner-content, learner-instructor, and learner-learner interaction variables.

Learner-Content Interaction

The learner-content model was a strong fit (R = .72; see Table 3). The independent variables explained nearly 60% of the variance in learner-content interaction. Computer self-efficacy, sex, age, academic unit, and ethnicity were not significant predictors of learner-content interaction (p > .05). For each unit of increase in perceived ease of use and perceived usefulness, learner-content interaction was predicted to increase by 0.36 and 0.39 points, respectively (p < .05).

Table 3
Model summaries for regression of study variables (N = 86)

Models	R	df	R Square	F	Sig.
Learner-Content	0.72	15	0.51	4.93	.00
Learner-Instructor	0.58	15	0.34	2.37	.01
Learner-Learner	0.60	15	0.36	2.61	.01
Student Satisfaction	0.86	18	0.74	10.37	.00

Learner-Instructor Interaction

The learner-instructor model was a moderate fit (R = .58). The independent variables explained just over 30% of the variance in learner-instructor interaction (see Table 3). Perceived usefulness, computer self-efficacy, sex, age, and ethnicity were not significant predictors of learner-instructor interaction (p > .05). For each unit of increase in perceived ease of use, learner-instructor interaction was predicted to increase by 0.36 points (p < .05). Students in the College of Medical Sciences were more likely to have lower learner-instructor interaction than the Faculty of Natural Sciences (B = -0.41, p < .05). The findings suggest that learner-instructor interaction increased as students gained confidence in the use of Moodle and that when Moodle is perceived as easy to use it influences students' interaction with lecturers.

Students appeared generally satisfied with how lecturers facilitated learner-instructor interaction via Moodle. Students reported (see Table 4) that lecturers used Moodle to communicate due dates (90%), assignment rubrics (80%), and instructions on how to participate in assessments (79%). The value of formative feedback seems to be in question, with only 49% stating that it helped them understand their strengths and weaknesses, 29% indicating that it did not, and the remaining undecided. When asked to define timely feedback to queries and assessments, students indicated responses provided within 24–48 hours (65%) and 14 days (92%), respectively (see Tables 5 and 6). The data suggest that while learner-instructor interaction was taking place, the quality of the interaction might be of concern, particularly as it related to feedback on assessments, given that rubrics seemed to be used by the lecturers.

Table 4

Frequencies for learner-instructor interaction (N = 86)

Survey Items	SA	A	UD	D	SD
	n (%)				
The course lecturer provided clear instructions on how to participate in course learning activities on Moodle.	16 (18.6)	52 (60.5)	12 (14.0)	5 (5.8)	1 (1.2)
The course lecturer used Moodle to clearly communicate important due dates and time frames for learning activities.	35 (40.7)	42 (48.8)	6 (7.0)	2 (2.3)	1 (1.2)
The course lecturer provided feedback via Moodle that helped me understand my strengths and weaknesses.	11 (12.9)	31 (36.5)	18 (21.2)	19 (22.3)	6 (7.1)
The course lecturer provided general guidance in a timely manner.	10 (11.6)	42 (48.8)	18 (20.9)	13 (14.4)	3 (3.3)
The course lecturer used Moodle to communicate assignment rubrics for learning activities clearly.	20 (23.3)	49 (57.0)	10 (11.6)	6 (7.0)	1 (1.2)

Note. SA = Strongly Agree, A = Agree, UD = Undecided, D = Disagree, SD = Strongly Disagree

Table 5

Time frame of feedback on queries (N = 86)

Time Frame	n	%
1 day	28	32.6
2 days	28	32.6
3 days	16	18.6
4 days	3	3.5
5 days	11	12.8

Table 6

Time frame of feedback on assessments (N = 86)

Time Frame	n	%
1–2 days	19	22.1
Within 7 days	41	47.7
Within 14 days	19	22.1
Within 21 days	4	4.7
Within 28 days	3	3.5

Learner-Learner Interaction

The learner-learner interaction model was a moderate fit (R = .60). The independent variables explained almost 40% of the variance in learner-learner interaction (see Table 3). Academic unit, sex, age, and ethnicity were not significant predictors of learner-learner interaction (p > .05). For

each unit of increase in perceived ease of use and perceived usefulness, learner-learner interaction was predicted to increase by 0.41 and 0.29 points ($p < .01$), respectively, while for each unit of computer self-efficacy, learner-learner interaction was predicted to decrease by 0.36 points ($p < .01$). The findings suggest that as computer self-efficacy increased among students, they were less likely to interact with peers in their various courses in comparison to perceived ease of use and perceived usefulness.

Predictors of Student Satisfaction

Finally, the student satisfaction multiple regression model was a strong fit ($R = .86$; see Table 3). The independent variables explained just under 75% of the variance in student satisfaction. Perceived ease of use, computer self-efficacy, learner-content, learner-learner, sex, ethnicity, and age were not significant predictors of student satisfaction ($p > .05$). For each unit of increase in perceived usefulness and learner-instructor interaction, student satisfaction was predicted to increase by 0.36 and 0.48 points ($p < .001$), respectively. The Faculties of Agriculture and Forestry ($B = 0.36$, $p < .05$) and Social Sciences ($B = 0.38$, $p < .05$) were more likely to have higher student satisfaction than the Faculty of Natural Sciences, with the College of Medical Sciences trending toward significance ($B = 0.25$, $p = .06$). The findings suggest that, overall, students in the Faculty of Natural Sciences were satisfied with the way lecturers used Moodle in comparison to two of the eight academic units examined.

Discussion

Hillman et al. (1994) suggest that learner content, instructor, and learner interactions are mediated by technology. Thus, the learner-interface interaction plays a critical role in the effectiveness of these interactions. This was reiterated by the findings of this study that the learner-interface interaction predicted learner-content, learner-instructor, and learner-learner interactions, as well as student satisfaction. These findings are supported by Pérez-Pérez et al. (2020) and Sabah (2020); however, unlike Weidlich and Bastiaens (2018), the learner-interface interaction was not found to be the strongest predictor of student satisfaction.

Lecturers appeared to share a similar relationship between their competency with the interface and their ability to utilize the platform to generate student interaction with themselves, the content, and each other. This was evident in the responses of lecturers who were unaware of features that could aid the provision of feedback or active and collaborative learning. This is supported by Reid (2017) who explained that lecturers' self-efficacy, instructional experience, and technology background determine the adoption and effective use of learning management systems.

Learner-instructor interaction was found to be the strongest predictor of student satisfaction. Fearnley et al. (2022) found that while learner-instructor interaction was a significant predictor, the learner-content interaction was the strongest predictor of student satisfaction. Lecturers at the University of Guyana also reported that this was very important. They indicated that they attempted to provide clear instructions to students and used rubrics for learning activities, to which

79% and 80% of students, respectively, concurred that this was done. This finding, while dissimilar to Bolliger and Martin (2018), was similar to Bali and Ramadan (2007) and Gaytan and McEwen (2007). Lecturers reported that feedback to queries was provided within 24–48 hours. This aligned well with the expectations of (65%) students who indicated that their definition of feedback to queries was within 48 hours and was similar to findings of research conducted by Dixson (2010), Mupinga et al. (2006), and Shackelford and Maxwell (2012). Feedback on assessments, however, was ≥ 28 days for more than 50% of the lecturers interviewed, compared to within 14 days, as expressed by 92% of students. The need for timely feedback with constructive comments to focus and motivate students was highlighted by Ally (2019), Martin and Bolliger (2018), Martin et al. (2019), Muir et al. (2019), Ragusa and Crampton (2018), Stone et al. (2016), and Winstone and Boud (2022).

The quality of the feedback may be questioned when only 49% of the students stated that the feedback helped them understand their strengths and weaknesses. This is despite students (80%) indicating that lecturers communicated assignment rubrics for learning activities. Li et al. (2020) found that the quality of feedback provided by lecturers significantly affected students' motivation. The authors also examined the delivery style of feedback and found that students preferred to receive both positive and negative feedback. Students wanted negative feedback for growth, even as they needed positive feedback for encouragement and motivation. Turk et al. (2021) found that lecturers used feedback to address progress and process, and they offered feedback along the way rather than simply at the end of the assessments.

Lecturers reported several challenges, including increased workload, managing family while working from home, and increased computer time as factors inhibiting feedback on assessments. Erlam et al. (2021) indicated that the increased time spent on the computer was the challenge most reported by 95% of academics (N = 67), with balancing family and work life (89%) placing third. Garcia-Morales et al. (2021) and Paris (2022) indicated that large class sizes (N = 50) in the shift to virtual learning saw an increase in emails as well as office hours, which could no longer be standardized but needed to be flexible to address the challenges of students. Garcia-Morales et al. (2021) quoted lecturers overwhelmed by this increase and the need to provide personalized feedback to each student for several pieces of assessment. Saha et al. (2022) pointed to feedback on assessment being a time-consuming task, and Paris (2022) agreed, adding that this was made worse with flexible deadlines and the need for lecturers to follow up on non-submissions. All of this added to the time lecturers were required to spend reviewing work to provide feedback. Addressing these challenges will be necessary for the university to improve the provision of feedback, a critical element of the interaction between learner and instructor.

Gonzales and Ozuna (2021), Paris (2022), and Winstone and Boud (2022) observed that lecturers were also not incentivized by their students to provide feedback, whom they stated paid little to no attention to the comments. This was supported by Rand (2017) who found in her study on written summative assessment feedback that students often delayed or avoided reading the comments in favor of seeing their grades and, thus, often did not act on the comments made for learning. Li et al. (2021), Martin and Bolliger (2018), Muir et al. (2019), and Stewart et al. (2022), on the other hand,

found that students not only wanted feedback but that they wanted detailed, constructive comments for improvement. Paris (2022) notes that it may be a matter of perception since lecturers believed that students viewed feedback as negative rather than constructive for forward development. Gonzales and Ozuna (2021) suggest that there may be an issue with how lecturers and students view feedback. Henderson et al. (2019) define feedback "as the processes where the learner makes sense of performance-relevant information to promote their learning" (p. 268); however, Gonzales and Ozuna (2021) found that lecturers were using it more as an evaluative tool rather than one for learning. Meanwhile, Winstone and Boud (2022) reported that it was being done as "a kind of backside-covering exercise to avoid student complaints" (p. 659). This may be consistent with the situation facing the lecturers who participated in this study.

Winstone and Boud (2022) posit that it may be time to separate grades from feedback so that the latter is provided to students before the former, with Turk et al. (2021) recommending the upgrading approach. The authors suggest this will allow students to focus on the comments for growth and development. Erlam et al. (2021), Gonzales and Ozuna (2021), Paris (2022), and Rand (2017), however, suggest that more research is needed to understand the perception of students toward feedback, to examine course/assessment design that may be more appropriate for the virtual learning environment, and to understand other factors, such as workload, to ensure that an enabling environment is created for successful education delivery in whatever may be the future modality. Suggestions could be implemented at the University of Guyana to understand better the challenges and barriers facing lecturers and students so that appropriate support mechanisms could be initiated to improve interaction via Moodle.

Li et al. (2021) gathered lecturers' and students' perceptions of the areas needing improvements to advance effective learning and found that lecturers revealed findings similar to those of this study. Much like Gabrielle and Imani, lecturers reported the absence of quality interaction in the discussion forums, stating that students had to be prodded to participate and that without clear instructions on the number of posts, there would be few responses to peers. On the other hand, students acknowledged the value of learner-learner interaction but seemed to indicate that the forums were not linked to learning outcomes, describing them as "busy work" (Li et al., 2021, p. 168). The students claimed that the fixed number of posts inhibited free-flowing interaction, which would be possible with "intriguing topics" (Li et al., 2021, p. 168). The recommendation was an examination of the design of the forums to ensure that they are in sync with the learning outcomes, making good use of relevant real-world examples to capture and retain the attention of students (Gašević et al., 2015; Li et al., 2021; Martin et al., 2019b; Schrenk et al., 2021).

Lecturers in this study transitioned their face-to-face content without much modification to the virtual learning environment, while others made attempts at learner-content, learner-instructor, and learner-learner interaction. Some experienced a lack of engagement, while others received pushback from students. Chloe recommended that course designers train and guide each academic unit to address these challenges because she understood that virtual learning required a different approach if students were to be engaged in learning. The literature supports the need for universities to invest in course design for the virtual learning environment; however, they refer to

the personnel as an instructional designer (Hernandez-Selles et al., 2019; Martin & Bolliger, 2018; Martin et al., 2019a; Martin et al., 2021). The instructional designer, according to Seels and Richey (1994), is responsible for "the theory and practice of design, development, utilisation, management and evaluation of processes and resources for learning." In essence, the instructional designer works with the subject expert on all the elements of course design to ensure that content captures and retains the attention of students, and assessment that measures learning outcomes is delivered in a manner that ensures learning.

Turk et al. (2021) state that "when designed or facilitated poorly, online courses fail not only to create and maintain a strong sense of community, but also fail to provide meaningful, engaging, and satisfying learning experiences for students." Thus, Alkhateeb and Abdalla (2021) and Kumar et al. (2021) call for course material that is current and relevant, while Tulaskar and Turunen (2022) address the delivery mode of course content, recommending that lecturers rethink lectures in terms of style of delivery and length. The authors found that students complained about inattentiveness when lectures were long and tedious.

Martin et al. (2021), Muir et al. (2019), and Turk et al. (2021) address the importance of building and sustaining a sense of community throughout virtual courses, whether through techniques such as icebreakers, announcements, and/or emails for queries/wellness checks to keep students stimulated and motivated. St-Onge et al. (2021) and Garcia-Morales et al. (2021) recommend that content and assessment be redesigned using a more learner-centered approach, all the while ensuring pedagogical alignment, with Pérez-Pérez et al. (2020) and Wimpenny and Savin-Baden (2013) emphasizing the need for a friendlier, less formal environment to encourage learner-learner interaction. Pérez-Pérez et al. (2020) also notes that formal discourse in virtual learning environments can dissuade student participation, while Wimpenny and Savin-Baden (2013) suggest that the tone of communication may negatively affect engagement. These are all areas that can benefit from the expertise of instructional designers.

Implications for Practice

The findings of this research have implications for practice and research at the university in Guyana. Pedagogy is essential whether in a face-to-face, remote, or online setting. Its purpose should be to facilitate learning. Alexander et al. (2009) define learning as a process that creates "enduring change in persons" through the "interactive relation between the nature of the learner and the object of the learning" (p. 186). Interaction is vital for student engagement and fosters enduring change (Bolliger & Martin, 2018). Lecturers in this study had difficulty engaging students with the content and with their peers, and students indicated that this was necessary for their learning. This could be attributed to course design and attempts to migrate face-to-face courses with minimal modifications to the remote setting. Tulaskar and Turunen (2022) found that university students in Finland and India were dissatisfied not only with virtual lectures that were more than 60 minutes but also when this occurred with back-to-back classes. Erlam et al. (2021), Garcia-Morales et al. (2021), and Saha et al. (2022) support these findings and, along with Tulaskar and Turunen (2022), urge universities to redesign course offerings not only with the content and

delivery in mind but also in prioritizing interactions between learner-content, learner-instructor, and learner-learner. Garcia-Morales et al. (2021) and Tulaskar and Turunen (2022) also recommended using learning management systems to deliver remote/hybrid learning since universities ensure high-quality learning in all environments. Qualitative research should be done to understand the challenges and barriers to learner-content and learner-learner interaction from the student's perspective. This will ensure that interventions made by lecturers result in effective teaching and learning.

The hurried nature of the required response to the COVID-19 pandemic meant that the university in Guyana did not have the time, understandably, to equip lecturers properly. The university did attempt to engage in some professional development; however, Fathema and Akanda (2020) caution against the one-size-fits-all approach. The authors recommend training in the elements of course design for effective remote teaching and learning and the functions and features of Moodle; however, they suggested that it may need to be done at different levels to meet the diversity of staff members at their point of need. This appeared to be the case with lecturers in this study, some of whom did not utilize the right features for the task at hand or did not know of features that could provide much-needed assistance, particularly with the provision of feedback, and thus could perhaps benefit from some basic LMS training. Other lecturers used several active and collaborative features but were at a loss as to why the degree of interaction was low. These lecturers could perhaps benefit from training on educational methodologies that aid in building a sense of community so that effective learning can occur. Fathema and Akanda (2020) also recommended discipline-specific training since what might be helpful for engineering lecturers may not be necessary for humanities majors. Research should be ongoing on the impact of course redesigns on learner-content, learner-instructor, and learner-learner interaction to foster knowledge-sharing on best practices and inform university policy development.

While lecturers seemed to be responding to queries promptly, their feedback to assessment may be deemed unacceptable in most institutions. Students indicated that the responses fell short of their definition of timely feedback and were often ineffective in guiding their progress and process. Consideration should be given to the kind of support lecturers need to deliver timely feedback in the remote setting. This may necessitate training in using the rubric feature on Moodle to reduce the time required to email individual students and prepare rubric comments for each student. Research may also be needed on the effectiveness of feedback to ensure that it is timely and affects students' ongoing learning (Paris, 2022; Planar & Moya, 2016; Winstone & Boud, 2022).

The COVID-19 pandemic disrupted the delivery of higher education globally; thus, the challenges and barriers experienced by the university in Guyana were in no way unique. Higher education institutions (HEIs) that were gradually attempting to integrate technology-enhanced learning strategies were forced to scale up overnight to meet the needs of their student population. This was a clear positive of the pandemic for many institutions as lecturers and students were pushed forcefully out of their comfort zones into the amazing world of educational technology. Some lecturers and students did exceptionally well, while others struggled with the challenges and barriers presented by the absence of the necessary support structures to guide and motivate them.

To this end, HEIs so affected may need to reimagine the role of technology in education, fully acknowledging that technology is a powerful tool that can, if allowed, transform learning in our institutions. The pandemic facilitated an explosion in innovations that can help us better engage and motivate learners, provide feedback, and build a sense of community among learners if we only explore and use them.

This study focused on using an LMS, but the digital transformation allows a broad and diverse array of technology to enhance learning strategies in face-to-face, virtual, and online environments. Higher education institutions have an opportunity to scale up their efforts and maximize the momentum of the small wins accomplished over the past three years as we learn to live with COVID-19. The questions, however, remain: Will this opportunity go begging where several HEIs devise strategies to cash in on the ability of technologies to enable higher lecturer-to-student ratios but deliver banking education? Or will they capitalize on the sense of urgency created by COVID-19 to form a guiding coalition of experts who can share their experiences and build out a strategy/vision that addresses the challenges and mitigates the barriers toward the change that is possible?

Technology-enhanced education delivery during the pandemic surprised many lecturers and students who were previously hesitant and/or resistant to its effectiveness and efficiency. Lecturers and students, however, need the support necessary to maximize the use of technology. Many new roles, such as instructional/learning designers, academic technologists, course designers/developers, and mentors/advisors, should be added to the organograms of HEIs where necessary, to prepare and support lecturers and students in technology-enhanced modalities. These professionals can assist in preparing customized professional development that meets the needs of lecturers and students, equipping them to deliver at incrementally higher standards as they build their self-efficacy with technology. Institutions affiliated with HEIs locally, regionally, and internationally, in anticipation of the need, have also prepared programs/courses that can be recommended for professional development so that lecturers interested in more can elevate themselves at their own pace. The literature has revealed the challenges and barriers facing lecturers and students, many of which mirror the situations in our context and provide a wide array of recommendations for how institutions can act should they desire to deliver high-quality, technology-enhanced education.

Feedback on assessments was a challenge for lecturers in this study, and several other researchers support this finding. This is, therefore, another area that needs careful examination as HEIs embrace technology-enhanced learning. Many higher education institutions, however, are somewhat reserved regarding e-assessments, highlighting the ease with which students can cheat, compromising the integrity of the process—valid concerns given their experiences. Researchers have not offered a solution; instead, they recommend raising awareness of the institution's academic integrity policy and procedures as a deterrent. Turk et al. (2021) suggest the need to be more creative and innovative in the design of assignments and how they are graded, a move away from traditional forms of assessment. Winstone and Boud (2022) offer an exciting alternative for HEIs by suggesting that perhaps now is the time to "disentangle" (p. 656) grades from feedback,

necessitating institutional reflection on what may be most important to their vision. Turk et al. (2021) found that some online lecturers were already moving toward feedback that emphasizes progress and process rather than grades for encouraging learner-instructor interaction. Winstone and Boud (2022) further report that grades detract from feedback, and thus, lecturers could explore scaffolded assignments that facilitate providing feedback along the way on progress and process, while sharing the grade at completion. The authors also suggest self-assessments or reflections where students submit a one-pager with their progress reports detailing how feedback improved their understanding and ability to complete the assignment. These are a few nontraditional ways in which feedback can be provided to improve learning experiences.

The task ahead for all stakeholders is challenging even when done well by some institutions. Maintaining the energy necessary to drive the change may require incentives and rewards for those seeking to fulfil the vision of their institution. Research shows that extrinsic rewards, such as monetary prizes or benefits, for example, promotions, work well for most employees; however, intrinsic rewards, such as recognition awards, are also needed to sustain change in institutions (Esteve-Mon et al., 2022; Reid, 2017). Institutions may need to include motivational mechanisms in their digitalization transformation strategic plans.

The suggestions that HEIs focus on how learning should occur in a technology-enhanced modality or in feedback or in professional development do not imply a piecemeal approach to scaling up the digitalization transformation in education. This transformation has been stressful and traumatic for many thus far because of the chaotic manner in which it was done due to the pandemic. Success going forward will require institutions to develop clear strategies that specify their definition of digitalization: what it means for them, why digitalization, and how it will be implemented. It needs to be holistic and not simply an investment because it is fashionable, one that lecturers and students need to figure out without proper guidance and support. Digitalization should be accompanied by a monitoring and evaluation plan. Higher education institutions should continually research to identify what works well, what does not, and why. Research should explore the effectiveness of the technologies employed, the changes in pedagogical practices, the resource and technology facilitating conditions, and the satisfaction of lecturers and students. A common thread throughout the research should be how they improve interaction with the interface, content, instructor, and fellow learners. This will enable the internal and external sharing of best practices and the realization of areas that need additional work to improve the quality of education delivered.

Limitations

The study had a few limitations. The selection criteria excluded lecturers whom the university did not train, who had been using Moodle for less than two years, who were not teaching at the time of the study, and who were not full-time employees. The findings, therefore, may not be representative of all lecturers. This study also assumed a sample of lecturers with a degree of expertise that may not necessarily be true. Further, due to the small sample size of students who participated in the survey, it was not possible to compare lecturers with their specific students to better understand the value of Moodle and whether the experiences of lecturers and students

aligned or misaligned. Replicating this study on a larger scale with a robust sample of students per lecturer, and perhaps some learning analytics to facilitate data triangulation, should be explored in the near future.

Conclusion

This study explored how lecturers and students perceived the use of Moodle through the lens of learner-interface, learner-content, learner-instructor, and learner-learner interactions. The study revealed several ways Moodle enabled student interaction with the content, instructor, and fellow students. Lecturers found Moodle helpful in engaging with students and used several delivery modes, communication, and active and collaborative features that fostered student interaction. Student satisfaction was derived from interaction with their lecturers via Moodle. Since the interaction between learner-instructor is intertwined with the learner-interface, learner-content, and learner-learner interactions, the findings of this study should be used as a guide for the development of sustained quality remote learning at the university.

Declaration

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