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Perception–practice gap in Moodle use: a TAM–ISSM perspective

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ABSTRACT

Learning management systems (LMS) are widely promoted as catalysts for digital transformation in higher education; however, positive technology acceptance does not necessarily translate into meaningful pedagogical practice. Drawing on an integrated technology acceptance model (TAM) and information systems success model (ISSM), this longitudinal survey examined the perception–practice gap (PPG) in Moodle use among 230 participants (26 teachers and 204 undergraduate students) at a specialized public university in Bangladesh. Although both teachers and students reported moderately positive perceptions of Moodle across perceived ease of use (PEOU), perceived usefulness (PU), information quality (IQ), user satisfaction (US), and behavioral intention (BI), these perceptions were not reflected in actual pedagogical practice. Teachers primarily used Moodle for assessment and content delivery, while collaborative and participatory features remained underutilized. The largest PPGs were observed in PEOU and actual usage behavior, particularly among teachers. The findings indicate that the PPG is driven by an administrative LMS culture, limited adoption of collaborative pedagogy, and the weak translation of digital readiness into pedagogical appropriation. The study extends the TAM–ISSM framework by positioning pedagogical appropriation as a critical intermediary between technology acceptance and educational transformation, highlighting the need for pedagogically driven digital transformation in higher education.

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1. INTRODUCTION

Learning management systems (LMS) provide a platform for managing learning materials, giving feedback, maintaining teacher-student interaction, and bridging brick-and-mortar and virtual classrooms [1], [2]. With the global technological revolution, the use of LMS has increased across educational institutions, and during the COVID-19 pandemic, its user base became widespread as a solution for managing teaching and learning activities beyond the physical classroom [3]. In particular, Moodle has become a well-known

LMS because it supports different modes of online learning by incorporating user-friendly features and adapting to user requirements [1], [4]. Despite the increasing use of LMSs in institutions, their pedagogical potential is not always fully realized. Studies have shown that many teachers limit their LMS to uploading notes, taking quizzes, and managing assignments, but they make relatively little use of student-centered or interactive teaching strategies [5]. As a result, in many cases, LMSs digitally represent traditional teacher-centered teaching methods rather than creating new ones. This problem is even more important in developing countries, where universities are rapidly developing digital infrastructure, but adequate training and pedagogical support for teachers are relatively limited [6]–[8].

Researchers have long used the technology acceptance model (TAM) to explain the adoption of educational technology. According to this model, perceived usefulness (PU) and perceived ease of use (PEOU), behavioral intention (BI) to use it in the future [9], [10]. Although TAM is useful in explaining users' attitudes and decisions behind technology adoption, it does not provide a deep understanding of how teachers actually use the technology in their teaching after adoption [11]. Therefore, it is often seen that while users express positive perceptions of the LMS, its interactive benefits or instructional potential are not fully utilized in real classrooms [5]. To overcome this limitation, recent studies are using DeLone and McLean's information systems success model (ISSM) in conjunction with TAM. ISSM assesses information systems success through multidimensional factors, including information quality (IQ) and user satisfaction (US) [12]. On the other hand, TAM–ISSM, when used together, provides a more comprehensive understanding of technology acceptance and effectiveness in education [2], [13]. However, these two models mainly focus on user perceptions, experiences, and satisfaction; the extent to which technology is being applied in actual teaching and learning activities has received relatively little attention.

For this reason, while previous studies on LMS have analyzed various aspects of technology adoption [14]–[16], the extent to which positive attitudes are changing actual teaching practices—especially in countries in the Global South—has not been adequately explained [17]. This discrepancy is explained in this study as the perception–practice gap (PPG). That is, although users have positive attitudes towards LMS, the use of various teaching methods and interactive features of Moodle in real classroom activities is still limited. This PPG shows that adopting technology alone does not bring about real change in the education system; rather, assessing the success of LMS requires considering the use of technology in real teaching activities in addition to acceptance and satisfaction.

The use of digital education and LMS-based learning systems is currently rapidly increasing in universities in Bangladesh [18]. In particular, a specialized public university in the Dhaka Division of Bangladesh uses Moodle as its main LMS. The university places great importance on using Moodle in various departments and academic activities. Therefore, this university can be considered an important example for understanding how effectively technology-based principles are applied in real teaching. In addition, this university can be a useful case study for understanding the changes coming in classroom teaching due to the adoption of technology in a higher education system with limited resources.

In this context, the present study uses the integrated TAM–ISSM framework to analyze teachers' and students' perceptions of Moodle and teachers' use of Moodle activities and resources at this specific university. By examining the relationship between users' perceptions and actual teaching activities, this study offers a more implementation-sensitive perspective on LMS evaluation. While previous LMS studies have focused primarily on users' perceptions, this study examines the link between perceptions and pedagogical practice to assess the extent to which LMS adoption has fostered meaningful learning. Specifically, the study sought to answer the following questions:

- How do teachers and students perceive Moodle in terms of PEOU, PU, IQ, US, and BI within a higher education context? (RQ1)
- To what extent are these positive perceptions translated into actual pedagogical and learning practices throughout the semester? (RQ2)
- What explains the PPG between cognitive acceptance and actual pedagogical appropriation of Moodle among teachers and students in higher education? (RQ3)

2. LITERATURE REVIEW

2.1. LMS in higher education and its use in teaching and learning

LMS has become an important part of teaching and learning management in higher education institutions, as it plays an effective role in online communication, assessment, content management, and blended learning management [2], [3]. However, previous studies have shown that, in most cases, the main goal of using an LMS is limited to administrative or assessment-oriented tasks such as assignment management, quizzes, attendance, grading, and learning materials distribution [15]. On the other hand, learner-centered and participatory tools such as discussion forums, workshops, glossaries, peer feedback,

collaborative tasks, or student-generated activities are relatively less used [15]. As a result, in many cases, LMSs digitally reproduce traditional teacher-centered pedagogy rather than bringing qualitative changes to teaching methods [19], [20].

Taken together, these findings suggest that the PEOU of an LMS may have a paradoxical effect. While PEOU facilitates adoption, it may also encourage routine, administratively efficient practices, reducing incentives to explore collaborative and student-centered pedagogies. Consequently, the LMS may function primarily as a platform for content delivery and assessment rather than as a collaborative learning environment.

2.2. Research on TAM and LMS acceptance

TAM is one of the most widely used theoretical frameworks in LMS-based research for analyzing PEOU, PU, and BI [10] and explaining teachers' and students' willingness to use digital learning platforms, satisfaction, and continuance intention [21], [22]. Although TAM is useful in explaining the psychological reasons for technology adoption, many researchers believe that this framework mainly analyzes users' perceptions and behavioral patterns but cannot adequately explain how technology is used in real learning processes [11]. As a result, a situation may arise where teachers and students evaluate the LMS as easy, useful, and satisfactory, but the actual classroom practice remains very limited or conventional. Research on educational technology has also shown that digital technology often makes traditional teaching practice more efficient rather than creating transformative pedagogy [19], [20]. Therefore, an acceptance-based framework alone is not sufficient to evaluate the success of an LMS.

2.3. ISSM and LMS effectiveness

Beyond user acceptance of technology, the DeLone and McLean ISSM is widely used to evaluate the overall effectiveness of an information system [12]. ISSM has been used in LMS research primarily to analyze how users perceive the quality and effectiveness of e-learning systems [2], [23], [24]. Previous studies have shown that if the content of an LMS is well-organized, easy to use, and relevant to students' learning needs, users are generally more satisfied with it [25]–[27]. However, ISSM mainly assesses how effective the system is and what the users' experience is; it does not directly analyze what kind of changes are occurring in classroom teaching methods. Therefore, there may be situations where students or teachers are very satisfied with the LMS, but the use of different teaching techniques or tools in teaching is limited. In other words, simply having a good experience using technology does not necessarily mean that the classroom will be participatory or student-centered. Therefore, it is necessary to examine the relationship between users' perceptions and how they actually conduct teaching or learning activities.

2.4. Integrated TAM–ISSM framework and the PPG

Many researchers are using the TAM–ISSM models together to understand LMS usage more comprehensively. Because it is not possible to explain the overall reality of LMS usage through only one model [2], [13]. This integrated TAM–ISSM framework brings the concepts of PEOU, PU, IQ, US, and BI into the same analytical scope. As a result, the various influencers behind LMS adoption and usage can be explained relatively fully. However, how LMS is used in real classrooms or teaching-learning activities has been relatively less discussed. As a result, an important reality remains hidden. In many cases, although users are satisfied with the LMS, the use of its various tools, features, or learning activities during teaching is very limited.

One of the main theoretical contributions of this study is to analyze the PPG to understand why instructional diversity is limited despite high levels of satisfaction with the LMS. That is, positive attitudes or evaluations of technology do not always reflect meaningful changes in actual teaching and learning. Therefore, the PPG concept provides a useful analytical perspective for linking LMS evaluation to actual teaching practice, rather than limiting it to technology adoption.

2.5. Research gaps

Despite the extensive literature on LMSs, several gaps remain. Most studies have focused on users' perceptions of Moodle or other LMSs, including PU, satisfaction, and continuance intention [14], [28]. Comparatively less attention has been paid to how teachers actually use LMS activities and resources in their pedagogical practices [28], [29]. Moreover, the extent to which positive perceptions translate into actual teaching practice, or result in a PPG, remains underexplored [28], [29]. Evidence from resource-constrained higher education contexts in the Global South is also limited. Addressing these gaps, the present study applies an integrated TAM–ISSM framework to examine teachers' and students' perceptions of Moodle alongside teachers' actual use of Moodle activities and resources. By integrating technology acceptance with pedagogical practice, the study provides a user-centered evaluation of LMS implementation and contributes to the literature on digital transformation and meaningful LMS integration in higher education.

2.6. Conceptual framework

Previous research on Moodle has mainly focused only on the perceptions of technology adoption or use [14]. However, these studies still have some limitations. Considering those shortcomings, this study proposes an integrated conceptual framework that combines the key concepts of TAM, ISSM, and PPG. This framework demonstrates that although teachers and students have positive attitudes toward LMS in higher education institutions, the effective and meaningful use of LMS in actual teaching and learning activities does not always ensure its effectiveness.

As shown in Figure 1, LMS adoption is explained by several key components of the TAM. These include PU, PEOU, and BI. At the same time, ISSM dimensions such as IQ and US are also included. While these components help form positive perceptions of Moodle, this framework argues that positive acceptance does not automatically translate into effective, learner-centered learning activities. Rather, a PPG may develop, in which the use of Moodle is largely limited to content delivery and assessment-based activities, while collaborative and student-participatory learning methods are not adequately implemented.

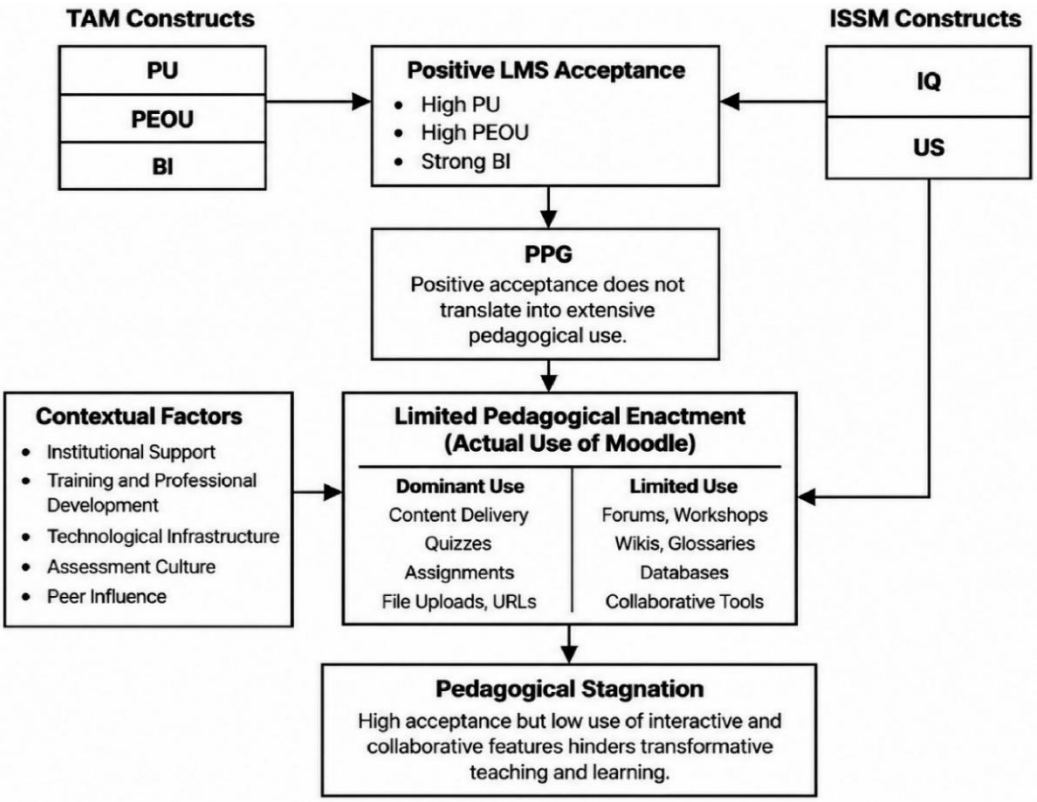


Figure 1. Conceptual framework of PPG in Moodle use: an integrated TAM–ISSM perspective

3. METHOD

3.1. Research design

This study employed a quantitative longitudinal survey design to investigate the PPG in Moodle use by comparing participants' initial perceptions with their actual pedagogical practices after sustained use of the institutional LMS [30]. Data were collected from the same participants at two time points during a single academic semester, enabling direct comparison between initial perceptions and subsequent pedagogical practices [30], [31]. This design enabled the examination of whether positive perceptions of Moodle translated into actual teaching and learning practices over time.

3.2. Study setting and context

The study was conducted at a specialized public university in the Dhaka Division, Bangladesh, where Moodle had been adopted as the official LMS and was routinely used across the participating departments. The university and the 2024–2025 academic year were purposively selected because Moodle had become an integral part of teaching and learning, enabling participants to complete an entire semester using the same institutional LMS. Conducting the study within a single institution ensured a consistent

academic, technical, and learning environment, reducing contextual variation and strengthening the internal validity of the longitudinal comparison. As the study aimed to examine the PPG within a real institutional context rather than to generalize findings across higher education, a single-institution case study was considered methodologically appropriate [32].

3.3. Participant selection and sampling

The study included teachers and undergraduate students from five departments: Internet of Things and Robotics Engineering (IRE), Educational Technology and Engineering (EdTE), Software Engineering (SE), Data Science and Engineering (DSE), and Cyber Security Engineering (CySE). A census recruitment strategy was employed, inviting all eligible participants to complete both survey phases; therefore, no a priori sample size calculation or statistical power analysis was conducted [30], [33]. The final matched longitudinal sample comprised 230 participants (26 teachers and 204 students). Participant retention is summarized in Table 1, with additional recruitment, eligibility, and retention details provided in Table 2.

A census recruitment strategy was employed. All teachers and undergraduate students from the five participating departments who used the institutional Moodle LMS during the 2024–2025 academic year were invited to participate. Only matched responses from participants who completed both survey phases were included in the final longitudinal analysis; unmatched or incomplete responses were excluded. Institutional email addresses were used solely for response matching and were deleted immediately after the matching process to ensure anonymity and confidentiality.

Table 1. Participant retention across the two survey phases

Survey phase	Teachers (n)	Students (n)	Total (n)
Phase 1 (initial perception survey)	28	215	243
Phase 2 (actual practice survey)	27	208	235
Final matched sample	26	204	230

Table 2. Participant retention across the two survey phases

Survey phase	Teachers (n)	Students (n)	Total (n)
Invited to participate	28	215	243
Completed Phase 1	28	215	243
Completed Phase 2	27	208	235
Final matched sample	26	204	230

3.4. Instrumentation and questionnaire validation

The survey questionnaires were developed using an integrated TAM–ISSM framework [10], [12]. Questionnaire items were adapted from previously validated instruments on Moodle use, technology-enhanced learning, and technology adoption. Separate but conceptually equivalent questionnaires were developed for teachers and students to measure initial perceptions and subsequent pedagogical practices across the two survey phases. The complete questionnaire is provided in Tables 3 and 4, respectively. Phase 1 questionnaire is shown in Table 3, while phase 2 is presented in Table 4. All items were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), enabling direct comparison between perception and practice across the corresponding TAM–ISSM constructs.

Content and construct validity were established through expert review by a specialist in technology-enhanced teaching and learning from a leading public university in Bangladesh [34]. The reliability of the four questionnaires was assessed using Cronbach's alpha. All four questionnaires demonstrated good internal consistency, with Cronbach's alpha coefficients ranging from 0.84 to 0.89 [35]. Detailed reliability statistics are presented in Table 5. All four instruments demonstrated good internal consistency, with Cronbach's alpha values ranging from 0.84 to 0.89, exceeding the recommended threshold of 0.70.

3.5. Data collection procedure

Data were collected at two time points during a single academic semester, with an interval of approximately four months between survey waves [31]. The initial survey (phase 1) was administered during the first week of the semester to measure participants' baseline perceptions of Moodle before substantial engagement with the LMS. The follow-up survey (phase 2) was conducted one week before the end of the semester to capture participants' actual pedagogical practices after sustained Moodle use. Both surveys were administered using Google Forms. Teacher questionnaires were distributed via institutional email, whereas student questionnaires were completed in class by scanning a QR code displayed on the classroom

smartboard. Participants provided their institutional email addresses solely for matching responses across the two survey phases. Following the matching process, all identifying information was removed before statistical analysis to ensure anonymity and confidentiality.

Table 3. Phase 1 questionnaire: initial perceptions of Moodle

Construct	Questionnaire items
PEOU	I find Moodle easy to use.
	My desired actions can be performed through Moodle without difficulties.
	Functioning Moodle is comprehensible, and the instructions are clear to me.
	Moodle is a user-friendly platform for communication.
	I find it convenient to master the features of Moodle.
	Overall, I find Moodle convenient.
PU	Moodle performs tasks efficiently.
	Moodle helps enhance my performance at work (teachers)/academic performance (students).
	Moodle contributes to my productivity.
	Moodle enhances my effectiveness at work (teachers)/I learn effectively through Moodle (students).
	Moodle assists me in my work (teachers)/learning materials are better organized and easier to study through Moodle (students).
	Overall, Moodle facilitates my work (teachers)/learning (students).
IQ	The layout and interface of Moodle are convenient to use.
	Navigating through Moodle is easy.
	Moodle provides sufficient resources to meet my needs.
	I feel comfortable using the resources available in Moodle.
	Moodle provides comprehensive information.
	Moodle provides information that is easy to understand.
US	I feel satisfied with my experience of using Moodle.
	The way Moodle performs is satisfactory.
	Moodle meets my academic learning needs.
BI	I intend to continue using Moodle frequently (teachers)/in my studies (students).
	I anticipate continuing to use Moodle in my daily work (teachers)/day-to-day studies (students).
	I plan to continue using Moodle in the future (teachers)/future studies (students).

Response format: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

Table 4. Phase 2 questionnaire: actual Moodle practices

Construct	Questionnaire items
Actual ease of Moodle use (AEOU)	I regularly use Moodle without needing assistance.
	I independently complete academic tasks through Moodle.
	I follow Moodle instructions during learning activities.
	I actively communicate with teachers or classmates through Moodle.
	I use different Moodle features in my studies.
	I regularly integrate Moodle into my learning routine.
Actual usefulness enactment (AUE)	I use Moodle to improve my academic performance.
	I use Moodle to complete academic activities more efficiently.
	I use Moodle resources to enhance my learning productivity.
	I rely on Moodle for managing my learning activities.
	I regularly study course materials through Moodle.
	Overall, I actively use Moodle for academic learning purposes.
Actual resource utilization (ARU)	I regularly navigate through Moodle to access learning resources.
	I use Moodle resources to meet my academic needs.
	I frequently use the learning materials provided in Moodle.
	I use Moodle information to support my understanding of course content.
	I depend on Moodle resources during my studies.
	I regularly use Moodle-provided information in my academic activities.
Actual learning engagement (ALE)	My satisfaction with Moodle encourages me to use it regularly.
	I actively continue using Moodle because it supports my learning needs.
	I frequently engage with Moodle for academic purposes.
Actual usage behavior (AUB)	I currently use Moodle frequently in my studies.
	I use Moodle as part of my day-to-day academic activities.
	I consistently use Moodle for future-oriented academic preparation.

Response format: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree

Table 5. Reliability of the survey instruments

Instrument	Items (n)	Cronbach's alpha
Teacher perception questionnaire	24	0.86
Teacher practice questionnaire	24	0.84
Student perception questionnaire	24	0.89
Student practice questionnaire	24	0.87

3.6. Data analysis

Data were analyzed using IBM SPSS Statistics version 27.0. Descriptive statistics were used to summarize participants' responses. To examine the PPG, mean scores from the initial perception survey were compared with the corresponding practice mean scores for both teachers and students. The PPG for each construct was calculated as the difference between the practice and perception mean scores (PPG=practice mean−perception mean). Descriptive analyses were also conducted to examine teachers' use of Moodle learning resources, assessment activities, and collaborative learning tools. The overall questionnaire structure and two-phase longitudinal research procedure are presented in Figure 2.

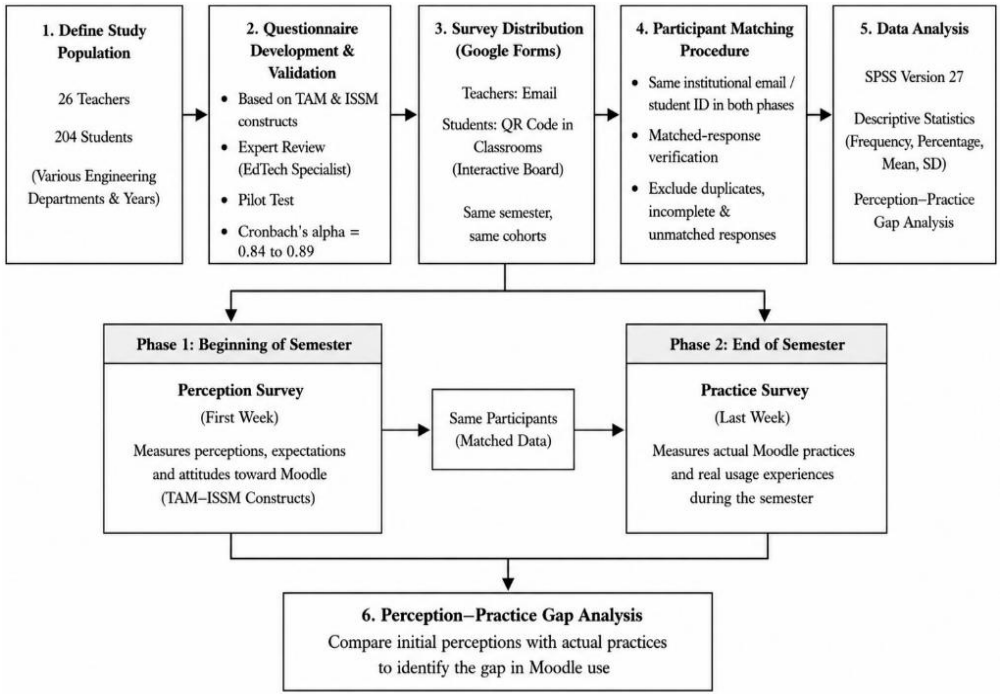


Figure 2. Flowchart of the two-phase longitudinal data collection and PPG analysis procedure

3.7. Ethical considerations

Participation in the study was entirely voluntary. Before data collection, all participants received information about the study and provided informed consent. Participants were informed that they could withdraw at any stage without penalty and that their responses would be used solely for research purposes. Institutional email addresses were collected exclusively for matching responses across the two survey phases and were removed immediately after the matching process. All data were analyzed anonymously and reported only in aggregate form to protect participants' privacy and confidentiality.

4. RESULTS

4.1. Demographic characteristics of the student participants

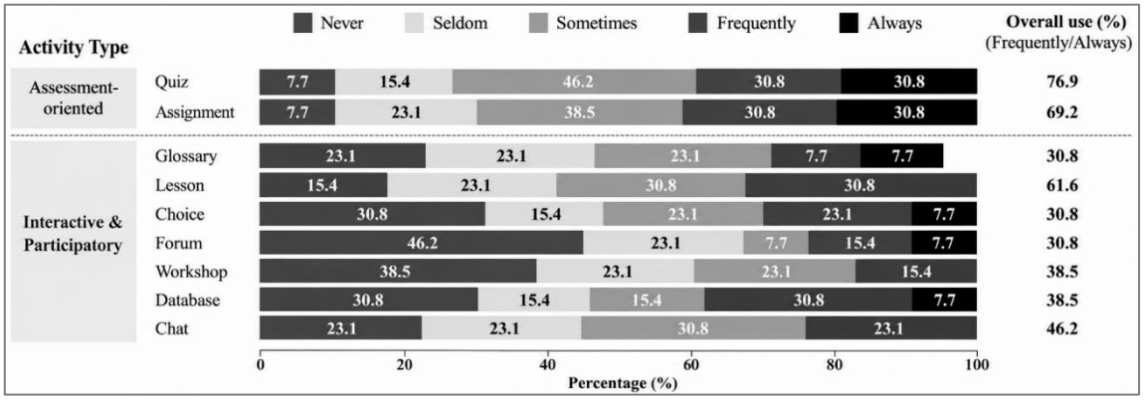
Table 6 summarizes the demographic characteristics of the student participants included in the final matched sample (n=204). All participants were aged 18–25 years. Male students (n=124) outnumbered female students (n=80). Most participants reported good or excellent information and communication technology (ICT) proficiency (n=144), whereas 60 students reported fair or poor ICT proficiency.

Table 6. Students' demographic profile

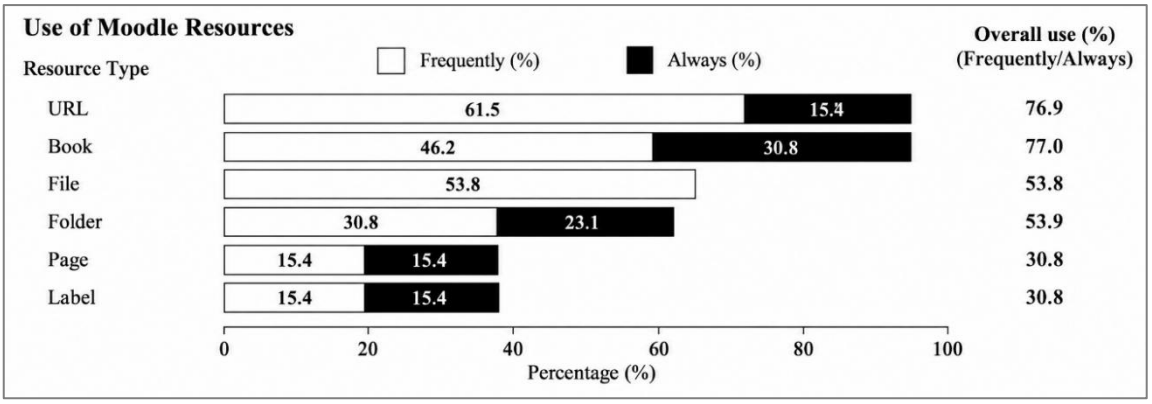
Variable	Category	n
Age	18–25 years	204
Gender	Male	124
	Female	80
ICT proficiency	Good/excellent	144
	Fair/poor	60

4.2. Patterns of teachers' Moodle use

Figure 3 presents teachers' Moodle use across two dimensions: activities and resources. The distribution indicates a stronger emphasis on assessment and content delivery than on interactive and collaborative learning. As shown in Figure 3(a), quizzes (76.9%) and assignments (69.2%) were the most frequently used activities, followed by lessons (61.6%). In contrast, glossary, choice, and forum activities each recorded 30.8% overall use, while workshops and databases each reached 38.5%. Figure 3(b) shows that books (77.0%) and URLs (76.9%) were the most frequently used resources, followed by folders (53.9%) and files (53.8%). Pages and labels recorded the lowest use (30.8% each). Overall, the findings suggest that teachers primarily used Moodle for assessment and content distribution, with comparatively limited use of its interactive and participatory features.



(a)



(b)

Figure 3. Teachers' patterns of Moodle activity and resource use: (a) use of Moodle activities and (b) use of Moodle resources

4.3. Comparison of Moodle perceptions, practices, and the PPG between students and teachers

Table 7 and Figure 4 present a comparative picture of the average scores of perceptions and actual practice of students and teachers in using Moodle. The results show a clear PPG. That is, their positive evaluation of Moodle was not reflected in actual use to the same extent. As shown in Table 7 and Figure 4, both students and teachers reported consistently higher perception scores than actual practice scores across all Moodle dimensions. Among students, the largest PPG was observed for PEOU (perception=3.61, practice=2.86, PPG=−0.75), whereas IQ exhibited the smallest PPG (−0.26). Moderate PPGs were also observed for PU (−0.44), BI/usage behavior (PPG=−0.46), and US (PPG=−0.27). A similar pattern was observed among teachers. The largest PPG occurred for PEOU (perception=3.83, practice=2.82, PPG=−1.01), followed by BI (PPG=−0.80) and PU (PPG=−0.60). The smallest difference was found for IQ (PPG=−0.14). Overall, teachers demonstrated a larger PPG than students across all five Moodle dimensions.

Table 7. Comparison of Moodle perceptions, practices, and PPG

Dimension	Students			Teachers		
	Perception	Practice	PPG	Perception	Practice	PPG
PEOU	3.61	2.86	−0.75	3.83	2.82	−1.01
PU	3.37	2.93	−0.44	3.45	2.85	−0.60
IQ	3.20	2.94	−0.26	2.98	2.84	−0.14
US	3.20	2.93	−0.27	3.23	2.72	−0.51
BI	3.37	2.91	−0.46	3.57	2.77	−0.80
Overall mean	3.35	2.91	−0.44	3.41	2.80	−0.61

Note: negative values indicate that actual pedagogical practice was lower than initial perceptions.

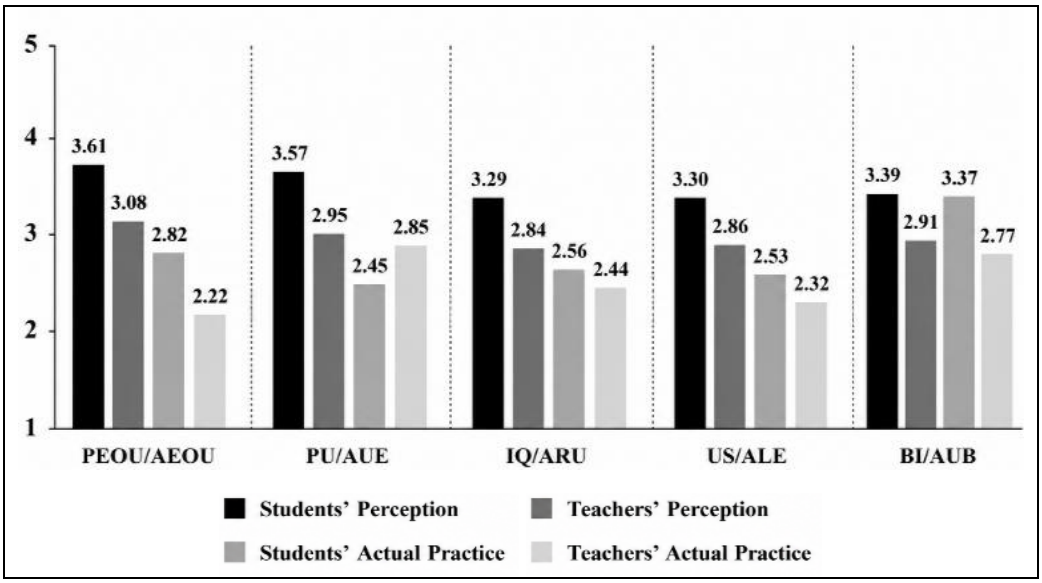


Figure 4. PPG across Moodle dimensions

5. DISCUSSION

5.1. Positive perceptions but uneven acceptance across constructs

The findings indicate that both teachers and students generally perceived Moodle positively, with overall mean perception scores of 3.41 and 3.35, respectively. Positive evaluations were observed across most TAM–ISSM constructs, particularly PEOU, PU, US, and BI. BI was also relatively high among students (M=3.37) and teachers (M=3.57), suggesting a continued willingness to use Moodle in future teaching and learning activities. However, perceptions were not equally positive across all dimensions. IQ received comparatively lower ratings, particularly among teachers (M=2.98), indicating concerns regarding the quality and pedagogical usefulness of the learning resources available through Moodle. These findings are broadly consistent with the assumptions of the TAM–ISSM, both of which identify PEOU, PU, IQ, and US as important determinants of technology acceptance [10]. The results also corroborate previous Moodle studies reporting generally favorable perceptions among teachers and students in higher education [1], [36]. Nevertheless, the comparatively lower evaluation of IQ suggests that positive technology acceptance does not necessarily imply complete satisfaction with the educational value of an LMS. However, these findings alone do not explain whether favorable perceptions are translated into meaningful pedagogical implementation. This issue is addressed in the following section through the concept of the PPG.

5.2. From technological acceptance to pedagogical appropriation

The principal contribution of this study lies in demonstrating that positive technology acceptance does not necessarily result in meaningful pedagogical transformation. Although both teachers and students reported favorable perceptions of Moodle across the core TAM–ISSM constructs, these perceptions were not consistently reflected in their actual pedagogical practices. The persistent PPG suggests that technology acceptance and pedagogical appropriation represent two distinct stages of educational technology integration. This finding provides an important extension to the TAM. While TAM proposes that PU and PEOU encourage technology adoption [10], the present findings indicate that positive perceptions alone do not necessarily promote innovative or collaborative teaching practices. Instead, teachers primarily used Moodle

for routine instructional activities, such as content sharing, quizzes, and assignment management, rather than learner-centered pedagogical practices. These findings are consistent with recent studies reporting that, despite the rapid expansion of digital technologies in higher education, pedagogical transformation has often remained limited [37]–[41]. Similarly, previous Moodle research has highlighted the platform's collaborative potential, although these pedagogical affordances remain underutilized [42]–[44]. Accordingly, this study extends the integrated TAM–ISSM perspective by arguing that technology acceptance alone is insufficient for educational transformation unless it is accompanied by meaningful pedagogical appropriation. The findings therefore suggest that pedagogical appropriation should be considered a critical intermediary stage between technology acceptance and meaningful educational transformation.

5.3. Administrative LMS culture and the avoidance of collaborative pedagogy

The findings further suggest that the observed PPG is strongly associated with what may be described as an administrative LMS culture. Although teachers reported favorable perceptions of Moodle, its actual use remained concentrated on assessment management and content delivery rather than collaborative teaching and learning. Quiz (76.9%) and assignment (69.2%) were the most frequently used activities, whereas collaborative features such as forum, workshop, glossary, and choice were used far less frequently. Consequently, Moodle functioned primarily as an administrative platform rather than a pedagogical environment for collaborative knowledge construction. This usage pattern provides an important explanation for the PPG identified in the present study. Rather than reflecting resistance to technology, the findings indicate that teachers primarily employed Moodle to support routine instructional tasks, including distributing learning materials, administering quizzes, and collecting assignments. In contrast, interactive and collaborative learning activities remained underutilized, limiting the pedagogical potential of the LMS.

Similar patterns have been reported in higher education, particularly in resource-constrained contexts, where LMS implementation often prioritizes administrative efficiency over pedagogical innovation [44]–[47]. Heavy teaching workloads, large class sizes, and the additional effort required to facilitate collaborative online activities may further discourage teachers from using interactive Moodle tools [48]–[51]. Collectively, these findings indicate that the observed PPG is not primarily a technological problem but a pedagogical one. Without deliberate pedagogical integration, digital technologies may simply reinforce existing teacher-centered approaches rather than promote collaborative learning. This phenomenon reflects a form of digital pedagogical stagnation, where institutional digitalization advances more rapidly than pedagogical transformation.

5.4. Student digital readiness and the paradox of low engagement

The findings revealed a mismatch between students' digital readiness and their actual engagement with Moodle. Although most students reported good ICT proficiency and regular LMS use, their actual engagement across Moodle learning activities remained consistently moderate. These findings challenge the common assumption that digital competence automatically leads to meaningful participation in online learning [52]–[55]. Specifically, 70.5% of the students rated their ICT skills as good or excellent, yet the mean practice scores across the pedagogical dimensions remained below 3.0. This suggests that technological competence alone was insufficient to promote meaningful engagement. A plausible explanation is that Moodle was used primarily to access learning materials and complete assessment-related tasks rather than to support collaborative learning, discussion, and knowledge construction. Similar observations have been reported in previous studies, which argue that meaningful engagement depends not only on students' technological capabilities but also on how learning activities are pedagogically designed and implemented [56]–[58]. This interpretation is further supported by research in critical digital pedagogy, which emphasizes the importance of pedagogical and social contexts in shaping technology-mediated learning [20], [59], [60]. These findings indicate that digital readiness alone does not guarantee meaningful engagement. Rather, students' technological competence should be intentionally translated into active learning through collaborative activities, peer interaction, reflective discussion, and knowledge-construction tasks within the LMS.

5.5. Theoretical and educational implications

The present study extends the integrated TAM-ISSM by showing that positive technology acceptance does not necessarily translate into meaningful pedagogical appropriation. Although both teachers and students reported favorable perceptions of Moodle, these perceptions were not consistently reflected in their pedagogical practices, indicating that technology acceptance and pedagogical implementation are distinct stages of LMS integration. Building on these findings, three practical implications emerge for higher education institutions. Higher education institutions should adopt pedagogical-first LMS implementation strategies that emphasize collaborative and learner-centered teaching in professional development programs. Collaborative Moodle activities should be systematically embedded in curriculum design rather than treated

as optional instructional tools. In addition, institutional digital transformation initiatives should explicitly link students' digital readiness to active learning opportunities to promote meaningful participation, collaboration, and knowledge construction.

This study has several limitations. It was conducted at a single specialized public university using a quantitative longitudinal design and did not include qualitative evidence to explain the underlying causes of the PPG. Future research should therefore employ mixed methods approaches, incorporate qualitative interviews or classroom observations, and extend the investigation to multiple institutions and cross-country contexts, particularly within the Global South.

6. CONCLUSION

This study employed a longitudinal survey integrating the TAM–ISSM to examine the PPG in Moodle use among teachers and undergraduate students. The findings showed that although participants reported generally positive perceptions of Moodle, these perceptions were not consistently translated into meaningful pedagogical practice. Instead, Moodle was used predominantly for administrative and assessment-related purposes, while collaborative and learner-centered activities remained underutilized. The study contributes to LMS research by extending the integrated TAM–ISSM framework beyond technology acceptance to pedagogical implementation. By conceptualizing the PPG, it provides a framework for understanding why positive acceptance alone does not ensure meaningful educational transformation, particularly in resource-constrained higher education settings.

The findings highlight the importance of adopting pedagogical-first LMS implementation strategies that integrate collaborative learning into curriculum design and connect digital readiness with active learning. Although the findings are limited to a single institutional context and a quantitative longitudinal design, they provide important insights into LMS implementation in higher education. Future research should employ mixed methods approaches that integrate qualitative interviews with longitudinal survey data, extend the investigation across multiple institutions, and undertake cross-country comparative studies to further examine pedagogical appropriation in diverse higher education contexts.

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AUTHOR CONTRIBUTIONS STATEMENT

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
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O : Writing - **O**riginal Draft
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Vi : **Vi**sualization
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Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

DATA AVAILABILITY

The data that support the findings of this study are available on request from the corresponding author, [MNH]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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