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Blended learning engagement practices with Moodle resources, in an introductory electronics engineering course: Exploring discursive manifestations of systemic contradictions using activity theory

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Abstract

The integration of Learning Management Systems in engineering education has tremendously changed teaching and learning. Studies on student engagement issues are typically conducted using learning analytics or log data quantitatively or using questionnaires on students and teachers' experiences, qualitatively. It is essential to holistically understand the reasons behind low engagement with Moodle resources, as this can help identify areas for improvement to enhance student engagement and performance. This study applies activity theory to investigate challenges in engaging students in a blended learning electronics engineering course using Moodle, focusing on systemic relations within the learning environment. By analysing contradictions within the activity system, the study reveals underlying tensions and conflicts, uncovering opportunities to improve engagement and effectiveness. Since contradictions cannot be directly observed, linguistic cues are used to identify their discursive manifestations, enabling educators to develop targeted interventions that address challenges and provide productive educational experience.

Findings derived from semi-structured interviews and questionnaires with teachers and students, show that inconsistencies in instructional materials, underutilisation of Moodle features, students' diverse learning preferences and teachers' compromised familiarity with Moodle are primary sources of contradictions, leading

to reduced student engagement. By drawing attention to the socio-cultural contradictions within the current system, this study emphasizes the importance of understanding and addressing these contradictions in educational contexts to foster progressive changes in the learning process. The study demonstrates how linguistic cues can be used to identify contradictions. Results indicate the need for better instructional design, effective use of Moodle, and improved teacher training to enhance student engagement in blended learning environments.

1. Introduction

Learning management systems (LMSs), such as Moodle, are powerful to facilitate hands-on learning activities, besides being able to create, foster and deliver learning beyond time and space in engineering education. Although these tools facilitate students to participate in online forums and group projects, students engage with these platforms minimally, limited to interactions like submitting assignments. Moodle and similar platforms are being viewed as repositories for course materials rather than interactive learning environments by course instructors too, leading to its underutilisation. Low student engagement with online learning materials in blended courses can negatively impact learning outcomes. Understanding the reasons behind low engagement is crucial for creating meaningful materials for students to learn with Moodle resources.

The lack of effective use of LMS in teaching subjects in Electronics and Communication Engineering may arise from a shortage of pedagogical strategies tailored to LMS environments or from insufficient familiarity and training among faculty and students. When designing educational content, it is important to consider the diverse learning preferences and the social, cognitive, behavioural, emotional, and collaborative engagement of students with the resources. Although the underutilisation of LMS has been extensively probed into, studies were largely focused on using learning analytics for quantitative analysis or qualitative questionnaires to capture experiences. These approaches often miss the socio-cultural influences that affect students' and teachers' motivation, sense of belonging, and identity within the educational environment, which are vital for comprehensive engagement strategies.

This study uses Activity Theory (AT) to examine the socio-cultural interactions between students and teachers with Moodle resources in an introductory electronics engineering course (EC101) in a Middle east engineering college. It

focuses on how both groups interact with these resources, at the micro (students/teachers with the tools), meso (among peers and close communities) and macro (within the wider frame of institutional policies, norms, larger community) levels exploring the challenges and identifying factors leading to low engagement in this blended learning course. Although the course, which is intense in problem solving, is taught by subject experts and scholars, and laboratory sessions are delivered by well-experienced instructors, students do not find it encouraging to practice problem solving with the current Moodle resources and do not perform well in the exams. Instructors often encounter challenges in engaging students with online learning tools, while students have expressed difficulties in problem-solving and non-availability of resources that match their learning preferences, but these concerns are seldom addressed.

Analysing historically situated contradictions that exist in the system, through the lens of AT helps uncover underlying tensions and conflicts within a learning environment, revealing areas where improvements can be made to enhance engagement and effectiveness. By understanding these contradictions, educators can develop targeted interventions to address specific challenges, enhancing both the pedagogical platform and instructional strategies for the course. This investigation into local practices in technology-enhanced learning seeks to provide insights into educational policy and practice, guiding the formation of effective pedagogical strategies and instructional design for LMS.

1.1 Research question

Focusing on understanding student engagement through student-teacher interactions with Moodle resources, the research explores:

- How do sociocultural contradictions in the activity systems of teaching and learning within the blended course EC101 impact student engagement with Moodle resources?

2. Literature review

Course design influences student engagement whereas the virtual, conceptual, and material tools are controlled by the educators and how technology is used defines its worth (Tualaulelei et al., 2022). This shows that well-designed blended learning happens when teachers provide resources that meet students' needs in a variety of engagement dimensions, foster a sense of community, and enable a range of student interactions with the course content.

To understand the current state of research on student engagement with virtual learning environments in blended learning engineering courses, a comprehensive search for open-access journal articles was conducted on databases such as Scopus, ACM Digital Library, and IEEE Xplore, and included articles from 2015 to 2023, using keywords “student engagement”, “Moodle”, “blended learning” and “engineering education”. From a refined collection of 26 case-study articles in English language, those on flipped classrooms, distance learning, active learning, online learning, were exempted which slightly veered away for the study topic.

The investigation on the final set of 12 articles focuses on two primary types of interactions within the Moodle learning environment: student interactions and teacher interactions. Research on student interactions reveals two emergent themes centred on the approaches used to facilitate and measure student engagement: “technological engagement” and “non-technological engagement. *Technological Engagement* includes studies utilizing digital tools and platforms, such as LMS and apps, that track, analyse, or enhance student engagement through metrics like logins and app usage. Conversely, *Non-Technological Engagement* implies studies that assess the behavioural, emotional, and cognitive aspects of student engagement without major reliance on digital tools, through observations, surveys, interviews, and traditional assessments that measure student participation, emotional responses, and cognitive effort. It is observed that before COVID-19, studies primarily relied on standard Moodle logs to measure student engagement. However, post-COVID, there has been a noticeable shift towards using learning analytics data for this purpose, which could be attributed to the increased popularity and adoption of learning analytics following the pandemic.

Most of the research focuses on student engagement whereas articles on teacher engagement were low. The related articles highlight that any teacher can create a modern and engaging learning environment that motivates students to achieve lasting learning success, as long as they have the right mindset and enough motivation. Findings of the review are classified on the basis of their key context and presented in a narrative manner in this section.

2.1 Measuring student engagement through traditional non-technological methods

Studies conducted to explore student engagement using traditional, non-technological tools use quantitative methods to analyse the influence of various factors, such as content access, online assessments, and lecturer support, on student

engagement (Swart, 2016; Mohd et al., 2016; Khoza & Van Der Merwe, 2022). Swart (2016) illustrates how an academic in electrical engineering uses LMS to promote student engagement through four primary features such as uploading and downloading documents, implementing assessment forms, fostering student-academic interactions, and monitoring students’ grades. Krasnova and Vanushin (2016) argue that learners’ engagement and satisfaction with online resources were influenced by convenience, clarity of design, ease-of-use, and flexibility and that the success of online learning systems hinges on effective course creation and delivery. Mohd et al. (2016) explore factors enhancing student engagement in blended learning and lecturer-student relationships in a quantitative survey which revealed a strong correlation between student engagement, lecturer support, and satisfaction with blended learning. Similar outcomes were indicated by Khoza and Van Der Merwe (2022) using quantitative data from LMS reports and qualitative insights from lecturer and student interviews. The study focuses on understanding the value that lecturers and students place on using LMS, the types of resources, activities, and assessments valued, and how these align with teaching and learning goals.

The studies mentioned above present valuable insights for the core study by demonstrating a high association between the kind of instructional material, the manner and timing of content access, student-teacher interactions, and student engagement. While these studies analyse parameters explicitly evident on the surface, they do not delve deeper into the underlying reasons behind these associations, leaving room for further exploration of the root causes

2.2 Evaluating student engagement via technological tools

Articles reviewed on the use of technological tools to evaluate student engagement focuses on measuring and enhancing student engagement. This is achieved by utilizing various interventions and learning analytics to monitor and support student activities. Emphasizing the role of technological tools, these studies aim to improve both engagement and academic outcomes through data-driven strategies and targeted interventions.

Quantitative data such as number of logins to Moodle, time on task, and the number of posts to a discussion board were used to measure student engagement in the studies by Gong et al. (2018); Maloney et al. (2022); Manasrah et al. (2023). The notifications options in Moodle were used to intervene in the students’ learning process indicating that blended learning with intervention can improve student en-

gement. By using statistical methods such as Pearson correlation and regression analysis, Jayasekaran et al. (2022) focuses on analysing the time students spend interacting with LMS and its correlation with performance in exams, in an engineering course in Hyflex (Hybrid – Flexible) mode. The study reveals that app engagement spikes can be attributed to various factors, which may help instructors in designing courses and helping students overcome challenges in the learning process. Jha et al. (2019) use demographic data of students from the student information system and a Moodle action log of students' online activities such as clicks and downloads to analyse the learning behaviour in a computer science course. The proposed model uses K-means clustering to group students of equal engagement to work together in a group assessment and a decision tree algorithm to identify and support students who are likely to fail. Salonen et al. (2021) explore how learning analytics (LA) can equip educators with information needed to guide students learning in a blended learning course. These investigations, however, lack depth in analysing subjective experiences which may indicate the underlying reasons.

Tualaulelei et al. (2022) report on a study that identified “pedagogical touchpoints” – opportunities within online resources for student engagement, exploring student and educator perspectives. The philosophy of this study closely matches that of the current research in the belief that “Technology by itself does not define practice; rather, the application of technology determines its worth”.

2.3 Teacher interaction with Moodle resources

Any teacher may create an appealing learning environment that is both contemporary and gratifying, encouraging and motivating students to attain long-term learning success, provided they have the appropriate attitude and sufficient drive (Gligorea et al., 2021). In their qualitative study, Tualaulelei et al. (2022) state that the implications for practice are that online courses need to be purposefully designed, not only for cognitive and behavioural engagement, but also for social, collaborative, and emotional engagement, as educators often focus on the former while neglecting the latter.

The literature lacks a systemic view that acknowledges how the larger educational context, including the relationships, practices, and institutions that either support or impede learning, impacts engagement. While quantitative analysis does not account for emotional and social engagement issues students may face, qualitative analysis tends to

isolate attributes instead of considering the interdependencies within the learning environment. Activities performed by individuals are significantly shaped by socio-cultural factors that have developed over a long period. Considering this, there could be several other factors that may influence student engagement, such as institutional norms which restrict the teacher from designing novel assessments and teaching aids, student-teacher interactions, teacher-tool interactions, student-tool interactions, and the broader educational culture of the region that shapes attitudes towards learning.

3. Theoretical framework

This study seeks to understand the student and teacher interactions with Moodle resources, using Activity Theory which, with its basis in dialectical materialism, aligns with the goal of examining complex, socially embedded activities in an educational setting. Grounded in Engeström's third generation AT, the study focuses on the notion of contradictions (Engeström, 2001). AT is used in two ways: in abstracting and explanatory roles in this study (Bligh & Flood, 2017), it abstracts details from the learning environment by using the elements of the activity system model (subject, object, tools, community, rules, and division of labour) and conceptualises them to systematically examine and identify the contradictions within the system. It has been used in similar studies by Anastasakis et al. (2022); Jaworski et al. (2012); Gedera and Williams (2013) and seems to be a befitting choice as a theoretical framework, in this context.

AT is built on Vygotsky's mediated triangle (Figure 1), which explains that individuals make meaning of the world through interactions with artefacts in a practical environment.

Figure 1. Vygotsky's mediated triangle

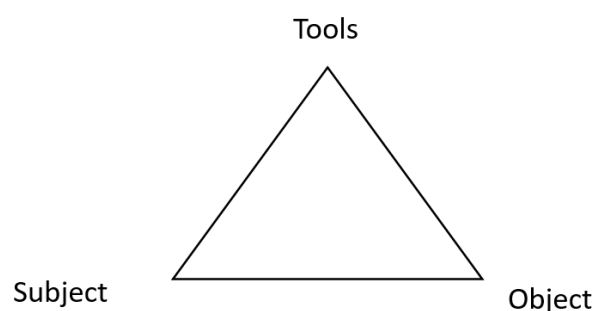
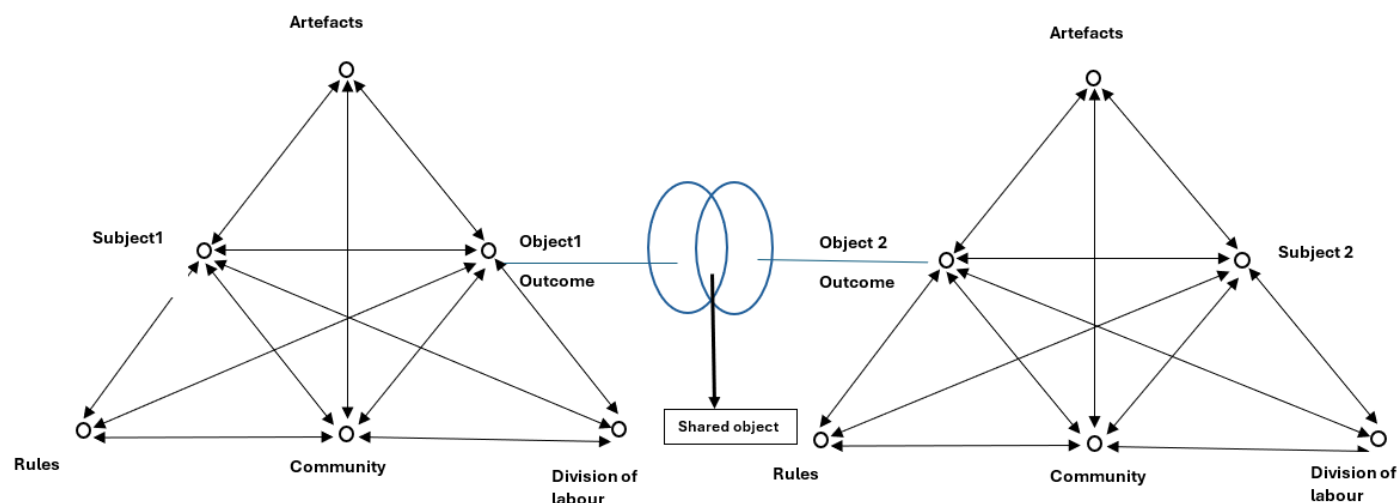


Figure 2. Activity systems represented with third generation Activity Theory, adapted from Engeström (2001)

“Activity”, the foundational concept of AT, is the relationship between the subject (an actor) and the object (an entity objectively existing in the world) (Kaptelinin & Nardi, 2012). It is important to distinctly recognize “activity” meaning collective, sustained human effort from “action”, meaning individuals’ or sub-groups’ time-bounded pursuit of goals (Bligh & Flood, 2017). Thus, an activity is made up of components that come together to form activity systems, which are useful units for comprehending human behaviour. Sociocultural environments such as an educational setting contain activity systems. Therefore, a more comprehensive approach to studying learning processes is provided by considering the socio-cultural context rather than focusing only on the individual level.

Engeström’s expanded AT offers a framework for understanding the dynamic and collective nature of activities in interconnected systems, as seen in Figure 2.

Each activity system consists of seven components viz: subjects (individual or sub-groups acting with social-historical experience), tools (the means by which the subject performs the activity), object (the aim of the activity), community (the social group involved while performing the activity), rules (norms both identified and unidentified), division of labour (roles in the community) and outcome (desired result of the activity) (Bligh & Flood, 2015; Gedera, 2015).

3.1 Contradictions

Contradictions are structural tensions that accumulate over time (historically) and assist in identifying the conflicts that emerge in activity systems (Gedera, 2015). However, these contradictions could also be seen as opportunities for growth or progress. Engeström (2015) proposes four levels of contradictions that may exist within and between the elements of an activity system: primary, secondary, tertiary, and quaternary (see e.g. Gedera & Williams, 2013; Bligh & Flood, 2015).

- Primary contradictions occur within activity systems.
- Secondary between elements.
- Tertiary when participants use advanced methods.
- Quaternary between central and outside activity systems.

3.2 Discursive manifestations of contradictions

Most importantly, contradictions cannot be observed directly and can only be identified through their manifestations (Engeström & Sannino, 2011). In this study, linguistic cues in interview dialogues are used to identify the contradictions present in the activity system. Although the framework is usually used to analyse real-time data like recordings of people working, this study extends its application to interview and questionnaire data and experiences of the focus group, recognising that it can still uncover important systemic contradictions and insights.

The four types of linguistic cues identified by Engeström and Sannino (2011) to express discursive manifestations of contradictions are:

- **Dilemma.** A dilemma is an expression of incompatible evaluations, commonly expressed as “on the one hand On the other hand, “or “but”.
- **Conflict.** People are in conflict when actions / speech of a person interferes with another and making it less effective, identified by “No” / I disagree.
- **Critical conflicts.** Situations in which people face inner doubts and feel resolutions cannot be made by the subject alone.
- **Double binds.** Processes in which actors repeatedly face pressing and equally unacceptable alternatives in their activity systems.

Third generation AT underlines how networks of activity systems interact to achieve specific common objectives, focusing on the interplay and contradictions among them. This framework will guide the research design by identifying key elements to observe and, during data analysis, will help uncover contradictions that affect student engagement. In the discussion phase, these contradictions, as sources of change, will facilitate the reconfiguration of the activity systems.

4. Research design

4.1 Research site

The research site is an engineering college offering undergraduate degrees in electrical engineering, electronics and communication engineering and computer engineering. The interactions of teachers and students with Moodle resources were examined in an introductory blended learning course, EC101- taught during the first year of the curriculum with a large number of students registering semi-annually, which is delivered 50% face-to-face and 50% online, by subject experts who are experienced teachers. The instructional materials used in the course are PowerPoint lectures and lab manuals, besides the online quizzes and assignments.

4.2 Study population and sampling procedure

The study population involves people who have direct experience with the course, students of the course (current and past), and faculty members teaching the course. While students cite learner’s experience and potential barriers to engagement, faculty members provide insights into pedagogical approaches and resource selection, and

teaching assistants bridge the gap, offering perspectives on student challenges and engagement levels within the course design. Focus group interviews were conducted to gather the experiences of 7 teachers teaching EC101. Additionally, purposive sampling was used to select 9 students, ensuring a mix of low, average, and high achievers, to better align the sample to obtain a wider outlook.

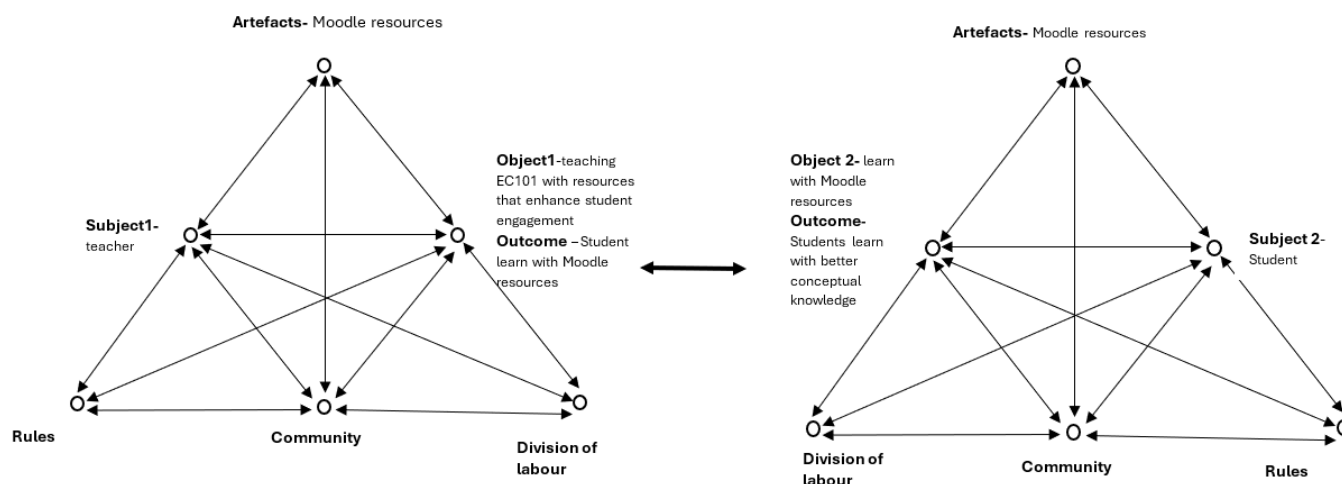
4.3 Data collection and data management

The semi-structured interviews with the teachers which lasted for an average of 35-40 minutes were recorded with their consent, via zoom and later transcribed using Otter.ai, and manually corrected for clarity. These interviews focused on identifying the elements of the activity system (subject, object, tools, community, rules, and division of labour) and the contradictions within these elements as they pertain to teaching EC101 course, guided by AT, which posits that understanding these elements and their interactions is crucial for identifying systemic issues and areas for improvement. Open-ended questionnaires were distributed to students. Nine responses received served to capture how students interacted with and perceived Moodle resources, the subjective meanings they attach to their learning experiences, and the interactions within the learning environment.

Before commencing data collection, ethical clearance was secured from the ethics committee at Lancaster University. In line with the ethical protocols, participants were informed about the objective of this empirical study and the author’s commitment to safeguard their anonymity. The participation consent forms were duly signed and collected.

4.4 Data analysis

The sixteen responses were subjected to a thorough search for linguistic cues that express manifestations of contradictions using the “find” function in Microsoft Word (Engeström & Sannino, 2011). Following these cues, actual manifestations were identified and analysed. The discursive findings were used to identify contradictions in two activity systems, representing student and teacher interactions with Moodle resources. Being an insider with specific insights into the research site, deductive thematic analysis was employed, allowing for a more targeted and informed exploration of the data. The results of this research are presented in the following section, strengthened by excerpts from the conversations with the participants. To maintain anonymity, pseudonyms are used: T1 through T7 for the seven teachers and S1 through S9 for the nine students. These excerpts are numbered to make it easy to refer to them in the subsequent sections of the article.

Figure 3. The two interacting systems in the teaching-learning of EC101

5. Findings

In this section, an illustration of the existing activity systems is presented and then the apparent contradictions therein are uncovered. An analysis of the linguistic cues used to identify the contradictions and the relation of these contradictions with few relevant factors are briefed upon later, which explains the reasons for low student engagement with Moodle in EC101.

5.1 Interacting activity systems

The two interacting activity systems seen operating concurrently in this case are depicted in Figure 3, which are the teachers' interactions towards effective delivery of the EC101 course (System 1) and student interactions towards learning EC101 with Moodle resources (System 2).

The seven elements of each system are described in Table 1.

The framework underscores the contrasts, tensions, or contradictions between the perceptions of the two groups and their differing objects.

5.2 Analysis of the linguistic cues used to uncover contradictions

Table 2 illustrates the types of manifestations of the contradictions identified in this study and the linguistic cues in the participant responses, used to identify them.

It has to be noted that situations of double binds were not observed, probably because of the lucid environment where individuals feel contradictions can be resolved.

Table 3 illustrates the frequency of occurrences of the manifestations throughout the interview transcripts. Only the linguistic cues directly indicating these manifestations were considered for the analysis, revealing that dilemmas and conflicts are the most prevalent, while critical conflicts are the least. Although 38 such manifestations were uncovered, excerpts relevant to the context are only included in this section.

Some examples of the manifestations are given below:

Dilemma:

1-T1. It is good to have the information as to how many clicks and downloads related to the resources, so that we can know about student engagement, but I do not think it is available.

2-T2. Yes, we can give them more online quizzes before they take the final exam, but I don't know if it will fit in the 14 weeks duration of the course.

Conflict:

3-S6. Sometimes, the naming conventions of the lecture files and "practice questions" files were not consistent, making it harder for me to find the resource I was looking for.

Critical Conflict:

4-S6. I prefer well explained PowerPoints, videos were too slow or too fast for my liking.

Table 1. Key elements of the two interacting activity systems

Element	System 1	System 2
Subject	Teacher while delivering the course	Student enrolled in EC101
Artefacts	Mediating Artefacts – PowerPoints in Moodle, Simulation software, Interactive Quizzes, Assessment tools, Annotated lecture notes, Tutorials	Mediating Artefacts – PowerPoints in Moodle, Simulation software, Interactive Quizzes, Assessment tools, Annotated lecture notes, Tutorials
Object	design and deliver EC101 course with student centred Moodle resources	to participate in learning with Moodle resources towards successful completion of the course
Rules	Rules – Institutional Policies, interaction protocols, assessment criteria and regulations	Rules – University programme, Institutional Policies, Course attendance requirement, interaction protocols, assessment criteria
Community	Community –Students, Instructors who share the course, Teaching Assistants, Academic Head, Student affairs and IT Staff	Community –Peer group, Teaching Assistants, Student affairs, Academic Head and IT Staff
Division of Labour	Instructors in design and deliver the course, providing feedback to students, monitoring student engagement, TA s in assisting in grading, conduct labs and tutorials, Students – responsibly interacting, IT Staff supporting technical aspects	Instructors in design and deliver the course, TA s in assisting in grading, conduct labs and tutorials, Students – responsibly interacting and learning, IT Staff supporting technical aspects
Objective	Students learn with Moodle resources	Enhanced learning experience, better understanding of concepts and perform better in exams

Table 2. Manifestations of contradictions and their linguistic cues

Manifestation	Linguistic cues
Dilemma	“But”, “However”, “I think maybe”, “I believe but I am not aware”, others expressing incompatible evaluations
Conflict	“No”, “I don’t think”, “that’s why”, “therefore”, “making it harder”, one’s action affecting another
Critical conflict	Some utterances which imply “presence of inner doubt” or feeling violated

Table 3. Frequency analysis of the manifestations

Dilemma		Conflict		Critical conflict	
Cues	Frequency	Cues	Frequency	Cues	Frequency
But	10	X, so NOT Y	7	Feeling violated	2
However,	1	I don’t think	1	Inner doubt	2
I think maybe	3	I disagree	3		
I believe, but not aware	2	That’s why	1		
others	3	Therefore	2		
		Making it harder	1		
Total	19		15		4

5.3 Contradictions and alignment within identified factors

AT used in the study revealed the interplay and dynamics between and within:

- The objectives and strategies of teaching EC101, as illustrated by Figure 4 (System 1), alongside teacher interactions with Moodle resources.
- Learning EC101, as illustrated by Figure 5 (System 2), alongside students' involvement and responses to the Moodle resources.

Contradictions observed in the system are presented under the following headings below viz: presentation of material, underutilisation of educational tools and differences in pedagogical strategies, assessment tools, and student scaffolding and communication protocols.

5.3.1 Presentation of materials

The instructional resources of the course, delivered by multiple instructors simultaneously, consisted of lecture slides in PowerPoints (made available well in advance of the lecture), links for lab report submissions, homework assignments, and annotated lecture notes uploaded by the instructors post session, all on a single Moodle page. Students commented on the difficulties they had in browsing through and picking the appropriate file for their study, whereas teachers expressed their concern on the overwhelming number of links created by all instructors in one page. Some excerpts are as follows :

5-S1. I found content organization and navigation sometimes difficult within large modules due to so many links.

6-T1. All the material is on one page, but it's difficult to find a particular material quickly and am confused where to post the link for homework submission.

These secondary contradictions manifested as dilemmas (confronting incompatible evaluations, manifested in "but"), as in excerpt 6, and conflicts (student cannot find the right material due to disorganisation of materials in Moodle), as in excerpt 5. This poor organization of instructional materials, leads to increased cognitive load and frustration, making it difficult for students to locate and effectively use resources.

5.3.2 Underutilisation of educational tools and differences in pedagogical approaches

Each instructor had a different style of presenting course materials, leading to multiple versions of the same content being uploaded. The teachers' personal preferences and practices clash with the institutional demand for uniformity, limiting the effectiveness of resource utilization.

7-T1. In my opinion, PowerPoint is good, but solving questions by hand is more important, so I solve and upload the annotated notes. It is not easy to write complex equations in PowerPoint.

8-T4. There are many faculty taking the course, and we are expected to deliver a unified material, but we have different ways of presenting it.

These contradictions manifest as dilemma between the "rules" (expectation of delivering unified material) and the "division of labour" (different faculty members with varying presentation styles), which implies rigid rules could limit the effective use of tools.

A contradiction between the tool used and the community's (students') preference is indicated in the following excerpt :-

9-T3. I prefer to use the textbook but I know the students they are not using the textbook, which is like, not good for them.

Instructors expressed concern over the lack of training about Moodle's features, which limited their ability to utilize the platform for effective learning, which can be seen as a conflict between the subject (teacher) and the division of labour (Institutional support)

10-T2. We are not aware of many features in Moodle which could help students learn better, I guess having an overview like at least once in a year is good.

In a comment from instructor T7, a conflict between the instructional strategy (students solving along with the instructor using a soft copy) and students' compliance with this strategy is identified.

11-T7. In my understanding, we ask the students to have a soft copy in class and solve along with the instructor, only a few comply each semester, and they find it extremely beneficial and achieve high success.

Figure 4. System 1—Teacher interactions with Moodle resources

Artefacts- PowerPoints, simulation software, Interactive quizzes, assessment tools, annotated lecture notes, tutorials

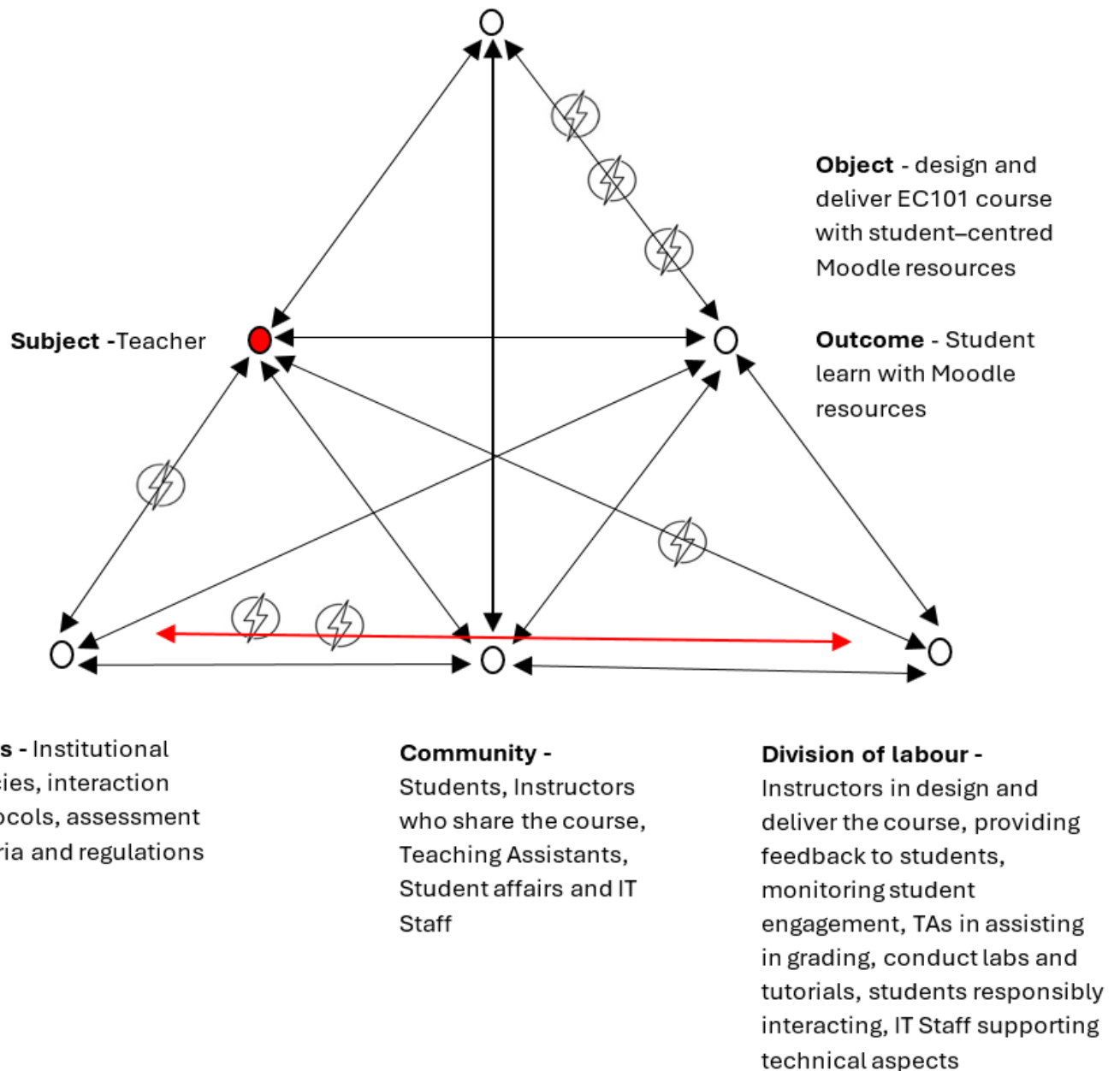
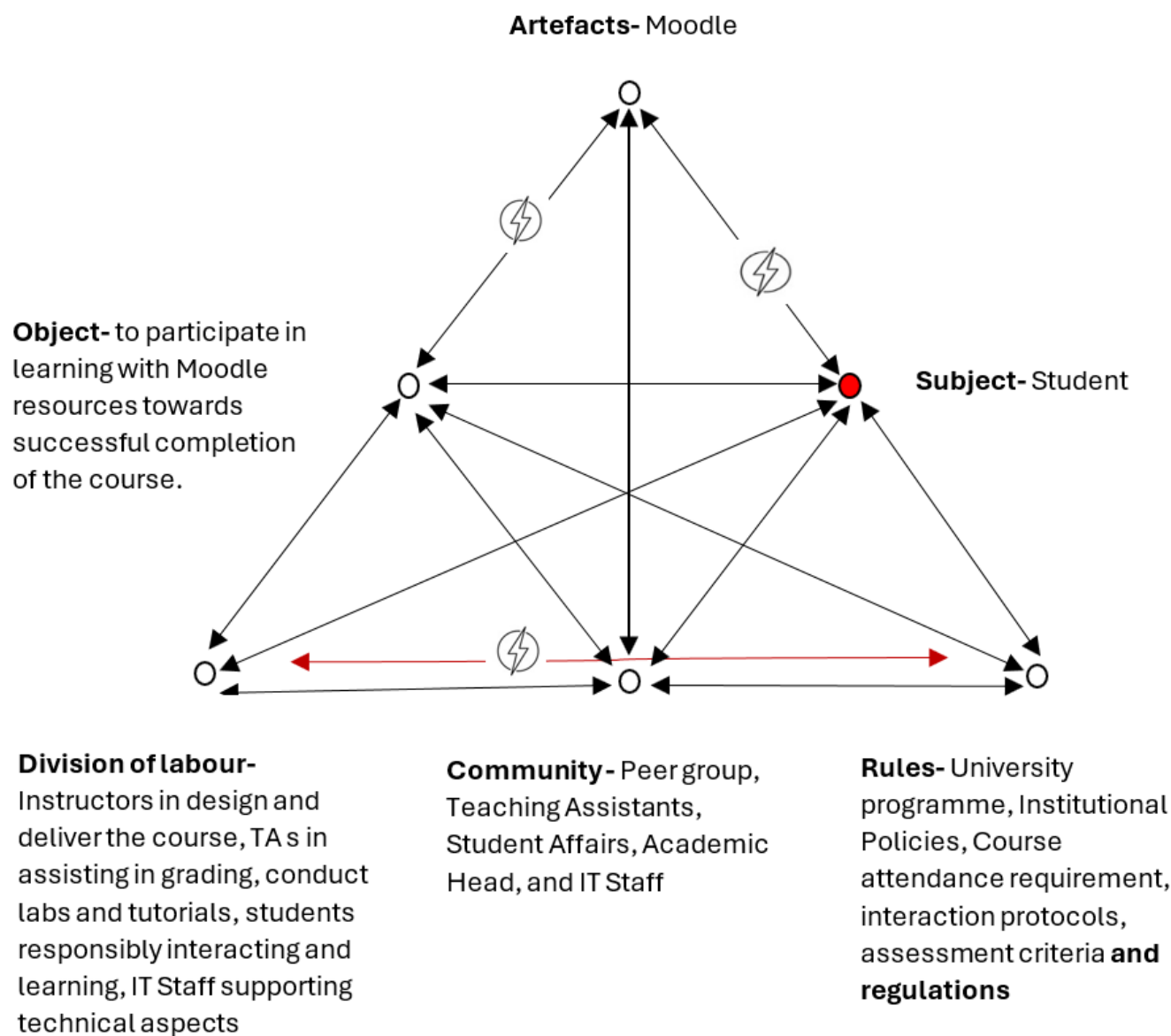


Figure 5. System 2—Student interactions with Moodle resources



Tensions manifest as conflicts in the student activity system where the lack of diverse and interactive materials on Moodle creates stress, leading to students' inadequate preparation for exams. Students expressed frustration in finding only key steps and commented that it was stressful and hard to rely on slides for the complete solution.

12-S9. There are not many examples for us to practise, so I find it difficult to solve in exams, I like to have videos because the PowerPoints don't have all the steps to get the final answer.

13-S6. The stressful aspect was how unclear certain examples are, i.e. when the steps are written without being properly explained, which made it hard for me to rely on some of the slides' calculations, they were not always clear on WHY certain steps were used.

Students were concerned that no interactive learning materials were provided which would have been helpful to self-assess their knowledge and take remedial measures to improve, before the summative exams.

14-S6. When I took the course, there were very few quizzes on Moodle to evaluate my mastery of the content, I did not get an idea of how well I was doing in the subject.

These contradictions exist between the “tools” (limited examples and incomplete steps in PowerPoints) and the “object” (students’ ability to solve exam questions effectively and attain success in the exams). It is critical to standardize teaching methods while allowing a certain level of flexibility and ensure the availability of diverse and interactive learning materials to enhance student engagement.

5.3.3 Assessments

The lab reports and assignments submitted online in PDF format, were corrected using the features available on Moodle by the teaching assistants who assisted in course delivery. They highlighted certain critical conflicts with Moodle’s features, which hinder detailed feedback on errors in intermediate steps, impeding student improvement.

15-T5. The platform includes built-in functions for marking, such as tick marks. However, it is challenging to add detailed comments directly on the document itself. For instance, if I am reviewing a 10-page report, I only have the option of using a single comment box for the entire report where I can type my feedback. This setup does not allow me to pinpoint specific issues or refer students to exact locations within the document or maybe I am not aware.

This contradiction exists between the “tools” (limited functionality for detailed feedback in the platform) and the “object” (providing precise feedback to students, making learning effective).

Instructors also expressed discomfort on the rigidity of the institutional norms for assessments which prevent them from using online quizzes and offering small rewards like badges which is a secondary contradiction that exists between the division of labour of the teacher(encouraging student engagement) and rules(institution’s grading policies).

16-T1. We can give them short interactive videos, but I know the students will not see it, so the only way to encourage them is to give some bonus marks, where can we include them in the grading rubrics, we need to see that.

5.3.4 Student scaffolding and communication

One of the lauded benefits of LMS is student scaffolding, which guides the learners through the learning process. The excerpts on student scaffolding and communication protocols in Moodle, in this study, highlights the necessity for improved monitoring and support mechanisms within the platform to enhance learning outcomes. Instructors expressed their strong desire to adopt strategies to improve guided student learning which they agree are critical for ensuring effective student engagement and commented that this data is not accessible to them. This indicates contradiction between the tool (Moodle) and the object (monitoring student engagement), manifesting as conflicts.

17-T2. It would be better if we were able to know and measure student engagement from Moodle, it will give the instructor an extra insight on the performance of the student, whether they are learning, I do not know if Moodle has this option.

18-T4. It will be helpful to know which students are engaging or interacting with our material, which material is mostly accessed? Are students convinced with this material or trying to find other sources if they ignore this material? But I am not aware if this is available for us? I do not think so.

19-T6. There is no data available such as clicks or downloads on the resources, so how do we know about the student engagement. The only thing I can see is when is the last time the student logged out of Moodle

Students commented that discussion forums are not active and hence they can only use the email system to reach out to their instructors, which sometimes caused a delay, indicating a conflict between the tool and the object of interacting with peers and tutors. Some of the excerpts are as below:

20-S6. I have never used Moodle to communicate with peers nor with the instructors as it does not feel like a communication platform where I would post my questions and expect others to answer.

21-S5. On Moodle, people rarely check the chats/discussions, I do not think I will get help to clear my doubts.

Meanwhile, the comment by student S9 indicates that some students may not be comfortable to participate in discussion forums which is a contradiction between the “tools” (Moodle for discussions) and the “division of labour” (effectively interact with peers and teachers)

22-S9. I don't feel comfortable having discussions over Moodle. It would be better to have online office hours instead.

Figure 6 depicts a summary diagram of the contradictions within the two systems, with lightning symbols indicating the contradictions. Although primary contradictions existed in the participants choices as in instructional strategies of the teachers and learning preferences of the students, secondary contradictions were more prominently observed.

6. Discussion

The study historically situated the low student engagement issue in EC101 from the teacher interactions and student interactions with Moodle resources using AT. It can be seen that the participants were involved in multiple objects towards attaining the final outcome. In System 1, in order to keep students interested, professors created course materials, graded the online assignments and lab reports, and provided feedback to the students. However, limited familiarity with Moodle features and limited access to Moodle logs hinder the teacher's objectives to effectively deliver the course and provide guided learning for students. In System 2, students faced challenges in using Moodle resources for problem-solving and did not interact with peers or teachers on Moodle discussion forums, either by personal choice or for other reasons. The participants indulged in multiple objects during the interactions, the shared object between the two activity systems being enhanced student engagement with Moodle resources. The disparate objects were specific to the roles and goals within each system: for teachers, it is centred around course delivery, monitoring student engagement and providing feedback, while for students, it's focused on learning, problem-solving, and exam preparation.

6.1 Impact of socio-cultural contradictions on student engagement

Analysing the socio-cultural contradictions within and between the elements of the activity systems reveal few primary issues that hamper student engagement in the context of the disparate objects, which is presented in Table 4. Their implications and proposed resolutions are also detailed.

As indicated in Krichevsky(2023), if contradictions are not recognized, then the transformative power in them will go unused. Understanding the conflicts between these disparate objects and tailoring interventions towards engaging in the shared object of effectively using Moodle, results in a more cohesive and effective improvement in practice, which could be done by implementing the resolutions presented in Table 4.

As indicated in the literature review, qualitative research tends to separate attributes rather than taking into consideration the interdependencies within the learning environment, whereas quantitative analysis does not account for emotional and social engagement challenges that students may encounter. Using the systemic view provided by AT, this study highlights the interdependency of shared and disparate objects in the interacting activity systems to identify crucial touchpoints needing intervention. In fact, it bridges the gap between theory and practice and enables the design of strategies that address both academic and engagement challenges, ultimately leading to a more integrated and effective educational experience.

This paper contributes to research by drawing the attention of researchers to the importance of understanding the socio-cultural contradictions that exist in the current system in order to reconfigure and catalyse progressive change. Results reveal that although the two systems share a common objective, i.e., effective use of Moodle, low student engagement is primarily due to issues within the disparate objectives of the two systems. Disorganized Moodle pages and lack of interactive study materials hinder engagement, while limited familiarity with Moodle features restricts instructors from creating engaging course materials. The various touchpoints mentioned in this article shall be used as pointers while designing a learning management system in order to address these issues.

7. Conclusion

Despite the potential of LMS like Moodle to facilitate interactive and hands-on learning in engineering education, they are often underutilised and viewed as mere resource repositories. The primary motivation behind this research was to investigate the low engagement with Moodle resources in an introductory electronics engineering course (EC101) at an engineering college in the Middle east region. By examining this issue as a collective human activity, the study aims to understand why students struggle with problem-solving and perform poorly in exams, thereby seeking to provide an improved pedagogical platform for the course. Drawing on

Figure 6. A summary diagram of the contradictions within and between the two systems

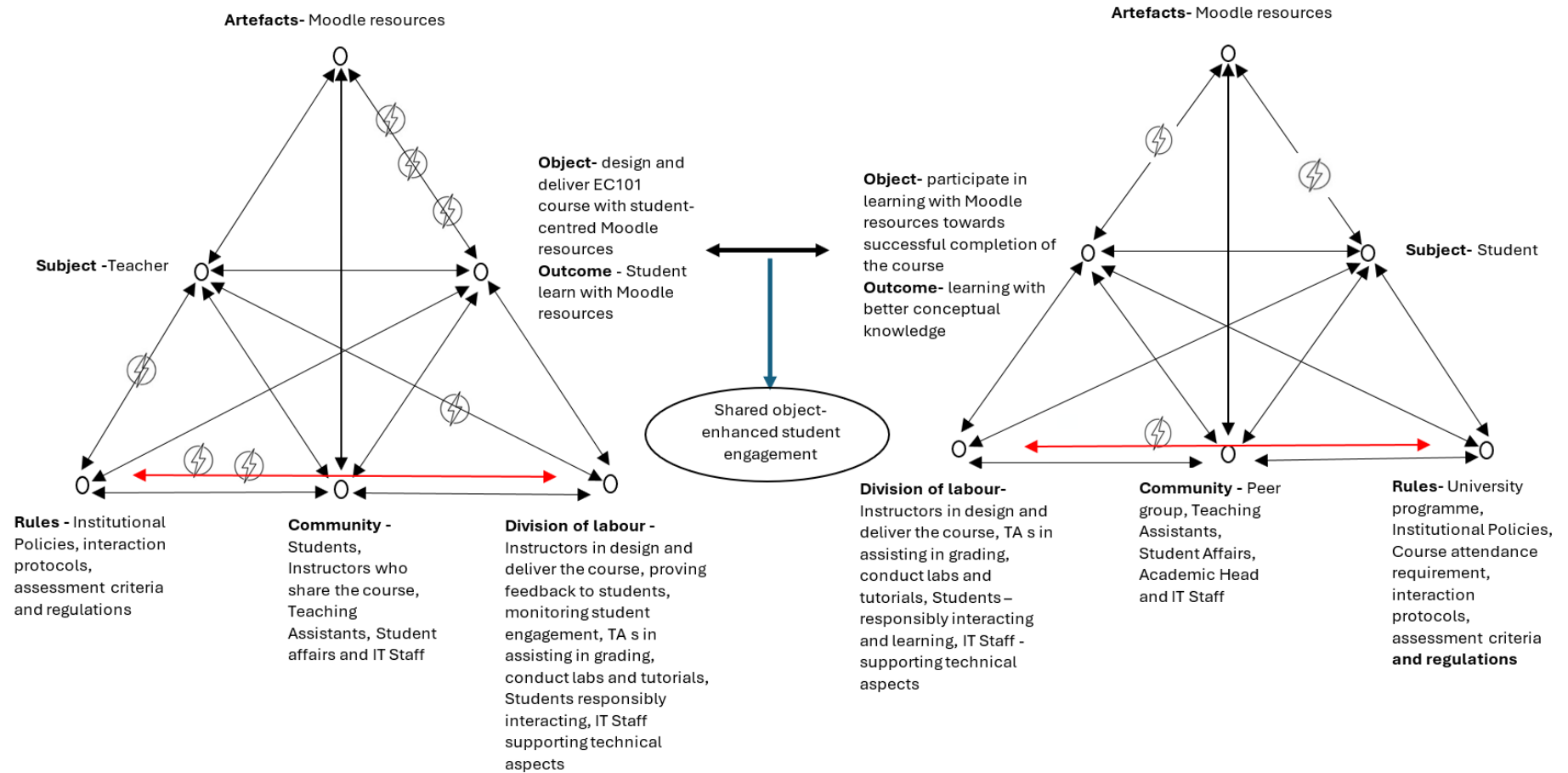


Table 4. key issues observed in the teaching -learning process of EC101 with Moodle resources

	Key findings	Implications
Issues highlighted in System 1—Teacher interactions with Moodle resources	Teachers are eager to create diverse resources but need training.	There needs to be an initiation from the institution to promote faculty development programs like providing training on the enhanced features of the LMS will enable teachers to create and utilize diverse resources more effectively
	Teachers need access to LMS log data for timely intervention.	Access to log data is crucial for teachers to monitor student engagement and performance. This information can help teachers provide timely support and interventions, ultimately enhancing student learning, as observed by (Gong et al., 2018), in their study.
	Coordination of course materials on Moodle is highly recommended	Organizing course materials in a clear and consistent manner on Moodle can improve accessibility and usability for both students and teachers, leading to a more efficient and effective learning environment.
Issues highlighted in System 2—Student interactions with Moodle resources	Mismatch between materials and preferred media (videos, PowerPoints, textbooks) contributes to disinterest in Moodle resources	There is a need to diversify the types of learning materials offered to students. Ensuring a variety of resources can help meet different learning preferences and enhance overall satisfaction and engagement (Krasnova & Vanushin, 2016).
	Low motivation for in-class problem-solving activities is observed.	Strategies need to be implemented to encourage hands-on engagement in class, by awarding badges on completion of the task. Emphasizing the value and benefits of these activities can help improve student participation and learning outcomes.
	Students expressed a desire for interactive videos with self-assessment elements.	Integrating interactive videos with self-assessment elements can help students gauge their understanding and adjust their learning strategies accordingly, promoting deeper learning and engagement, as illustrated by (Swart, 2016). Self-reflective exercises facilitate guided learning.

Engestrom's third generation AT, two interacting activity systems depicting teacher interactions and student interactions with the Moodle resources are analysed in this study.

Using linguistic cues to identify contradictions that manifested throughout the discourse of the participants in the semi-structured interviews and questionnaires enabled the identification of contradictions in an unbiased manner, which is crucial to me as an insider researcher. This study demonstrates how contradictions can be effectively identified using linguistic cues and effectively explores the underlying reasons for low engagement and addresses them.

The key findings highlight the need for faculty development programs and access to LMS log data, enabling teachers to create diverse resources, monitor student

engagement, and provide timely interventions. Linking in-class problem-solving activities to Moodle through strategies like awarding badges for task completion can enhance both hands-on engagement and Moodle resource utilisation, thus improving educational outcomes.

A limitation of this research is its context-specific nature, which restricts the generalizability of the results. To explore further in this regard, the study may be expanded to include participants from similar universities and to conduct focus groups across these institutions, aiming to broaden the scope and enhance the applicability of the results.

To further expand this study, future research should implement the recommended changes based on identified contradictions and navigate a change laboratory (Bligh &

Flood, 2015) involving an iterative cycle of initiating and resolving these contradictions. This will involve longitudinal data collection with continuous monitoring and analysis of interactions, feedback, and engagement patterns over multiple semesters, which will inform strategies to enhance the utilization of LMS tools.

In conclusion, this study has highlighted the critical role that macro- and meso-level policy-practice tensions and stakeholder dynamics play in shaping technology-mediated educational practices. By revealing the contradictions and challenges encountered in a blended learning environment, this research contributes valuable insights into the ongoing discourse on the effective integration of technology in education, emphasizing the need for alignment between policy frameworks and practical implementation.

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