Using game design elements in Moodle to enhance student engagement at a Mozambican University

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Abstract

The modern educational technologies have brought significant positive changes but are also posing challenges for teachers and students within universities. The introduction of technologies such as Learning Management Systems (LMSs) and the entrance of digital natives into universities are contributing to the rapid integration of innovative educational practices, such as online learning. Online learning has gained traction in the new social reality, essentially after the peak of the COVID-19 pandemic, which forced universities to adopt new means to deliver education during global isolation. However, despite its increasing popularity, to engage students in online learning remains one of the challenges faced by today's university teachers. Various teachers adopt online learning, whether compulsory or voluntary, without adequate preparation and indicative guidelines to support in designing online learning. This often leads to low student online engagement and suboptimal learning outcomes.

The aim of this study is to propose ways of using game design elements in Moodle to enhance student engagement and learning outcomes in higher education. Moodle is currently the most widely used open-source LMS for delivering online courses in numerous countries, including Mozambique. When Moodle is well implemented, it can effectively support the education process and lead to enhanced student learning outcomes. This platform allows teachers to incorporate elements, such as game mechanics and other attractive components, to promote student engagement. The integration of game mechanics into a non-game environment, referred to as gamification, is gaining popularity in the education sector.

This study applies a Mixed Methods Case Study Research (MMCSR) approach to explore how to integrate gamification in the Moodle platform for supporting in enhancing student engagement and learning results. It begins with a contextual analysis and literature review for an in-depth understanding of the problem and designing the intervention at Eduardo Mondlane University (UEM), in Mozambique. The intervention consists of design principles informed by the Laurillard's Conversational Framework for applying gamification in the Moodle platform to motivate student engagement. Overall, three teachers and 112 students from UEM participated in the intervention conducted in this study. The study utilizes qualitative and quantitative data

collection and analysis methods. The primary data sources were transcriptions of teacher interviews and a file containing responses of the students to the questionnaires. The open-ended questions responses data were coded based on the inductive approach. The QualCoder software is utilized in this study for helping in qualitative data analysis, while the SPSS program is applied in generating the graphical representation of the quantitative data.

The findings suggest that the application of gamification elements increases student engagement and enhances learning outcomes. The gamification within the Moodle platform creates an enjoyable and meaningful online learning environment and motivate interactions in three of the five communication cycles in Conversational Framework. The gamification elements, such as points, levels, leaderboards, and immediate feedback stimulate students to engage in learning activities and are particularly support in facilitating the teacher communication cycle (TCC), teacher practice cycle (TPC), and teacher modelling practice (TMC), leading to enhanced learning outcomes. The study also shows that integrating gamification elements increase teachers and students' satisfaction towards the use of the Moodle platform, as well as their intention to continue using it.

Keywords: Gamification, Higher Education, Moodle, Online Learning, Student Engagement.

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List of Abbreviations

AEP - Audience Engagement Platform

CF - Conversational Framework

CHAT - Cultural-Historical Activity Theory

COVID - Coronavirus Disease

ICT - Information and Communication Technologies

LMS - Learning Management System

MMCSR - Mixed Methods Case Study Research

MOODLE - Modular Object-Oriented Dynamic Learning Environment

PCC - Peer Communication Cycle

PMC - Peer Modeling Cycle

SCORM - Sharable Content Object Reference Model

SPSS - Statistical Package for the Social Sciences

TCC - Teacher Communication Cycle

TLA - Teaching and Learning Activities

TMC - Teacher Modeling Cycle

TPC - Teacher Practice Cycle

TWTD - Teaching with Technology Day

UCT - University of Cape Town

UEM - Eduardo Mondlane University

UNESCO -United Nations Educational, Scientific and Cultural Organization

Chapter 1: Introduction

The latest events and the waves of technological progress have been impacting our lives in different ways. During the peak period of the COVID-19 pandemic, several educational institutions adopted different Learning Management Systems (LMSs) to deliver online courses for supporting both on-campus and online education (Alexander et al., 2021). However, online teaching and learning is a complex process, and since then, its effects in student engagement and learning outcomes have been the centre of some discussions in the field of education (Poondej & Lerdpornkulrat, 2019; Farrell & Brunton, 2020; Alexander et al., 2021). The low student engagement in online environment has negative impact in student performance and academic results (Garas-York, 2020), and improving it became not an easy task for educational institutions (Dubey et al., 2023).

Undoubtedly, modern educational technologies have brought significant changes in higher education, including the improvement of student engagement. The use of the Moodle platform LMS is capturing greater attention in universities globally (Zharova et al., 2020; Alomari, 2024), including in Mozambique. There are various benefits of using the Moodle platform LMS, which can be summarized to facilitate the work of teachers and to improve the quality of education (Alomari, 2024). Using Moodle platform adequately, educational institutions can create motivating online learning setting to engage students and to promote meaningful learning experiences, whether in distance or blended learning. Beyond the adoption of Moodle, a variety of studies apply the integration of game design elements into education as a new strategy to promote student engagement and enhance academic outcomes by making learning enjoyable, fun, and engaging (Khan, Egbue, et al., 2017; Poondej & Lerdpornkulrat, 2019; Rahman et al., 2019). This practice, referred to as gamification (Barna & Fodor, 2019), is gaining popularity in the field of education and has become a key feature in many LMSs (Poondej & Lerdpornkulrat, 2019).

However, despite the growing popularity of Moodle adoption and gamification as strategies to enhance student engagement in universities, questions about their effectiveness in teaching and learning persist. The success of an LMS depends on how eager students are to use and interact with it (Dubey et al., 2023), yet there are few studies offering in-depth perspectives on online student engagement in higher education settings (Farrell & Brunton, 2020). There is a mix of

controversial results related to the effects of gamification in education (Smiderle et al., 2020) and few studies on its application in Mozambican educational settings (Turpin, 2019; UNESCO, 2019). Moreover, it was found that certain teachers interested in integrating gamification into their courses implement it without any support, relying on their own ideas and experiences (Svanberg & Bergh, 2023).

Thus, the main aim of this study is to propose ways to use gamification elements in Moodle as a new strategy for creating online learning activities that help teachers promote student engagement and enhance the quality of online and blended learning in the Mozambican context.

1.1. Problem Statement

The Eduardo Mondlane University, known by its Portuguese name and abbreviation Universidade Eduardo Mondlane (UEM), is a public higher education institution in Mozambique, which is making greater investments in technology to support teaching and learning. There are investments in information technology infrastructure, including systems to support academic management and teaching and learning process, as well as in teacher training programmes to promote the use of educational technology within the university.

The UEM has been using Moodle to support both fully online and blended learning programmes. During the peak period of the COVID-19 pandemic, teachers were forced to shift from completely face-to-face teaching in the classroom to online learning using Moodle platform.

Studies showing that the integration of technology in education poses positive effects in student learning (Poondej & Lerdpornkulrat, 2019; Rahman et al., 2019; Smiderle et al., 2020). However, despite UEM's efforts, the implementation of Moodle is not yielding the expected results at institution. A significant number of teachers remain hesitant to use the Moodle platform as a tool for supporting teaching and learning activities.

Zharova et al. (2020) found that the most resistance to using Moodle stemmed from users who were not prepared to do it. Indeed, teaching online entails more than just duplicating the classroom teaching experiences (Alexander et al., 2021). Teaching online requires the adoption of new

practices, prompting teachers to reflect on the way they carry out content delivery, student engagement and assessment.

On the other hand, anecdotal evidence shows that the use of traditional face-to-face teaching methods in online environment is demotivating online student engagement at UEM. Many teachers attempt to replicate the face-to-face experience in the online environment by using video conferencing with BigBlueButton within the Moodle platform. Most of the students are not satisfied in using the UEM Moodle platform, and they feel like they are not making progress as it was intended, leading them to have preference for attending traditional classroom classes. There are also a considerable number of teachers reporting problems related to student engagement and academic success in online learning. In addition to this, Zharova et al. (2020) found that students have reported the Moodle platform should be more user-friendly and convenient, presenting an interface design that is more minimalistic and intuitive.

Therefore, it is required to have a new practice in designing online learning to motivate student engagement and enhance interactions in the Moodle platform. To achieve this goal, the use of gamification elements in education contexts is currently gaining increasing attention globally (Viamonte & Figueiredo, 2019; Paľová* & Vejačka, 2022; Adam & van den Berg, 2022).

However, there are few studies addressing the effectiveness of gamification in Mozambican educational settings (Turpin, 2019; UNESCO, 2019), with none providing perspectives on using game mechanics to enhance student engagement in higher education. Moreover, no studies were found applying gamification elements in Moodle within a higher education context in Mozambique, despite this platform being widely used in this country.

1.2. Research Questions

The main aim of this study is to propose ways of using game design elements in Moodle to enhance student engagement and learning outcomes in higher education.

The main research questions are:

i. What gamification elements in learning management systems are most effective for enhancing student engagement in higher education?
ii. How can teachers design and implement gamification in Moodle courses to enhance student engagement and support the achievement of learning outcomes in higher education?

1.3. Theoretical Framework

Gamification in higher education is a novel approach that has not been well explored yet. There are several studies using different approaches to apply game mechanics in education contexts (Viamonte & Figueiredo, 2019; Paľová* & Vejačka, 2022; Adam & van den Berg, 2022) as well as proposing methods to implement gamification into online learning environments (Toda et al., 2019; Benner et al., 2022). However, integrating game mechanics in education is a creative process (Toda et al., 2019), and most studies have not systematised all design decisions. Thus, there is a paucity of theories or practical guidelines available for effective application of gamification in higher education in a coherent manner (Dichev & Dicheva, 2017).

1.3.1. Conversational Framework for designing educational practice

The present study uses the Laurillard (2007) Conversational Framework to design a learning practice incorporating gamification elements in Moodle platform to motivate online student engagement. This framework is useful in proposing improvements to design the learning process (Laurillard, 2007) in any academic situation (Laurillard, 2002). It depicts the interaction and communication, as well as the technology that facilitates these dialogic processes that occurs between students and teacher (Laurillard, 2007).

Laurillard (2007) suggests that learning is a dialogic process between teacher and student which occurs on two levels, namely conceptual and practice. In the conceptual level the focus is on theory, concepts and description building, while in the practice level the focus is on practice, activity and procedure building (Laurillard, 2002).

The figure 1.1 shows the formal Conversational Framework that according to Laurillard (2007) represents the core five communicative cycles of an academic learning dialogue.

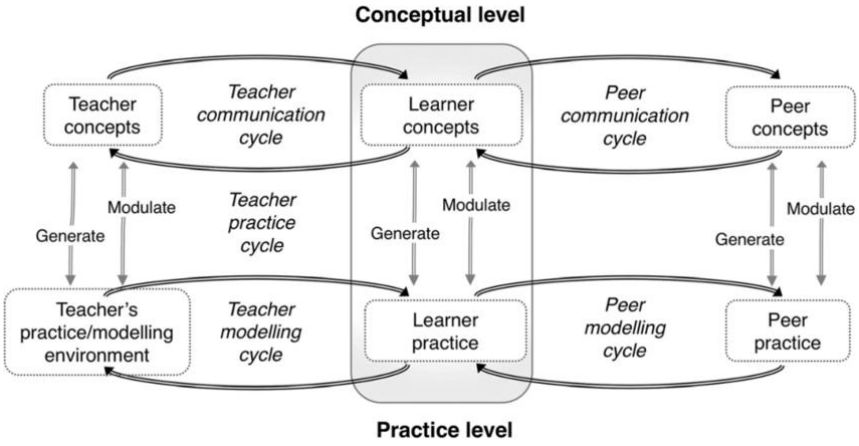


Figure 1.1: The Conversational Framework (Laurillard, 2002)

The Conversational Framework facilitates teachers in mediating teaching and learning from the student's perspective (Laurillard, 2002). The grey area represents the internal student knowledge development, what is referred to as the learner's internal learning cycle (Holmberg, 2017).

The teacher's communication cycle (TCC) is represented as a series of iterations between teacher and students at the conceptual level. It occurs when a teacher initiates the descriptions of the content topic and learners respond by describing and re-describing their perceptions based on the teacher feedback. When the individual student and peers discuss their ideas and concepts, Laurillard refers to this dialogue as the peer communication cycle (PCC) (Holmberg, 2017).

The teacher practice cycle (TPC) represents a series of the iterations at the level of the practice level, in which students receive feedback from teachers of their actions in the practice environment (Laurillard, 2002). It encourages students to adjust their practice by taking actions that result in feedback from teachers (Holmberg, 2017). Moreover, it also offers teachers insights into their

teaching methods and the effectiveness of student learning (Holmberg, 2017). When students receive feedback automatically provided by a technology-supported learning environment, the dialogue process is referred to as the teacher modelling cycle (TMC) (Holmberg, 2017).

Finally, the peer modelling cycle (PMC) refers to the dialogue between an individual student and peers in which they share the output of their practice. It motivates each student to engage in actions within the practice environment, as well as it enables them to adjust their practice in the light of their peer's output.

1.4. Research Design

This study applies a Mixed Methods Case Study Research (MMCSR) approach to explore how to integrate gamification in the Moodle platform to support in enhancing student engagement and learning results. This is a systematic and iterative effort to design and explore an innovative educational practice by using both quantitative and qualitative methods, aiming to provide a comprehensive analysis of the process of integrating gamification in Moodle and its impact on student learning. In this study, innovative educational practice is understood as the integration of modern technology into pedagogical methods to enhance the teaching and learning process (Mikheeva & Pankova, 2021).

The study was conducted over a year at UEM. It started with a contextual analysis of the problem. A literature review and consultation with teachers were carried out to have the initial perceptions of the problem refined and its causes explained. The literature review was also instrumental in examining the theoretical frameworks applied by other researchers to address comparable problems.

The second phase of the study involved designing and constructing a prototype solution to tackle the identified problem. The Laurillard's (2012) Conversational Framework was applied to support the practical design of the prototype solution constructed in this study.

Finally, the last phase of the study consisted of exploring the constructed prototype solution, evaluating it, and reflecting on the findings. Teachers and students participated in exploring and

evaluating the prototype solution. Data were collected through semi-structured interviews with teachers, a structured questionnaire with students, Moodle logs and researcher observations. The data were analysed to examine the perceptions of teachers and students towards the prototype solution. The findings were reflected upon in the conclusion and recommendations of the study.

The following subsections present the practitioners and participants of the study and instruments used for data collection and analysis.

1.4.1. Practitioners and Participants

This study involved teachers and students from Licentiate in Environmental Education and Licentiate in Informatics Engineering programmes at UEM. Two teachers and 71 first-year students from the Licentiate in Environmental Education programme participated in this study, along with one teacher and 41 third-year students from the Licentiate in Informatics Engineering programme.

The teachers played the role of practitioners in this study. They contributed by providing learning content of their courses and actively collaborated with the researcher in constructing the prototype solution using gamification elements within the Moodle platform.

Students were involved as participants in the experiment to explore the constructed prototype solution in the study. The opinions and ideas arising from the students' reflections towards the constructed prototype solution, which applies gamification elements in Moodle, were essential for the findings of this study.

1.4.2. Data Collection and Analysis

This study applied triangulation approach for data collection and analysis. The primary data were obtained from semi-structured interviews with teachers and questionnaires given to students. Students were asked to respond to questionnaires regarding the experiment conducted in this study. The questionnaires were administered online through the UEM Redcap platform. Afterwards, teachers were interviewed to understand their perceptions toward the constructed prototype solution and what they had just experienced during this study. The interviews were recorded and

then the audios were transcribed using TurboScribe[1] tool, an Artificial Intelligent transcription service.

The secondary sources of data were the log files extracted from the online Moodle courses, and the researcher's field notes containing observations, thoughts, and reflections made during the study.

The process of analysis initiated with coding the textual data obtained from responses to open-ended questions in interviews and questionnaires. The data were coded based on the inductive approach, which is also referred to as the open coding method (Brailas et al., 2023). QualCoder open-source software was used for helping in qualitative data analysis, while the SPSS program was used to generate descriptive statistics and graphical representation of the data.

The Conversational Framework was applied to examine how the constructed prototype solution supported the learning process across its five distinct communicative cycles.

1.4.3. Research Ethics

This study was conducted respecting the University of Cape Town (UCT) Code of Ethics and in accordance with this research proposal. Data were collected and processed respecting the protection of fundamental human rights.

This study is part of the investments made by UEM to promote the use of educational technology. Therefore, the UEM was informed about and supported this research.

Participation in this study was voluntary. Participants were carefully informed about the purpose of the research, expected duration and procedures, and how the data would be presented. Afterwards, each participant was requested for consent prior to taking part in this study. The researcher did not influence participants' responses and respected their privacy and confidentiality. Moreover, the researcher has been keeping the UEM key people, including participants and the Educational Technology Unit, aware of the research progress.

[1]TurboScribe is an AI transcription service that provides unlimited audio and video transcription, available at https://turboscribe.ai/.

1.5. Contributions of the Study

The principal aim of this study is to contribute to the field of learning design in Mozambique, particularly online, considering the digital age where nearly everyone is connected to the Internet. It provides valuable insights for teachers and learning designers to address the problem of low student engagement in online learning, a crucial aspect of education in the current era. In addition, by investigating the application of gamification for enhancing online student engagement within the Mozambican higher education context, this study contributes to educational innovation and social transformation in the country.

Lastly, by demonstrating the application of a MMCSR approach to implement gamification to enhance student engagement in online learning, the study provides insights for further research in this area.

1.6. Structure of the Study

Chapter 2: Literature Review

This chapter presents background information concerning online learning and gamification in education, including the practices, theories, frameworks and enabling technology that have been applied in the studies conducted in these fields, as well as their implications for student engagement.

Chapter 3: Research Methodology

In this chapter, the research design is detailed, including the application of MMCSR approach and principles of the Conversational Framework. It also includes descriptions of the data collection and analysis instruments.

Chapter 4: Findings and Discussion

This chapter discusses and analyses the results of the data gathered during the intervention conducted in this study.

Chapter 5: Conclusion

This chapter presents the study findings derived from the results and discussion chapter, along with an analysis of how these findings responded to the research questions. It also covers the limitations of the study and recommendations for further research.

Chapter 2: Literature Review

This chapter reviews and synthesises some of the main studies of online learning and gamification in education. It presents the background information, including technology, practices, methods, and theories applied in this field of study. The chapter also includes the main challenges in these areas and analyses of the impact of gamification on student engagement and learning results.

2.1. Gamification in Education

Gamification is the use of game elements, mechanics and design techniques outside of gaming contexts, such as in professional and educational settings, to develop a product that is both engaging and enjoyable, while also being productive and effective (Khaldi et al., 2023; Barna & Fodor, 2019).

In the education field, gamification has been gaining increasing traction as an essential aspect of learning practices that can be applied to improve student engagement and motivation (Poondej & Lerdpornkulrat, 2019). By implementing gamification, the teacher creates an environment where students can learn in a laid-back and relaxed manner. There are several studies showing the effectiveness of gamification to improve student motivation and engagement in varied educational contexts (Khan et al., 2017; Poondej & Lerdpornkulrat, 2019; Rahman et al., 2019).

It is currently considered one of the essential features in an educational system (Poondej & Lerdpornkulrat, 2019; Leung et al., 2022). There are several online learning environments with gamification elements incorporated (Klubal et al., 2018), ranging from free and open to paid systems.

2.1.1. Gamification Elements

Games have specific characteristics which are essential in gamification (Paľová* & Vejačka, 2022). Interactivity, goal orientation, challenge, immediate feedback, social connectivity, progress mechanism, recognition of efforts and rewards based on performance and fun orientation are some of the game aspects which can be applied to motivate learning (Paľová* & Vejačka, 2022). Rewards in gamification in education refer to motivators, such as points, badges and levels, that

encourage students to engage in learning. In a learning environment, these game aspects are enacted through the integration of gamification elements, such as avatars, quests and challenges, points and levels, badges and leaderboards (Alsawaier, 2017; Gupta & Goyal, 2022).

Avatars

Avatars are virtual representations of players within the game environment, typically embodying the player's persona or character within the game (Christopoulos & Mystakidis, 2023). Avatars have gone through various developments in order to adequate to the needs of players in digital game environments (Segaran et al., 2021), in the sense that they reflect their perspectives, vulnerabilities, and the various roles they play in the real world (Alsawaier, 2017).

Students are more likely to engage at higher levels when they are in a suitable emotional state (Segaran et al., 2021). Using a moderately cartoonish avatar to represent players in a virtual world shows more potential in promoting positive emotional experiences among viewers compared to slightly realistic or overly exaggerated characters (Segaran et al., 2021). Allowing students to choose or design their own avatars contributes to the development of more effective and comfortable online learning environments, motivating student engagement and improving knowledge development (Alsawaier, 2017; Segaran et al., 2021).

Quests and challenges

A quest refers to a specific task that a player-controlled character or group undertakes to earn a reward (Christopoulos & Mystakidis, 2023). In the gamified virtual environment, to earn a reward assists to motivate student players and to prevent potential disappointment (Christopoulos & Mystakidis, 2023).

To fail in a gamified learning environment does not have the same negative implications as in the real world (Alsawaier, 2017). The concept of failure is fragmented to small failed attempts (Alsawaier, 2017). The game over or failure of an avatar character provides an opportunity for reflation, learning from mistakes, and starting again to accomplish the task (Alsawaier, 2017).

The incorporation of quests often is associated with the creation of learning activities that require problem-solving (Christopoulos & Mystakidis, 2023). They present a series of challenges that require student players to apply their critical thinking skills to solve mysteries (Alsawaier, 2017). This feature can also be explored to encourage student interaction and collaboration, rather than fostering competition among peers in the classroom (Alsawaier, 2017).

Points and levels

Many games rely on points as a core mechanic because they support simple and easy-to-understand measurements of achievements and track progress (Christopoulos & Mystakidis, 2023). Players essentially earn points for accomplishing objectives, reaching milestones, or making significant achievements within gameplay (Christopoulos & Mystakidis, 2023). Points have a significant role in a gamified environment (Alsawaier, 2017). According to Gupta & Goyal (2022) they have been implemented in different educational settings to reward achievements, to quantify a player's achievements, for comparison with competition among students and to get feedback on participant attitude.

Connected with points are levels. Levels in a game are divided into segmented portions or stages that players advance through as they interact with the game (Christopoulos & Mystakidis, 2023). In the gamified learning environment, they help to encourage progress of the student player (Butler, 2014). Advancing to each new level typically signifies an increase in difficulty or complexity, introducing new challenges to the player (Christopoulos & Mystakidis, 2023). To achieve a new level can give a sense of pride for a student, thereby motivating them to continue engaging in learning.

Badges

After reaching an established advance level of points users can receive various rewards such as badges of accomplishment for completing certain actions (Paľová* & Vejačka, 2022). Badges visually represent the accomplishments players obtain after achieving certain targets or milestones within gameplay (Christopoulos & Mystakidis, 2023). They are important signs of the progress of students (Alsawaier, 2017) and learning achievements.

According to Christopoulos & Mystakidis (2023), badges offer a reflection of achievement, providing students with insights into their progress and clarifying their position in the learning process. In addition, the process of attempting for badges can stimulate critical thinking and problem solving, as students may need to strategize how to gain a particular badge, thereby enhancing the learning process (Christopoulos & Mystakidis, 2023)

Leaderboards

Leaderboards visually display players' rankings based on their achievements (Christopoulos & Mystakidis, 2023). In gamified education environments, leaderboards allow students to visualize their relative position in relation to their peers, which is usually defined by their performance and learning progress. Players' satisfaction levels vary depending on their position on the leaderboard, as humans are inherently social and tend to compare themselves with their peers, fostering competition (Gupta & Goyal, 2022). In educational field, satisfaction is the perception of contentment resulting from an evaluation of educational services, facilities and experience (Weerasinghe et al., 2017). As such, publishing the rank of the students according to their levels of achievement allows them to measure their progress relative to their peers (Christopoulos & Mystakidis, 2023), and to foster the achievement of learning goals (Paľová* & Vejačka, 2022).

However, Gupta & Goyal (2022) have identified certain negative aspects of leaderboards that should be taken into account when applying them in a learning environment. They found that leaderboards might inhibit performance if players become self-conscious about their scores being visible to others. Participants at the top or bottom positions were more inclined to attempt playing again compared to those in the middle positions (Gupta & Goyal, 2022).

2.1.2. Studies of Gamification in Education

There are several studies applying gamification in various education settings (Viamonte & Figueiredo, 2019; Paľová* & Vejačka, 2022; Adam & van den Berg, 2022). In addition, there are also varying literature review studies investigating the impact of gamification on motivational

mechanisms and effectiveness of learning (Dichev & Dicheva, 2017; Oliveira et al., 2022; Khaldi et al., 2023).

Researchers from Technical University of Košice, in Eslováquia (Paľová* & Vejačka, 2022) applied gamification principles to increase the attractiveness and active use of the published sources into an online Moodle course. The experience involved first-year students of bachelor study of the study branch Finance (Paľová* & Vejačka, 2022). The researchers implemented different types of Moodle activities with games aspects, namely hangman, quizventure, solve the puzzle and online tests and assignments. They called Random activities, as students should participate voluntarily. To participate, students had to actively monitor the information about the running activity published during the face-to-face lectures, via Microsoft Teams course channel or calendar in LMS Moodle course. As a result, the researchers found that gamification might improve study experience and study results of students at the university. Therefore, lecturers and educators should try to implement the gamification principles into the educational process of their courses to achieve these positive effects (Paľová* & Vejačka, 2022).

The other group of researchers (Viamonte & Figueiredo, 2019) conducted a gamification experience with first-year students in a mathematical curricular unit, at Instituto Superior de Engenharia do Porto, in Portugal. These researchers used points and levels, rewards and penalties game design elements into an online platform to motivate students from a face-to-face teaching course to engage in learning and reduce dropouts. All students had a hundred starting points, corresponding to the first level, which would increase or reduce depending on their performance in online learning activities (Viamonte & Figueiredo, 2019). There were twenty levels and students had to earn a hundred points to pass each level. There were also some medals and bombs. Medals were rewards attributed to the students for doing certain tasks and bombs were penalties attributed to students for not doing certain required tasks such as homework, Moodle activities, among others (Viamonte & Figueiredo, 2019). As a result, they verified that students were more motivated and involved in the classes and in the activities of the curricular unit, hence the dropout rate was lower, and the approval rate was improved. According to the researchers, students reported that they had more work in that semester, which in their opinion is not negative, because it was reflected in the positive approval rate.

In the African context, (Osakwe et al., 2022) investigated how high school students perceive the use of game elements in learning. They used the quantitative research approach where online survey questions were employed to collect data from the participants within four African countries, namely Namibia, Nigeria, Ghana and Kenya. As a result, the researchers presented the perceptions of students towards gamified learning in African countries, where they found that most students understand how to play a digital game and believe that it can be used in education settings to help them to learn. Even though there are remaining students, particularly in rural settings, who are rarely exposed to technology, hence either not conversant with digital games or do not know how to play them (Osakwe et al., 2022). However, overall, the researchers found that students always feel very motivated when a teacher uses technology such as Chrome books, smart Boards, or clickers in the classroom.

Adam & van den Berg (2022) conducted case study research to understand students' experiences of online gamified quizzes and how gamified quizzes influence their motivation to learn in a Programming Module, at a South African higher education institution. The researchers utilized Mentimeter, an audience engagement platform (AEP), to create online quizzes to engage students with open and closed ended questions related to the course topics. Students were able to see other people's responses and reply, helping them to learn and correct their own knowledge. A WhatsApp group was used to facilitate interactions among students and researchers. As a result, they found that students had varying experiences with gamification, with some of them being motivated by learning and obtaining rewards. The leaderboard game element and some social aspects enabled by gamification, namely student autonomy, sense of relatedness and opportunity for voluntary collaboration highly motivated students to engage in online learning (Adam & Van den Berg, 2022). However, there were some students demotivated by peers not engaging, what the researchers state is a concept not widely explored in the literature. Therefore, although the results indicated that gamified quizzes were effective to engage students in an online learning setting, the researchers recommended cognizance of the factors that could demotivate students in gamified environments.

There was found one study on gamification in a Mozambican context. Applying an exploratory-descriptive approach of qualitative nature, (Franco, 2022) investigated how gamification can be used as an engagement strategy for distance education in Mozambique. The researcher presents

the most discussed aspects about the use of gamification in distance education, highlighting the increase in students' engagement and motivation, as well as in development of skills and the ability to deal with difficult subjects. As a result, the researcher concluded that gamification significantly contributes to students' motivation, performance, and commitment to learning. Therefore, gamification is becoming a necessary and differential strategy, which will culminate in the improvement of the quality of distance education in Mozambique. The researcher concluded that it is required further study for the training of teachers capable of dealing with gamification in education.

The benefits and challenges of gamification in education are in greater detail discussed in the following section.

2.1.3. Benefits of Gamification in Education

Gamification brings the component of fun to education (Alsawaier, 2017), that assist in making learning more meaningful (Barghani, 2020). It has the potential to enhance student engagement and increase motivation in learning (Gupta & Goyal, 2022), as well as to improve knowledge retention (Putz et al., 2020), to foster collaboration between students and to create a positive and personalised learning environment (Barghani, 2020). These beneficial aspects of gamification in education are well discussed in the following.

Improve Student Engagement

According to Putz et al., 2020, students are slightly more engaged in a gamified environment compared to a non-gamified. The effectiveness of gamification in engaging students can be attributed to the incorporation of game elements that stimulate intense focus and provide them with the autonomy to choose their preferred manner of learning (Barghani, 2020).

The social dynamics of gamification also have a positive effect on student engagement (Barghani, 2020). Students tend to invest more effort and time in activities in which their peers are also engaged (Leung et al., 2022), often creating a sense of competition. This can create individual social pressure, leading to increased levels of student engagement and potentially enhancing their participation and learning (Barghani, 2020).

Increase Student Motivation

The inherent fun and engaging aspects of gamification enhance students' intrinsic motivation to participate in learning activities (Barghani, 2020). For instance, according to Gupta & Goyal (2022), gamifying the simple act of arriving to class on time may increase attendance and improve course grades. The constructive competition among peers promoted by game elements increases student motivation to engage productively in learning activities (Barghani, 2020). As students become more immersed in playing, continuing quests, discovering secrets, or solving puzzles, their determination and competence increase (Barghani, 2020).

Moreover, the game mechanics stimulate students to continue, thus driving and motivating them to accomplish the tasks (Barghani, 2020).

Foster Collaboration Skills

The popular forms of games are designed for groups to work together towards a common goal. In the learning process, cooperative gamification elements can be applied to foster teamwork and collaboration (Barghani, 2020). Collaboration among students to reach common objectives helps them develop social skills such as responsibility and emotional investment (Barghani, 2020).

Improve Knowledge Retention

In addition to motivating learners to learn (Leung et al., 2022), gamification in education contribute to students' knowledge retention, regardless of age or gender (Putz et al., 2020). By stimulating understanding of the learning content, gamification encourages the recycling and application of concepts and theories (Barghani, 2020). The game element immediate feedback is essential for boosting academic self-capability and facilitating knowledge development (Barghani, 2020).

Create Positive and Personalised Learning Environment

One of the main benefits of gamification is its potential to personalise and customise learning according to the individual needs of each student (Barghani, 2020; Leung et al., 2022). The selection of game mechanics based on students' characteristics an and preferences, such as grade level, age group, educational content and relevance, can have a positive impact on creating a productive and enjoyable learning environment (Demirbilek et al., 2022; Leung et al., 2022).

Overall, shifting from a general to a more tailored and personalized strategy would enhance the effectiveness of gamification in education (Leung et al., 2022). Oliveira et al. (2022) found different studies that have tailored gamified learning environments by considering various individual human aspects, including gamer type, learning style, goal orientation, personality traits, age, gender, demographics, instructor preference, user preferences, psychological need satisfaction, and motivational stage. Considering students' levels of motivation, personalities, and game preferences allows educators and instructional designers to create formats that better align with each individual characteristics and increase their sense of autonomy (Barghani, 2020).

2.1.4. Challenges of Gamification in Education

Despite the increasing popularity of gamification (Leung et al., 2022), there are negative situations encountered in implementing it in educational contexts (Charlo et al., 2022), which institutions should attempt to eliminate (Demirbilek et al., 2022). Some of these challenges are discussed in this section.

Challenges in Ensuring Alignment with Educational Objectives

Game elements should be clearly aligned to and relevant for the intended learning outcomes of the course or program (Svanberg & Bergh, 2023). Their use should not move focus from the intended learning outcomes to the game elements themselves (Svanberg & Bergh, 2023).

However, gamification in education is far from the expected and desired level due to pedagogical obstacles (Demirbilek et al., 2022). There are challenges such as difficulty of finding educational game elements that are effective in addressing certain topics and engaging students in learning (Demirbilek et al., 2022). Educators and instructional designers often face challenges to combine game design elements with learning objectives and curriculum, as well as in providing evidence of students learning in gamification implementations (Charlo et al., 2022).

Challenges in Designing Effective Game Mechanics

When designing a gamified learning activity, priority should be given to game elements that are suitable for the level of the students and promote the development of multiple skills (Demirbilek et al., 2022).

However, it is difficult to create a gamified environment that is adapted to all students' ability (Charlo et al., 2022). The required knowledge for a proper game design, sociological and cultural obstacles, as well as the technology costs can limit incorporation of successful game mechanics in the learning process (Charlo et al., 2022).

Demirbilek et al. (2022) found that the improper use of gamification elements in education can lead to psychological problems, removal from social environment, and some health problems. Challenges during the game, irregularities, objections, negative competition among peers and the time required to student accomplish the tasks can cause negative impact in education (Demirbilek et al., 2022).

Technology Integration Issues

The potential of gamification implementation is constrained by negative situations related to technical and financial obstacles such as insufficient computer literacy, the lack of digital devices, Internet connectivity issues and institutional provision of ICT Infrastructure and services (Demirbilek et al., 2022).

2.2. Online Learning

There are no doubts that technology has been transforming the way education is delivered in different contexts (Turnbull et al., 2020). The evolution of Information and Communication Technologies (ICTs) has been causing significant changes in the practices applied to facilitate teaching and learning into many educational institutions (Januszewski & Molenda, 2008). The ICTs have been incorporated to support the learning process, encompassing the simple integration of basic digital tools to mediate the instructional functions in classrooms to more advanced Internet-based practices (Januszewski & Molenda, 2008). Online learning is when the learning process occurs on an Internet-based virtual environment (Luminita, 2011). The learning process can take place with teachers and students located in different sites, and the interaction can be asynchronous (Luminita, 2011). The benefits of online learning are well discussed in the following section.

Online learning can be categorised into two core groups: fully online and blended (or hybrid format) learning. Fully online learning refers to the process that has most of its activities accomplished online (Dhull & Arora, 2019). Blended or hybrid learning is when a traditional face-to-face course integrates materials and activities using some online elements (Besele, 2021).

2.2.1. Benefits and Challenges of Online Learning

The advantages of online learning encompass accessibility, self-pacing, personalized learning, cost-effectiveness, equal opportunity, and globalization.

By allowing educational institutions to expand their reach to an evolving audiences (Januszewski & Molenda, 2008), online learning serves as an adequate option for students facing challenges in traditional education settings, such as full-time workers, pregnant and young mothers, students with health problems, individuals studying abroad, and others who, for some reason, do not fit well within regular academic structures (Januszewski & Molenda, 2008).

In online learning, students can learn from anywhere at their convenient time and pace (Dhull & Arora, 2019). It also enables students to identify and manage their learning preferences, content, objectives, existing knowledge, and unique skills, while also fostering the development of cognitive abilities. (Dhull & Arora, 2019). In addition to this flexibility, online learning generally incurs lower costs compared to classroom teaching (Panigrahi et al., 2018). As students can learn through the Internet in an online environment, less money is spent (Panigrahi et al., 2018) with traveler expenses, learning material (EL Hajjar, 2014) and physical environment maintenance costs (Lopes, 2011).

The COVID-19 pandemic demonstrated the significant role of online learning in higher education (Wright et al., 2023). During the peak period of the pandemic, most of the educational institutions had been closed and had to adopt online learning to deliver education. This indicates that, in some way, online learning is going to have an increasingly important role in higher education, particularly due to its potential ability to enhance accessibility and flexibility for marginalized student groups (Wright et al., 2023).

One of the primary challenges in implementing online learning is the access to reliable Internet connection and digital devices (Besele, 2021), particularly in African contexts. Moreover, the effectiveness of online learning in higher education has been a subject of debate (Wright et al., 2023). There are studies relating online learning to decreased levels of student engagement (Besele, 2021; Wright et al., 2023) and lower student learning (Dhull & Arora, 2019; Rizwan & Haleema, 2022).

Nowadays, teachers and administrators are no longer questioning whether to adopt online learning, but rather how to apply it in an effective way to promote student engagement and achievement of learning outcomes (Wright et al., 2023).

2.2.2. Student Engagement on Online Learning

When two people decide to marry, it is said that they are engaged. Similarly, student engagement refers to the evolving relationship established between student and education (Thomas, 2025). It is the connection that brings together aspects of contexts – educational institution, home, peers and community – with students and learning outcomes (Christenson et al., 2012). In other words, student engagement can be seen as the interactions that take place whenever a student comes into contact with anything that they perceive as education (Thomas, 2025).

Each time a student interacts with education, their level of engagement will either increase or decrease, depending on various aspects categorized in three dimensions or types of engagement (Thomas, 2025). Essentially, there are three traditional dimensions of student engagement, namely emotional, cognitive and behavioral (English, 2024; Thomas, 2025).

Emotional or affective engagement is related to how students feel regarding the education (Thomas, 2025). It encompasses indicators such as students' levels of enjoyment, the value they place on education, their motivation, their sense of belonging or connection to the educational institution, and the support they receive from their peers and teachers. Cognitive engagement refers to a student's willingness to invest in education (English, 2024) how they think about themselves as a student (Thomas, 2025). Behavioral engagement describes the way in which students act towards learning (Thomas, 2025). It includes attendance, participation and compliance to expectations during activities (English, 2024).

The engagement perspectives are beneficial for educators searching for strategies to reduce the risk of academic failure (Christenson et al., 2012), whether in online or face to face teaching. The three previously discussed dimensions assist in understanding of student engagement but should not be considered as separate entities (Thomas, 2025). How a student feels about educational institution certainly will impact they thoughts about themselves as a student and how much they are prepared to expend mental energy into their learning (Thomas, 2025). On the other hand, the way students perceive themselves as learners will directly influence how they feel about education (Thomas, 2025).

Deng (2021) found that emotional engagement plays a more significant role than other dimensions of engagement in predicting students' satisfaction with online learning. Thus, maintaining students' emotional engagement in online learning influences their behavioral engagement (Deng, 2021), which can be manipulated to enhance educational performance and academic achievement (Christenson et al., 2012). This aligns with the purpose of the study, which explores ways to integrate gamification in education to increase students' emotional engagement – enjoyment – and, in turn, enhance behavioral engagement and academic results.

2.2.3. The Adoption of Online Learning

Prior to an online learning implementation, it is crucial for the institution to understand the factors that influence its adoption, continuation intention and student learning, at both the individual and environmental levels, in order to take maximum benefit of it (Panigrahi et al., 2018). In fact, implementing online learning is not merely about adopting technology to create a virtual learning environment. It involves a set of factors, including the learning design principles and other aspects, which are detailed as the following.

Choose the right technology

Panigrahi et al. (2018) state that perceived usefulness and perceived ease of use are the primary factors which must be taken in account in choosing the technology. While technology can introduce innovative ways to engage students (Barghani, 2020), the main objective of its

integration into education should not just be to add novelty, but to support the achievement of learning outcomes (Januszewski & Molenda, 2008). Choosing the wrong technology can hinder the success of the teaching and learning process. The adoption of any educational technology must align with the learning objectives (Januszewski & Molenda, 2008), otherwise it may negatively impact academic results.

In additional to aligning the technology with educational purposes, it is important to fit it to the characteristics of the individuals (Panigrahi et al., 2018). Technology may not provide the expected results, if teachers and students find it difficult to use. Therefore, an analysis of the learning objectives, the characteristics of both teachers and students, and the institution's capacity to provide technical support must take place prior to any technology integration (Panigrahi et al., 2018) in education.

Adopt learning design principles

The field of learning design is adapting to new advancements in technology. To help teachers in the challenging task of designing learning using technology (Shaheen & Hoque, 2021) that aligns with learning objectives, indicative guidelines are necessary (Chang, 2004). Similar to a doctor that requires a proper diagnosis to prescribe an effective remedy, recommending an appropriate technology for a practical learning problem necessitates an accurate analysis (Ertmer & Newby, 2013). Several theories, models and frameworks with technological and pedagogical principles have been developed to assist in designing learning (Anderson & Anderson, 2002; Laurillard, 2002; Mishra & Koehler, 2006). Thus, to ensure technology aligns with learning objectives, teachers and instructional designers may adopt an existing practical framework or develop a new one with indicative technological and pedagogical guidelines to support the design of learning experiences.

Train teachers and students

To carry out an activity appropriately requires training (Shaheen & Hoque, 2021). Educational institutions should facilitate teachers with appropriate training, relevant resource materials, reliable Internet connectivity and digital devices (Shaheen & Hoque, 2021). These institutions must also recognize that teachers and students have varying levels of technical knowledge and expertise

(Fisher & Baird, 2005). Therefore, the educational institution must make sure that each teacher and student has been trained according to their needs to ensure adequate and productive use of an online learning environment.

Provide support to teachers and students

Unresolved technical issues and inadequate support can decrease student motivation and contribute to higher dropout rates (Fisher & Baird, 2005). Therefore, it is crucial for educational institutions aiming to deliver online courses to offer channels for assisting students with technical issues, enabling them to continue their learning process (Fisher & Baird, 2005). Similarly, teachers also can also face challenges. Therefore, insufficient support can influence their perception towards the implementation of online learning methods in their teaching.

Panigrahi et al., (2018) have found that using cloud-based assisted instruction enhances the students' intention to engage in online learning, and suggested educational institutions to integrate this supportive service in their online learning environments to improve student interaction.

Overall, the success of online learning is directly related to student engagement and motivation (Panigrahi et al., 2018). The online learning environments should incorporate enjoyable and engaging elements to assist teachers in addressing the potential problem of student demotivation and lower academic performance. (Khaldi et al., 2023).

2.3. Learning Management System

A Learning Management System (LMS) is a web-based software or a platform designed to deliver the material that is used for online learning (Turnbull et al., 2020). LMSs facilitate timely and accurate communication between students, teachers and other institutional stakeholders in the learning process (Turnbull et al., 2020). They are useful in creating interactive online environments and assist to automate the organisation, delivery, and administration of learning materials and activities (Turnbull et al., 2020). An LMS assists with course registration, assignment management, grading, report generation, and tracking the completion status of students (Panigrahi et al. (2018).

A robust and high-quality LMS is crucial to the success of online learning and to create a seamless experience for teachers and students (Turnbull et al., 2020). It can have a significant impact on the reputation of the institution (Turnbull et al., 2020), particularly now, after the disruption of the COVID-19 pandemic, with the increasing number of online learning courses (Phan et al., 2022).

According to Turnbull et al. (2020), the vital features in a high-quality LMS are course management, communication tools, social connectivity, assessment, tracking progress, gradebook, ubiquitous access, security and privacy. Gamification is also now one of the essential features in any LMS (Poondej & Lerdpornkulrat, 2019).

There are proprietary, free and open source LMSs (Klubal et al., 2018) that have been used by many universities around the world for delivering fully online or blended learning courses such as Moodle, Blackboard, Canvas, D2L (Phan et al., 2022) and Google Classroom.

2.3.1. The Moodle Platform

Moodle (Modular Object-Oriented Dynamic Learning Environment) is a free and open source LMS that educators can use to create effective online learning sites (Lopes, 2011). It was created based on a constructivist philosophy that emphasises the role of learners as creators of content rather than passive consumers (Turnbull et al., 2020).

Moodle is widely regarded as the most popular open-source LMS currently in use (EL Hajjar, 2014, Turnbull et al., 2020). Anyone with advanced ICT skills can use Moodle to create and maintain an online learning environment with no cost, on various types of servers (Lopes, 2011).

Thus, universities with their own servers can implement Moodle at no additional cost. As many universities typically have a team dedicated to ICT infrastructure management, including software applications administration (Lopes, 2011), it is easier for them to find people with the required skills to provide support with Moodle installation, maintenance and management.

The benefits of using Moodle encompass all the LMS potentials such as organising and delivering learning materials and activities according to the educators' educational objectives (Lopes, 2011).

2.3.2. Moodle Features

The standard Moodle system has various built-in features to support online teaching and learning (Simanullang & Rajagukguk, 2020). These features include file management, resources, discussion forums, chat, quiz, assignments , glossary, questionnaire, database, wiki, workshop SCORM (Sharable Content Object Reference Model) and survey (Lopes, 2011). It also incorporates the vital security and privacy features, which according to Turnbull et al. (2020), are essential for the success of a LMS.

Additionally, the Moodle features can be extended. There are several free and paid themes and plugins available online to download and integrate on Moodle to incorporate additional visual aspects and features (Lopes, 2011)

There is a variety of studies with discussions about the affordances of LMSs features (Griffin & Rankine, 2010; Nyagorme et al., 2021), which means what can be achieved by a teacher or student using these technologies (Xue, 2022). Table 2.1 shows the Moodle affordances, organised into eight categories which are expected to be incorporated into a high-quality LMS (Turnbull et al., 2020).

Table 2.1: Moodle Features

Category	Affordance
Course Management	• Provides teachers private spaces to add, organise and share with their students' learning materials and activities, according to their needs. • It supports different types of resources, such as text, image, audio and video files, as well as online pages, books, labels, links and SCORM packages.
Assessment	• Enables a teacher to create and communicate tasks, quizzes tests, students' review, and peer assessment, collect work and provide grades and feedback.
Tracking Progress	• Provide course reports and analytics data to help teachers to track the progress of their students.
Gradebook	• Allows students to view their grades. Some activities such as Assignment and Quiz send grades back to this gradebook. It is also possible for teachers to enter grades directly into the gradebook.
Communication Tools	• The forum and Chat features enable teachers and students to have asynchronous discussions • It enables collaboration in information creation and collection, through features such as wiki, survey, and database.
Social Connectivity	• Students can use chat to discuss their experiences with each other and their teacher, as well as they can collaborate in a wiki, with everyone being able to edit the content.
Security and Privacy	• Provides security and privacy to users. Teachers provide resources and activities in private space where only their students can access.
Ubiquitous Access	• The Moodle mobile application allows teachers and students to install android and OS Moodle app in their smartphones to access Moodle online courses.

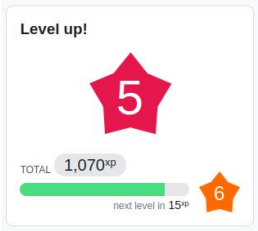
2.3.3. Gamification in Moodle

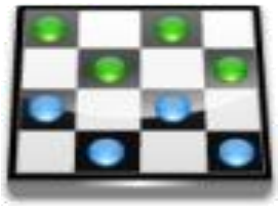
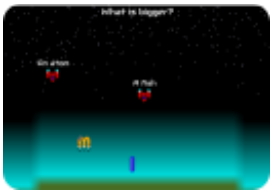
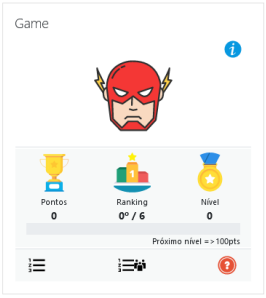
Moodle is appropriate for applying gamification in online learning (Poondej & Lerdpornkulrat, 2019). There are several studies that show the effectiveness of gamification elements within Moodle in higher educational contexts (Poondej & Lerdpornkulrat, 2019; Viamonte & Figueiredo, 2019; Paľová* & Vejačka, 2022). Gamification in Moodle can assist in increasing the level of active participation in learning process and improving students' academic results (Paľová* & Vejačka, 2022).

The standard Moodle functions include several game mechanics (Poondej & Lerdpornkulrat, 2019; Paľová* & Vejačka, 2022), which can be extended by multiple plugins available to download on the official Moodle website (Paľová* & Vejačka, 2022).

Kawagoe et al. (2019) evaluated Moodle plugins with gamification aspects based on usefulness, usability, effectiveness, security, and ease of learning and remembering criteria. They found plugins with the potential to motivate students in Moodle such as Level UP, Game Module, Quizventure, H5P Interactive Content, Stash, and Block Game. Table 2.2 shows these Moodle plugins with aspects of gamification, available in the official Moodle website, along with their affordances and game design elements.

Table 2.2: Gamification elements in Moodle

Plugin	Affordances	Game elements
Level UP 	Teachers can define the levels and add a block that displays current student level and progress towards the next level into an online course. Learners receive points for their actions, visualize their progress, compete with others through a leaderboard, and unlock content based on their individual needs and experiences. It helps to retain learners, increase completion, and provide a stimulating education experience.	Points and levels, leaderboard, badges, rewards, and progress bar

Game Module 	Allow teachers to use quiz questions and glossaries to create and offer a variety of interactive games: hangman, crossword, cryptex, millionaire, sudoku, snakes and ladders, the hidden picture and book with questions. By playing these games, students can check their knowledge and learn from mistakes at the same time (Paľová* & Vejačka, 2022).	Points, rewards and fun
Quizventure 	Allows teachers to create spaces ships games, using multiple choice and yes or no quiz questions in online courses. The possible answers come down as spaceships and students must shoot the correct one. While playing, students earn points. It helps to solve the problem of students procrastinating and motivates them by allowing them to simultaneously learn and play games.	Points, rewards and fun
Block Game 	Like Level UP, it allows teachers to add a block that display avatars and other information related to student progress, such as student scores, levels, student ranking relative to other peers, and progress bars. It provides teachers the ability to configure the learning environment to assign scores and badges for each activity, section or course completion, with clearly defined completion criteria.	Points and levels, leaderboard, badges, rewards and progress bar
H5P Interactive Content 	It allows teachers to create rich content into an online course, such as interactive Video, Quizzes, Collage and Timeline, to allow students to play. It also allows teachers to access various interactive content types, as well as to share, download, edit and reuse H5P content, according to their needs.	Points and levels, reward, badges, feedback, and fun

Stash 	Allows teachers to create items and then place them in activities and resources for students to find. Items can be set to be collected once and encourages exploration of the course material. It is also possible to set an item to have an unlimited supply from a set location. This could encourage students to return to specific areas to collect more items. This plugin has a block that shows students items that they have picked up through the course.	Points and levels, rewards and fun

Additionally, Huerta et al. (2022) developed the FastTest plugin, which according to the authors it allows teachers with limited Moodle experience to develop a question pool without a great deal of time and effort. It also has an option to import questions from Moodle platform to an android game app available on Play Store, named Cauchy, allowing students to engage with the course content without needing to be on the Moodle platform (Huerta et al., 2022).

However, despite its numerous advantages, gamification in Moodle should not be regarded as a miraculous technology that revolutionises education and dramatically boosts students' engagement and learning results (Paľová* & Vejačka, 2022). Gamification in Moodle inherits the overall challenges of gamification in education. The gamification of an online course requires meticulous preparation, and teachers must have the capability to implement it properly (Paľová* & Vejačka, 2022). Teachers must be able to determine which gamification features or plugins in Moodle are most suitable for their needs, based on the affordances available. Poondej & Lerdpornkulrat (2019) found that the restricted gamification mechanics in LMS, the lack of digital literacy of the instructors and insufficient technical support are the major obstacles for implementing gamification in education.

2.4. Gamification in Higher Education

As previously shown, gamification has been widely adopted in educational institutions. There are several studies applying different approaches (Viamonte & Figueiredo, 2019; Paľová* & Vejačka, 2022; Adam & van den Berg, 2022) as well as proposing methods to implement gamification in varied types of learning settings (Toda et al., 2019; Benner et al., 2022).

However, gamification involves a complex set of creative aspects that have to be carefully decided in the designing process (Dichev & Dicheva, 2017). None of these studies provide practical guidelines for ensuring the systematic implementation of gamification to support student engagement, motivation and learning results.

Nonetheless, there is a diversity of theories and frameworks that have been applied for support in integrating technology in educational contexts (Laurillard, 2002; Bozalek et al., 2015; Holmberg, 2017).

After thorough research, it was found that among these theories and frameworks, Laurillard (2007) Conversational Framework provides the most adequate principles for supporting both the design of the educational practice and examination of the constructed prototype. The reason for this is based on the fact that this framework incorporates the key concepts of principal theories of learning and provides a practical basis for learning design (Laurillard, 2002).

Moreover, the Conversational Framework has been widely used to integrate technology in different learning settings in a systematic and coherent manner (Holmberg, 2017; Shonagh, 2023), including in higher education (Xue, 2022). This framework is detailed in the following section of the study.

2.5. The Conversational Framework

The Conversational Framework was created by Diana Laurillard (2002) to help teachers in designing learning using technology (Xue, 2022). Thus, it is also referred to as Laurillard's model (Xue, 2022). It represents the different roles played by teachers and learners in formal learning contexts through what Laurillard (2002) refers to as communication cycles.

The author borrows Vygotsky's (1913–1917) concept by stating that the learning process occurs through interaction and communication between teachers and students. According to Laurillard (2012), the essentials of learning remain unchanged, despite the cultural and technological progress. Regardless of the context, the learning process is an iterative dialogue, which must be discursive, adaptive, interactive and reflective (Laurillard, 2002).

Laurillard (2002) refers that the dialogue between teachers and students must operate on discursive (also referred to as conceptual) level and experiential (also referred to as practice) level. At the discursive level, teachers and students exchange theories, concepts and ideas (Laurillard, 2002). In the learning environment this is enacted by communicating, reading, listening, discussing and other dialogic approaches (Laurillard, 2002). At the experiential level, students engage in practical learning activities created by teachers (Laurillard, 2002). It can be a field work, experimental lab, exercises, practice class, simulation and so on (Laurillard, 2002).

All these iterative communications between teachers and students are represented in the Conversational Framework (Xue, 2022).

2.5.1. The Formal Conversational Framework

Figure 2.1 shows the core forms in which the interactions and communications occur in an academic conversation (Laurillard, 2002). The arrows indicate the activities that comprise the iterative conversation between and within teacher and student.

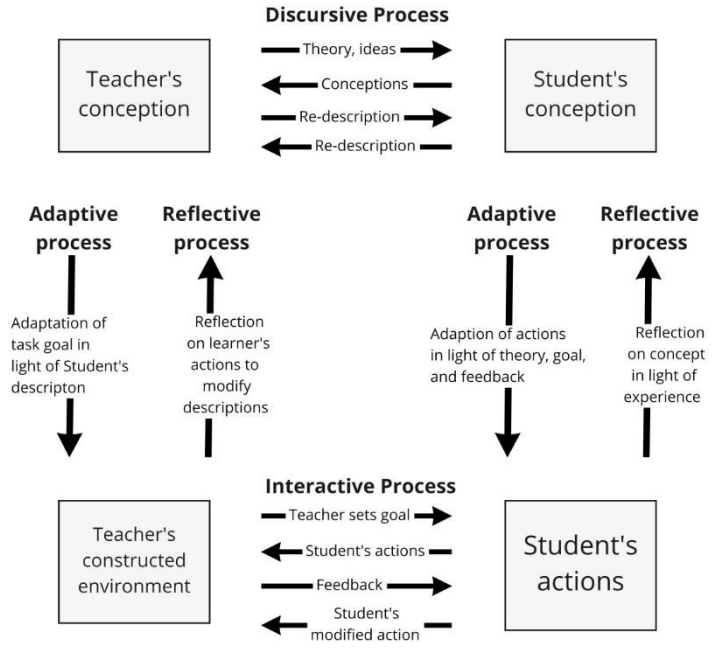


Figure 2.1: Conversational Framework (Laurillard, 2002)

The discursive process represents a series of activities at the discursive level, where teachers and students engage in dialogue about concepts, theories, and ideas (Laurillard, 2002). Adaptive

process occurs when a teacher or student adapts their actions in practice based on the insights from the discursive process (Laurillard, 2002).

The interactive process represents a series of activities carried out by teachers and students at experimental level (Laurillard, 2002). It encompasses all actions in the practice learning environment, including the students' adjustment of their actions based on the feedback provided by teachers. When each teacher and student reflects on their interaction at the experimental level to describe their conceptions at the discursive level, this is referred to as the reflective process Laurillard (2002).

2.5.2. Communication Cycles in the Conversational Framework

Furthermore, Laurillard (2012) discusses this framework and presents the model with communication cycles illustrating the five ways in which an individual learner interacts with teachers and other peers. Figure 1.1 shows the five communication cycles in the Conversational Framework.

The Conversational Framework facilitates teachers in mediating teaching and learning from the student's perspective (Laurillard, 2002). It defines what any teaching strategy should provide, guiding teachers in delivering what students need, in order to determine the most effective ways to support their learning experiences (Laurillard, 2008). According to Laurillard (2002), teachers should know their students as part of the effort to design learning materials that address their learning needs. In figure 1.1, the grey area represents the internal student knowledge development, what is referred to as the learner's internal learning cycle (Holmberg, 2017).

The teacher's communication cycle (TCC) is represented as a series of iterations between teacher and students at the conceptual level. It occurs when a teacher initiates the descriptions of the content topic and learners respond by describing and re-describing their perceptions based on the teacher feedback. When the individual student and peers discuss their ideas and concepts, Laurillard (2012) refers to this dialogue as the peer communication cycle (PCC).

The teacher practice cycle (TPC) represents a series of the iterations at the level of the practice level, in which students receive feedback from teachers of their actions in the practice environment Laurillard (2012). It encourages students to adjust their practice by taking actions that result in

feedback from teachers. Moreover, it also offers teachers insights into their teaching methods and the effectiveness of student learning (Holmberg, 2017). When students receive feedback automatically provided by a technology-supported learning environment, the dialogue process is referred to as the teacher modeling cycle (TMC) (Holmberg, 2017).

Finally, the peer modeling cycle (PMC) refers to the dialogue between an individual student and peers in which they share the output of their practice. It motivates each student to engage in actions within the practice environment, as well as it enables them to adjust their practice in the light of their peer's output (Laurillard, 2012).

2.5.3. Learning Types in the Conversational Framework

These cycles are related to six distinct learning types: acquisition, inquiry/investigation, production, discussion, practice and collaboration (Laurillard, 2012).

Acquisition occurs when students listen to the teacher or read learning material (Laurillard, 2012). Inquiry involves students investigating or asking questions within the learning environment (Laurillard, 2012). When students create something for the teacher to evaluate and provide feedback, Laurillard (2012) refers to that as production. Discussion is encouraged when the activity involves individual students communicating about concepts with their peers (Laurillard, 2012). In the practice learning type, students are required to generate actions, interpret the teacher's feedback, and sometimes reflect on the concepts, to modulate their actions in order to achieve the goal (Laurillard, 2012). Collaboration involves students working together, whether on a project or another type of learning task (Laurillard, 2012).

These learning types are crucial in designing learning materials and activities. Teachers should begin with an analysis of the topic, subject objectives and students' learning needs to decide which learning type to adopt or whether to combine different types (Laurillard, 2002). According to Laurillard et al. (2013), for each learning type, teachers must adopt appropriate educational technology to support its implementation. The integration of gamification into these six types of learning may enhance student engagement. By incorporating game design elements, such as immediate feedback, rewards, points, leaderboards, fun, challenges and quests, teachers can create

different types of engaging learning materials and activities that motivate students to learn (Poondej & Lerdpornkulrat, 2019).

2.6. Chapter Summary

This chapter discussed the main topics related to online learning and gamification in education. It provided an exhaustive review of previous studies. Digital technologies are having an increasing impact on student learning. Teachers should consider integrating adequate technology into their teaching practices, adapting their instructional methods to engage students in meaningful learning experiences. The chapter also highlighted game mechanics and discussed the benefits and challenges of gamification in education, as well as its impact on student engagement. Although gamification is gaining traction in educational contexts, there is a paucity of theories or frameworks that systematise the entire design process for applying game mechanics in a coherent manner to support student engagement, motivation and learning results. Thus, this chapter also provided a detailed discussion of the Conversational Framework as the theoretical model used to inform both the design of the prototype and to assist in examining the learning process, which are detailed in the next chapter.

Chapter 3: Research Methodology

This study employs a Mixed Methods Case Study Research (MMCSR) approach to explore how to integrate gamification in the Moodle platform to support in enhancing student engagement and learning results at UEM. This chapter discusses the MMCSR methodology. It also includes the description of the practitioners and participants, as well as a discussion of the methods used for data collection and analysis.

3.1. Mixed Methods Case Study Research

This study adopts a Mixed Methods Case Study Research (MMCSR) approach, which integrates both qualitative and quantitative research methods within the context of a case study (Yin, 2014). The combination of these two approaches is crucial for understanding complex phenomena (Cook & Kamalodeen, 2021), such as technology integration (Jacobsen et al., 2011; Pinder, 2016) and the low student engagement in online learning at Eduardo Mondlane University (UEM), which is being investigated in this study. This approach enables researchers to respond to complex questions and gather evidence that would not be obtained through either single method alone (Yin, 2014).

In this study, the case study component is reflected in the focused investigation of online student engagement at UEM, particularly within the context of blended learning using the Moodle platform. The mixed methods aspect is represented by the integration of both qualitative data from semi-structured interviews with teachers and quantitative data from student questionnaires, alongside Moodle usage logs. This combination allows for a more robust analysis of the effectiveness of applying gamification elements into the Moodle platform.

3.2. The Intervention Design

This study follows a structured, three-phase design process: analysis and exploration; design and construction; and evaluation and reflection. Figure 3.1 shows the course of this study process.

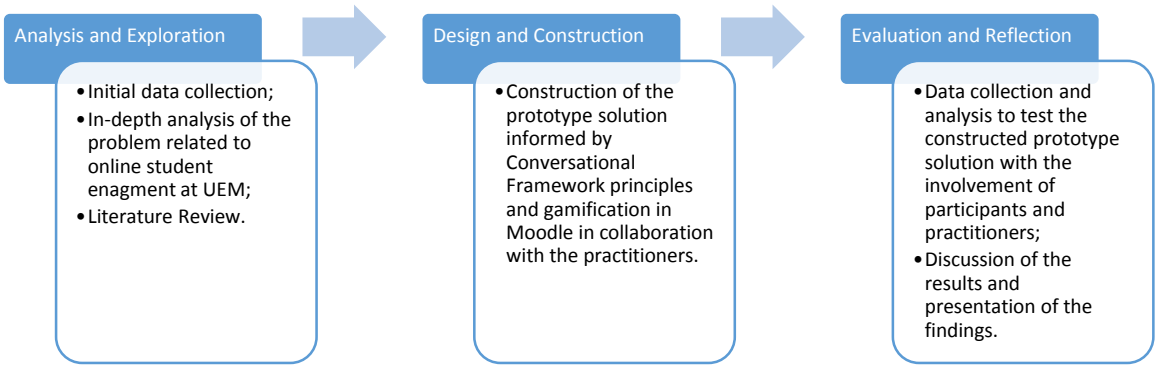


Figure 3.1 Diagram illustrating the research methodology adopted in this study

Phase 1: Analysis and Exploration

The research began with initial data collection through consultations with teachers to identify and analyze the issues surrounding online student engagement at UEM. Qualitative data was gathered through semi-structured interviews with 15 teachers. The interviews aimed to explore teachers' perceptions of the Moodle platform, challenges faced in engaging students, and factors influencing academic results in blended learning.

The results of the preliminary data analysis indicated that despite teachers' awareness of Moodle's potential to enhance student engagement and academic results, most had not used it in their teaching. Teachers who had already used Moodle in their teaching reported facing difficulties in engaging students in online activities. They reported that the lack of devices and Internet connectivity, as well as low digital literacy and absence of technological support, influenced students not to enjoy online activities. However, they also reported that students enjoy spending a significant amount of time on social media, with Facebook and WhatsApp being the most predominantly used platforms.

A literature review was conducted to investigate how to address the problem of student engagement in online learning, which found that gamification had been widely used to overcome the same issue in different contexts (Viamonte & Figueiredo, 2019; Barghani, 2020; Paľová* & Vejačka, 2022).

These findings were then used to inform the development of the intervention in subsequent phases.

Phase 2: Design and Construction

In the second phase, the prototype solution was designed and constructed. This solution was guided by the principles of Laurillard's (2002) Conversational Framework to integrate gamification elements within the Moodle platform to enhance student engagement. The plugins Level Up, QuizVenture, Game, H5P Interactive Content and Stash were integrated into the UEM Moodle platform and used to design learning activities.

Phase 3: Evaluation and Reflection

The third phase of the study focused on evaluating the constructed prototype. Quantitative and qualitative data were collected over a two-week period through questionnaires administered to students after completing online activities and semi-structured interviews with teachers. Log file data from Moodle, which provided reports on students' activity completion, was also analyzed to evaluate the level of engagement.

3.3. Practitioners and participants

A convenience sampling method was used to select teachers who had completed the Teaching with Technology course, as this ensured that the participants had prior experience with the Moodle platform and blended learning methods. According to Golzar et al. (2022), this method is suitable when researchers select a sample based on its readiness, availability and accessibility.

In the first phase, the sample of 15 teachers represented various departments across UEM, providing a diverse perspective on the problem being investigated. Three of these teachers participated in the second phase in constructing the prototype solution. The third phase consisted of the experiment conducted in this study, to test and evaluate the constructed prototype solution with students at UEM. In the second phase, three of these teachers participated in the construction of the prototype and later asked their students to take part in the experiment.

Overall, a total of 112 students took part in this study as participants. 71 students were from the first-year class of the Licentiate in Environmental Education programme at the Faculty of Education and 41 were third-year students of the Licentiate in Informatics Engineering programme at the Faculty of Engineering.

3.4. The prototype solution

Two prototype solutions were constructed. The first prototype to promote student engagement in ICT in Environmental Education course, was created using content from the topic entitled "The Use of Blog in Education". In this topic, students were expected to understand the educational benefits of blogging and explore diverse blogging platform features. The second prototype solution was constructed to support the Computer Networking course. It applied content from the topic of network devices. In this specific topic, students were expected to have a deep understanding of the roles of various types of network devices in computer networks.

Although the two prototypes had different content, they shared similar characteristics. The illustrations showing the constructed prototype solution are presented in appendix B.

Each online course in Moodle was configured to incorporate Level Up features, introducing elements of friendly competition among students. Five levels were created. Through the LEVEL UP leaderboard and ranking list features, students could visualise their points and progress compared to their peers. This was beneficial for boosting motivation among competitive students who were interested in achieving top positions (Knoll & Tonetto Londero, 2021).

Each student started in level one and had to complete the activities to gain points and pass to the following level. The activities could be repeated until students achieve the requirements to earn points. At each moment the student achieved the necessary points to move up a level, a congratulatory notification was displayed, informing the new reached level. These feedbacks were crucial for students to track their progress and consequently increase their engagement in task completion. (Knoll & Tonetto Londero, 2021).

However, this could not work without content and activities. Thus, practitioners had to provide learning materials and to create activities using the H5P interactive content and QuizVenture game in each of their online courses. The assignment feature was also used to ask students to submit a summary of what they had learned during the experiment. During the design of the online course, teachers were instructed to consider incorporating gamification elements to support the five communication cycles in the Conversational Framework. Students had to access and carefully read the instructions and learning materials provided by the teachers to accomplish the online activities.

The tasks were communicated in the classroom sessions, after presenting and discussing the topic theories and concepts. After reaching a final understanding, students were expected to accomplish the online learning activities available in the Moodle platform. They could read and reread the online learning material and instruction many times, as well as to post questions for clarification in the online forum used by teachers to interact with students within the Moodle platform.

3.5. Data collection

The study employed a triangulation approach for data collection, which included semi-structured interviews with teachers, online questionnaires for students, log file data from the Moodle platform, and the researcher's field notes. The analysis of these data sources was conducted using both qualitative and quantitative methods.

Semi-structured interviews with teachers

In the third phase of this study, semi-structured interviews were conducted with the teachers to understand their perceptions toward the prototype solution. The interview questions, provided in Appendix D, focused on exploring the teachers' overall impressions, the challenges they encountered, the usability of the prototype and any thoughts or suggestions that may have arisen throughout the intervention.

The interviews were scheduled in advance and took place at UEM. They were audio-recorded, with the teachers' consent, to ensure accurate capturing of responses. Each interview lasted approximately 45 minutes.

Student questionnaires

After completing the online activities, students were asked to respond to a structured questionnaire about their engagement, perceptions, and experiences in online learning. The questionnaires were administered online through the UEM Redcap platform, a web platform for creating survey and collecting data, which also allows for exporting data to PDF, Excel and various common statistical packages. The questionnaire, which can be found in Appendix C, included both closed and open-ended questions, allowing for the collection of quantitative data as well as qualitative insights from students.

Moodle log files

Activity completion reports generated from the Moodle platform were consulted to help in understanding how student interacted with the online course content during the intervention.

Field notes

The researcher maintained detailed field notes documenting observations, thoughts, and reflections occurred during the intervention. These notes were reviewed and analyzed to supplement the primary data sources and provide contextual understanding of the study.

3.6. Data analysis

The data analysis process was multifaceted, incorporating both qualitative and quantitative techniques to provide a comprehensive understanding of the findings.

Qualitative analysis

The interviews recordings were transcribed using TurboScribe platform, an Artificial Intelligent transcription service, available online, which converts audio and video files to text in different languages. The transcriptions were reviewed for accuracy before initiating the coding. Both textual data from the interviews and open-ended questions from the questionnaires were imported into QualCoder, an open-source software for qualitative data analysis.

The coding approach applied in this study was inductive, which is also referred to as the open coding method, where data were examined without predefined categories, allowing for themes and patterns to emerge inductively (Brailas et al., 2023). Codes were assigned to specific segments of text, capturing key ideas and recurring themes that reflected the teachers' and students' experiences and perceptions toward the intervention.

Following the coding process, the themes were grouped and examined using the Laurillard's (2002) Conversational Framework. The mapping of the teachers' and students' experiences onto Laurillard's (2002) Conversational Framework cycles allowed for the assessment of how well the

prototype solution supported the interactions in the learning process and how it enhanced the student engagement and academic results.

Quantitative data analysis

The data from the responses of the closed-ended student questionnaires were analyzed using the SPSS program. Descriptive statistics were used to summarize the data, while graphical representations were generated to visualize trends and patterns in student responses. This quantitative analysis helped to quantify students' engagement and satisfaction with the prototype solution.

3.7. Ethical Considerations

The researcher ensured that all participants were fully informed about the data collection and analysis procedures, as well as the potential ethical implications of the tools used in this study, including TurboScribe AI transcription service. Informed consent was obtained from each practitioner and participant before data collection. They were made aware of how their data would be stored, and measures were taken to anonymize the audio recordings and transcriptions to protect their privacy.

Additionally, it was ensured that no personal data was shared with third parties. The ethical considerations surrounding the use of Moodle and the gamification plugins were also considered, ensuring that the tools complied with UEM’s data protection policies.

3.8. Teacher Preparation and Support

Teachers who participated in the intervention were given detailed instructions on how to design and implement the gamified activities in Moodle. The instructions included step-by-step guides on how to create engaging activities, monitor student progress, and encourage participation through Moodle gamification elements. These guidelines were informed by the Laurillard's (2002) Conversational Framework and can be obtained in the appendix A.

Teachers also received ongoing support throughout the implementation process to ensure the activities were running smoothly and to address any challenge.

3.9. Chapter Summary

This chapter described the adoption of MMCSR as the methodology applied in this study. It also provided detailed information of the practitioners and participants of this study, as well as a discussion of the data collection and analysis methods applied. This chapter discussed the three stages of this study. It presented the discussion of the prototype solution constructed in Phase 2 of this study. Chapter 2 presented an exhaustive review of relevant literature as an outcome of the first Phase of this study, while Chapter 4 provided a detailed discussion of the results obtained from Phase 3.

Chapter 4: Findings and Discussion

This chapter discusses and analyses the results of the data gathered throughout the intervention conducted concerning the use of gamification elements in a higher education setting.

4.1. Results

The data from participants (students) were collected and presented separated from the data from practitioners. Practitioners were three teachers who actively participated in creating the prototype solution for the experiment of this study.

4.1.1. Study Participants

121 students from Eduardo Mondlane University (UEM) were invited to participate in this study, 80 were attending first-year of the Licentiate in Environmental Education Programme and 41 were attending third -year of the Licentiate in Informatics Engineering Programme.

33 of the students attending the first-year of the Licentiate in Environmental Education Programme were attending in the evening, called after-work class, while the remaining 47 were attending the daytime classes. 3 students from daytime and 6 from after-work classes in the Licentiate in Environmental Education Programme made no effort to carry out the assigned tasks in the Moodle platform, therefore they were not included in this study. Fortunately, all invited students from the third -year of the Licentiate in Informatics Engineering Programme participated in the experiment of this study.

Therefore, a total of 112 students participated in this study, 86 women and 26 men. Figure 4.1 shows distribution of students according to gender and age. All students were between the ages of 18 and 50 years. Over 60% of students were aged between 18 and 24 years old, while 26.8 were between 25 and 35 years old. 4.5% of participants were between the ages of 36 and 49 years.

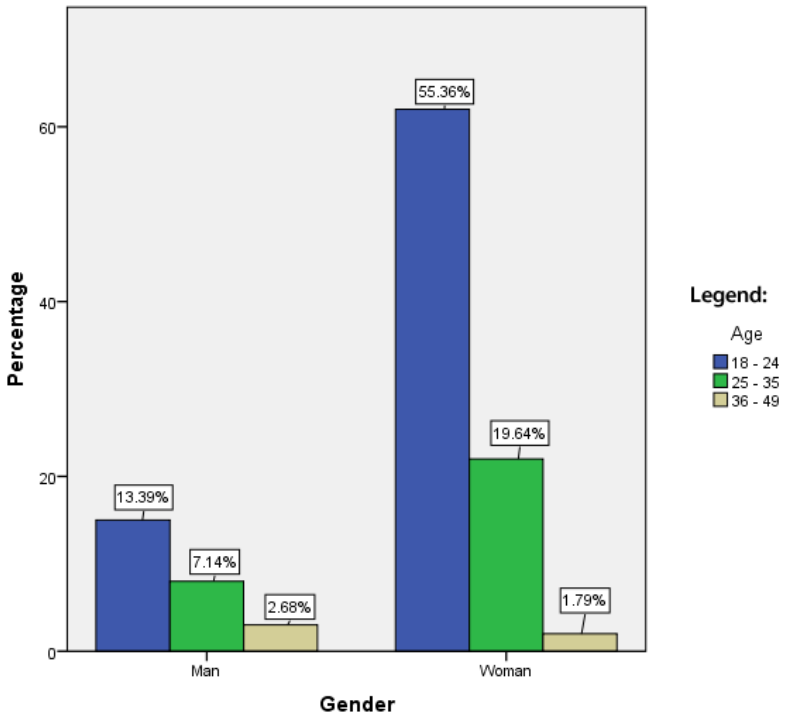


Figure 4.1: Distribution of teachers by age and gender

In the background information survey, students were asked about their computer literacy and information about how they usually connect to the Internet.

Figure 4.2 shows the students' computer literacy, the ability they have to use computers and related technology. Over 40% of students said they had difficulty in understanding how computers work and using digital technology. 24% said they were unsure about their computer literacy. About 30% of students said they were confident in operating computers easily.

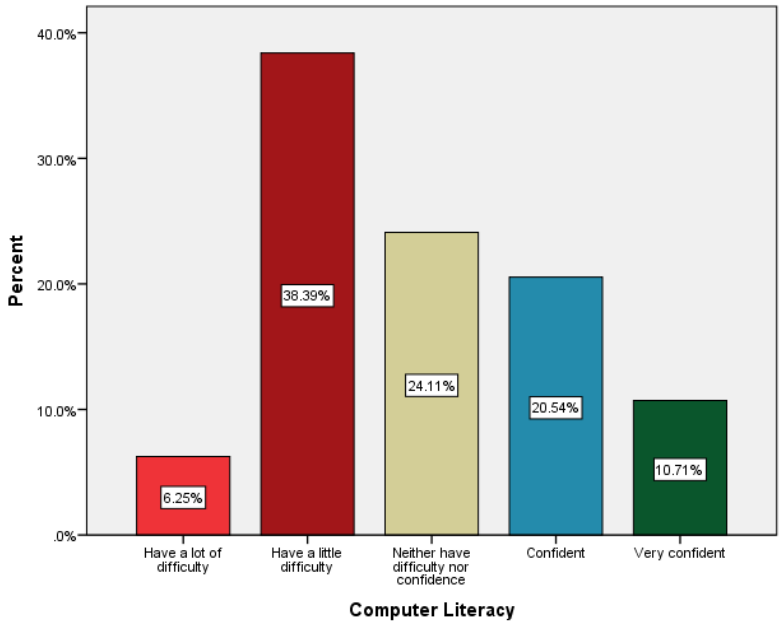


Figure 4.2: Students' computer literacy

Figure 4.3 shows how students connect to the Internet. Over 70% of students said that they used mobile data to connect to the Internet. 20.2 % of students said they used the Internet provided by the university, while about 8% said they used the Internet from their homes and other places, such as working places.

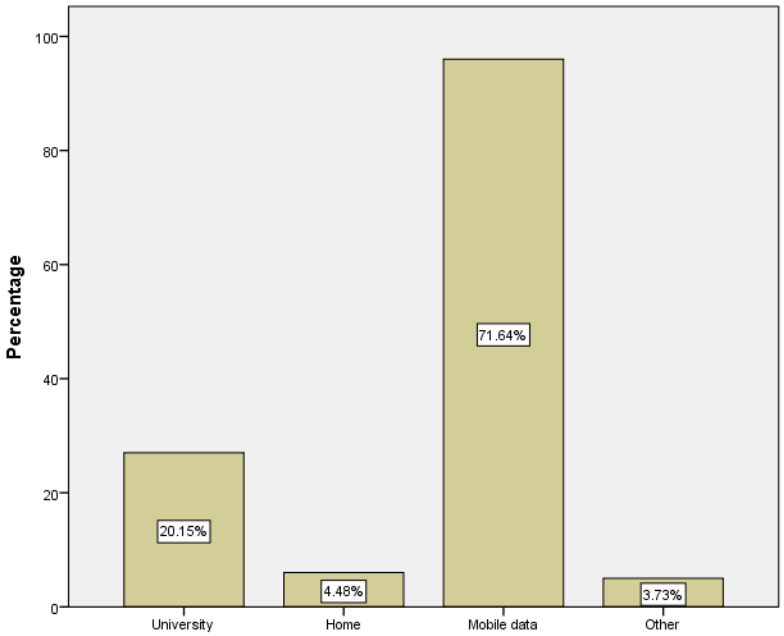


Figure 4.3: How students connect to the Internet

Figure 4.4 shows the devices that students usually used to connect to the Internet. No one indicated anything different from mobile phone, computer and tablet. Mobile phone is the device usually used to connect to the Internet, having more than 74% of students said that they used it. 24.3% of students said that they usually used computers to connect to the internet, while 1.4 % said they used tablets.

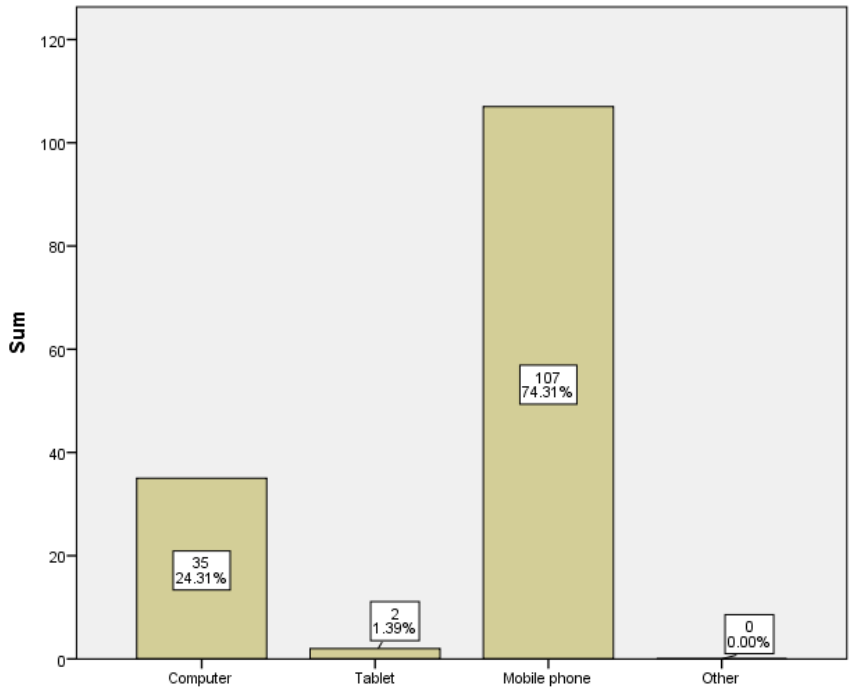


Figure 4.4: Devices students usually used to access the Internet

4.1.2. Participants' experience using gamification in education

Table 4.1 shows the relation between the students' awareness of gamification in education and their previous experience with using game elements in education before participating in this study. 47.4 3% of students said that they were unaware about the gamification in education, while 30.4% said that they were aware. 22.3% of students indicated that they were unsure.

A considerable percentage of the students, about 40%, said they had never used game elements in education before participating in the experiment conducted in this study. 26.8% of them said they were unaware of gamification in education, while 3.6 said they were aware. The remaining 10.7% responded that they were unsure about the usage of gamification elements in education.

28.6 % of students indicated that they rarely used gamification elements in education, and 19.7% said that they had used sometimes. 3.6 % of students said that they were unsure about gamification in education, and they did not remember having used it. 4.5% of students said they were unaware of gamification in education but have used it sometimes.

Table 4.1: Relation of students' awareness of gamification in education

Awareness of gamification in education	Experience with using game elements in education					Total
	Never	Rarely	Do not remember	Sometimes	Always	
Very unaware	10.7%	4.5%	0.9%	0.0%	0.0%	**16.1%**
Unaware	16.1%	6.3%	4.5%	4.5%	0.0%	**31.3%**
Unsure	10.7%	6.3%	3.6%	1.8%	0.0%	**22.3%**
Aware	3.6%	11.6%	1.8%	13.4%	0.0%	**30.4%**
Very aware	0.0%	0.0%	0.0%	0.0%	0.0%	**0.0%**
Total	**41.1%**	**28.6%**	**10.7%**	**19.7%**	**0.0%**	**100.0%**

Figure 4.5 shows that over 80 % of students said that gamification had a positive effect in students' learning, while 14.3% opted for a neutral stance in their responses. Approximately 1% said gamification had a negative impact on students' learning.

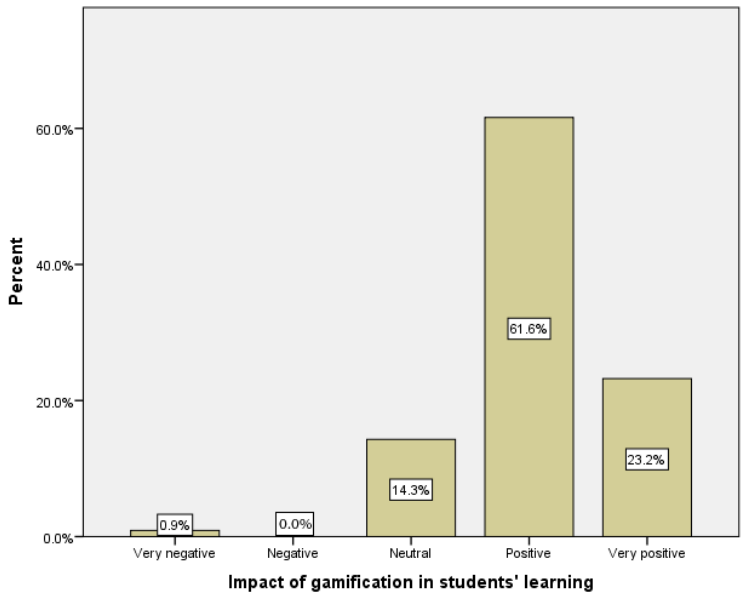


Figure 4.5: Students' perceptions towards the impact of gamification in education

Figure 4.6 shows that 85.7% of students said that they did not know about the existing gamification elements in Moodle. Approximately 14% of students said that they already knew the game elements in Moodle.

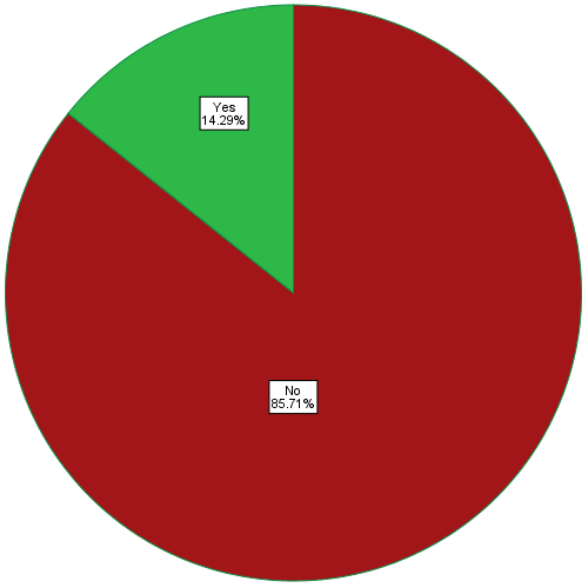


Figure 4.6: Students' awareness of existing game elements in Moodle before the experiment

4.1.3. Participants' reflections toward the experiment of gamification in Moodle

The experiment in this study consisted of the incorporation of gamification elements into Moodle platform to enhance student learning engagement. In phase 3 of this study, evaluation and reflection, participants were asked to complete online learning activities designed with gamification elements in online Moodle courses.

The Figure 4.7 shows that the majority, about 80% of participants said they managed to complete the activities. On the other hand, 18.75% of participants said that they did not manage to complete the activities.

Participants stated various reasons for not completing the online gamified activities, such as feeling that they have difficulty using computers, facing challenges in following instructions, and not having access to appropriate devices to carry out the task. One participant expressed a lack of interest, while another mentioned specific issues on the quizventure activity. The latter participant

stated: "*when I tried to shoot the correct spaceship to answer the question, the screen enlarged instead"*.

None of the participants mentioned problems related to Internet connectivity, electricity and time management.

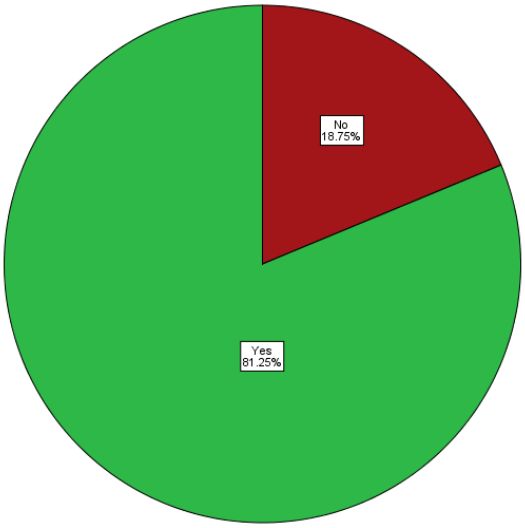


Figure 4.7: Completion of the gamified online learning activities during the experiment

The following data are from students who managed to complete activities in Moodle online course with gamification elements.

Figure 4.8 shows that over 60% of students said that they dedicated less time in interacting in Moodle with gamification elements than they used to dedicate on non-gamified online courses, while 16.5% were not sure about it, having said neither less nor more. 18.7 % of students said that they dedicated more time to interacting with the learning materials and activities in the online course with gamification than they usually dedicate in other courses in Moodle.

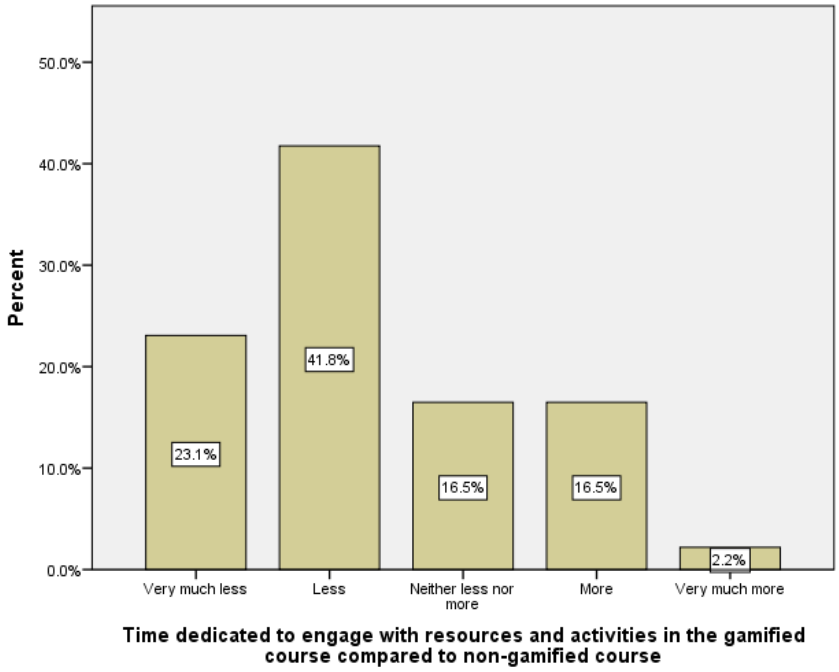


Figure 4.8: Students' time spent in a gamified environment compared to in a non-gamified Moodle platform

Table 4.2 shows that 13.1% of students who managed to complete the activities within the online course said that they faced difficulty in understanding the tasks, while 49.5% considered the tasks easy to understand. About 37.4 % of participants preferred to say neither difficult nor easy.

Each student had to complete about six activities created within the online course using the Moodle gamification elements H5P and Quizventure. Approximately half of participants said that it was difficult to accomplish the activity to play a Quizventure game. 31.8 % of participants said that the game was neither difficult nor easy to play. Only 16.5% of participants said it was easy to play the Quizventure game.

However, over 40% of participants said that it was easy to manage to accomplish the other assignments created using the H5P gamification element. 14.3% of participants found it difficult to accomplish the other assignments, while 46.2 % said neither difficult nor easy.

Table 4.2: How students rated the difficulty to understand and accomplish the assignments

Difficulty	Very difficult	Difficult	Neither difficult nor easy	Easy	Very easy
Difficulty in understanding the tasks	1.1 %	12.0 %	37.4 %	41.8 %	7.7 %
Difficulty to play Quizventure game	15.4 %	36.3 %	31.8 %	12.1 %	4.4 %
Difficulty to accomplish other assignments	0 %	14.3 %	46.2 %	33.1 %	6.6 %

Figure 4.9 presents the responses for understanding students' reflections toward the application of gamification elements within online courses in Moodle. Over 60 % of participants agreed with the statements regarding the benefits of using Moodle with gamification elements which were presented in this study.

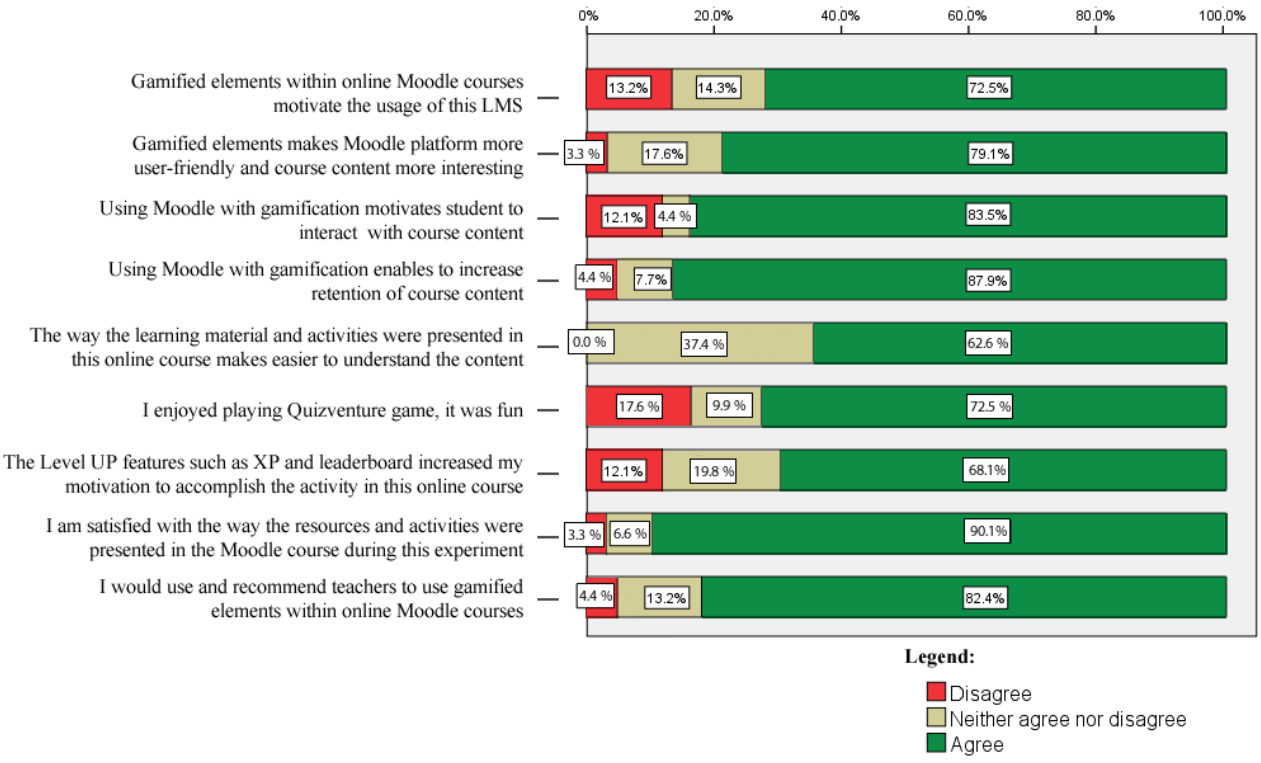


Figure 4.9: Students' reflections toward the experience of using Moodle with gamification elements

Figure 4.10 shows that over 90% of students said that they were satisfied with using the gamification elements in Moodle, while 5.5 % were uncertain about their feeling, having responded neither satisfied nor dissatisfied. 2.2 % said that they were dissatisfied with using the gamified online course in Moodle.

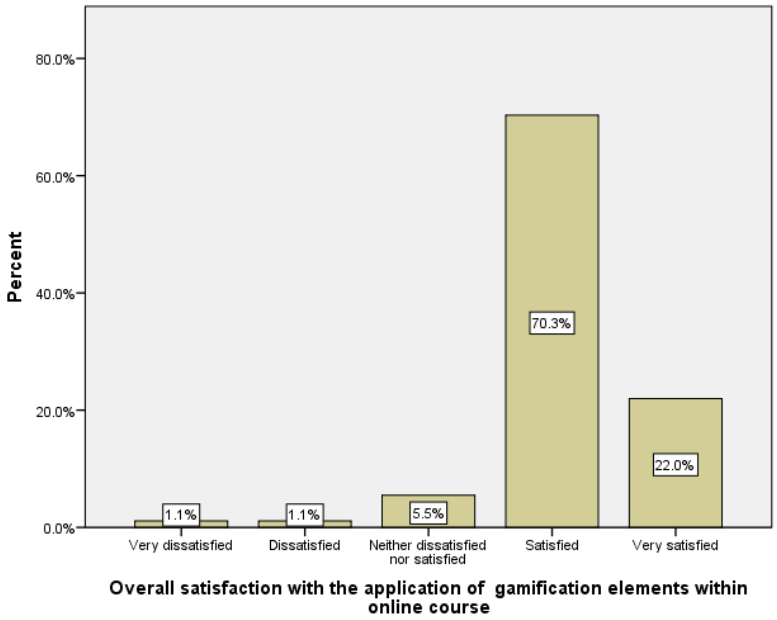


Figure 4.10: Students' satisfaction towards the use of gamification elements in Moodle course

Additionally, students were required to respond to open-ended questions to help understand their perceptions. The responses of students were coded using the inductive (also referred to as open coding) method. The textual data was read and revisited many times to identify recurring meaningful patterns, then the patterns that emerged were tagged with indicative code names (Brailas et al., 2023). After reviewing the interrelated codes, they were grouped into categories.

For the first open-ended question, students were asked to report what had influenced their stance in responding to the question regarding the Quizventure game activity. Table 4.3 shows two main codes of reasons that were determined based on students' responses for disagreeing with the statement that playing Quizventure game was an enjoyable learning activity. It also presents the number of students and some selected quotes from their comments to illustrate and support the key reasons for not enjoying the Quizventure game. Out of the 10 students who did not agree that Quizventure game was an enjoyable learning activity because it was difficult to understand how it works, 6 disagreed because they considered it not easy to play.

Table 4.3: Students' reasons for not enjoying Quizventure game

Code	Number of Students	Selected Students' comments
Difficult to understand	10	• "*I had difficulty in understanding how to play, even though I knew the answers."* • *"...I couldn't understand the real objective of the game and I couldn't even play."* • *"I didn't like it because I couldn't understand what I should do."* • *"It took me a while to get familiar with the game and I didn't like it."* • *"At the beginning it was difficult to understand how the score works. It seemed the points were decreasing but after understanding that I had to shoot only the correct one I was able to play the game."* • *"The game seemed to have no end. Even when I had won points, it made me lose again."*
Not easy to play	6	• *"Well! I didn't like it because it was difficult to manipulate."* • *"... I was unable to move the space ship..."* • *"... I partially didn't like it because the options came down very quickly and I had no experience playing this type of game."* • *"...I believe that it can help in learning, but the appearance of the game makes the process a little bit difficult."*

Similarly, Table 4.4 shows four different codes of reasons that were determined based on students' responses for agreeing that playing Quizventure game was an enjoyable learning activity. It also includes the number of students and some selected quotes from their comments to illustrate and support the key reasons for enjoying the Quizventure game. Out of the 23 students who agreed that Quizventure game was an enjoyable learning activity because it was fun, 10 students said it promote interaction, while 17 said it helps in increasing content retention. 16 students said that the Quizventure activity was a challenging game that was worth playing.

Table 4.4: Students' reasons for enjoying the Quizventure game

Code	Number of Students	Selected Students' Comments
Enjoyable and fun	23	• *"It was funny, although there were repeated questions "* • *"The game is fun; it takes us a little time and it is good to apply new things"* • *"I liked it because it was different, bit a very fun experience."* *".. it was very funny, neither easy nor difficult."* • *"... it was a new and fun experience ..."*
Promote engagement/interaction	10	• *"I found it funny and motivational. It requires a lot of concentration and creativity"* • *"I found it stimulating, it promotes creativity and I was able to study in a shorter time than I usually do."* • *"It's a fun way to carry out an activity, it makes people become interested in learning, ... because it makes people curious to see what will happen in the following levels."* • *"It helps to increase motivation for studying, improves memorization capacity ... you have to practice your memory."* • *"I liked it because it allows the student to pay more attention and simultaneously activate the reaction in relation to the answers, ..."* • *"... it just requires concentration. It's good to have fun studying, it makes you want to continue ..."* • *"When I first saw the game, it seemed difficult because it was the first time, I was doing this type of activity, but when I approached my colleagues and asked for an explanation I saw that it wasn't difficult..."* • *"... educational games related to the course helps to develop cognitive skills, in the case of attention..."*
Increase content retention	17	• *'I learned by playing, given that by shooting the correct answer I could earn points. "* • *"... the game helped me to acquire knowledge."* • *"I partially liked the spaceship game because I could memorize the learning content while I was playing."* • *"After reading the learning materials, it is easy to understand. It's like multiple choice*

		questions. I really liked it; it is essential for learning." • *"I had a lot of fun, and I could memorise the learning content."* • *"I had never played an educational game, but with this game I was satisfied because I realized that there are many ways to acquire knowledge."* • *"I liked it because it is a game, but with learning content to my area of training"* • *"The game stimulated my mind. It asked me questions about the content taught during the lessons. The game helps to study in a simple and fun way."*
Challenging	16	• *"The game was challenging but it helped to retain information very quickly."* • *"It was challenging but I partially liked it because I have learnt, and I already have experience to play the game and accomplish activities on the platform."* • *"... I learnt quickly, but it was difficult to roll the spaceship and shoot at the same time."* • *"It was complicated to play on mobile phone"*

In the second open-ended question, students were asked to indicate the aspects of the Moodle course that contributed to their satisfaction levels in the experiment of this study, whether positively or negatively. Table 4.5 shows four different codes of gamification elements that were determined based on students' responses. It also presents the number of students and some selected quotes of their responses to illustrate and support the key aspects of gamification in Moodle that contributed to their satisfaction. 49 students said that they liked all the aspects of the Moodle course with game elements, while 6 said that they only liked the activities that were created using the H5P element. The spaceships game created using the Quizventure element was popular among students, with 22 of them responding that it had a negative effect on their satisfaction. The features of Level Up element received comparatively less attention, with only 4 students having mentioned them.

Table 4.5: Gamification elements that contributed to student satisfaction

Code	Number of Students	Selected Students' Comments
H5P activities	6	• *"I liked the activities 1-6, kind of multiple-choice questions. I didn't like activity 7 because I couldn't understand when the game had finished…"* • *"I liked the activity where I learned about blogs, it was like playing a game. I could understand how to create a blog."* • *"I liked the multiple-choice questions but I didn't like the spaceships game."*
Quizventure game	22	• *"I liked the activities because they were clear except for the spaceships games, probably because I didn't understand how it works."* • *"…, I didn't like the way the answers appeared in the spaceship game."* • *"I liked the game because it is creative, the challenge was the spaceships game, I had difficulty shoot the correct answer."* • *"I liked it because it's easy to learn, it helps students to be dynamic and makes it helps to memorise the learning content, but I didn't like the spaceship game because it's fast and doesn't give much time to read the questions."* • *"I liked practically everything, however I didn't much like the spaceship game because it is continuous and a little difficult to play on the mobile phone."* • *"I had a little difficulty playing the spaceship game but afterwards it was a lot of fun."* • *"I liked the spaceship game because it encouraged me to work hard to understand the learning content."*
Level Up features	4	• *"I liked it so much because I could earn points for each correct answer..."* • *"I really liked it, because for each correct answer I had earned certain points..."* • *"The game provides an interactive way to learn, I also liked it because it gives immediate feedback and shows how the students are going..."* • *"…, but it was difficult to earn points"*
All characteristics of the course	49	• *"It was a very good experience, it made me enjoy using the Vula platform."* • *"I liked how easy it is, because I can connect from anywhere at any time."*

		• *"... the activities helped to relax and retain information with less of the effort."* • *"I liked the interaction and organisation of the learning content because it allowed me to retain information more easily."* • *"I really loved it.... I had to work hard to understand and have a deeper comprehension of the learning content. Honestly speaking, it was the topic which I most understood."* • *"... very easy to use and effective, it allowed me to be more creative."* • *"... the platform has become more interesting and educational, allowing learning to be done dynamically and quickly, it just requires a little bit of commitment and concentration."* • *"... I had the opportunity to learn more with digital games, they made me want to continue playing and understand the task even more* • *The platform is good, it has everything to facilitate learning and is organised in a practical and simple way. It's a good way to interact with students."* • *"It was a very good new learning methodology, it's a shame the platform has few activities."* • *"I enjoyed all the tasks, although it was difficult because it was my first time carrying out a task of this kind and I still don't have much proficiency in using technology."* • *"The platform is very good and practical for accomplishing the tasks and finding learning content."* • *"Many people think that digital games only promote development delay in learning, but from these games we could see that games stimulate and facilitate our learning."* • *".... all aspects were very good and interesting for us to understand the resources that we can use for our learning."* • *"the game is good for learning because you fight to win, so you end up playing many times to be the winner, then you consume a lot of material in your head to be able to win, that's why it's good to play"*

On the last open-ended question, students were given the opportunity to report other thoughts about the experience that might not have been covered. The responses of students were grouped into two categories: recommendations and suggestions.

Although the terms recommendations and suggestions are used interchangeably, in this session of the study, the first term is used to refer the category of codes that indicate recommendations to use Moodle with game elements, while the latter refers to the category that group codes of opinions to improve the prototype solution that was experimented in this study.

Table 4.6 shows five codes of recommendations that were determined based on the students' responses. 19 students recommended repeating or continuing the same experience or activities within the Moodle and involving other teachers and courses, while seven recommended increasing the number of online activities in the courses. Two students suggested promoting or incorporating more educational digital games within the course. Four students said that they encourage students to adhere to the practices of using Moodle platform. Two responses fell under the category of Other, indicating recommendations that did not fit into the specified codes.

Table 4.6: Students' recommendations

Code	Number of Students	Selected Students' Comments
To repeat the experience	19	• *I loved the experience; I ask teachers to repeat it* • *… you should do more similar work on the platform.* • *Continuing with the games, they should be used frequently to improve our performance and interest in using the platform in teaching and learning.* • *I liked it too much, it should be implemented in other courses* • *"It is an important practice in the platform … I hope there are more similar content in the platform"* • *"They are such good didactic materials. You can continue using this platform…"* • *"… we could use it at least once a week to allow students to be familiar with the platform."*
To increase activities	7	• *"... more exercises, more games to allow us to learn more..."* • *"... more games to practice..."* • *" ... more learning activities to help me improve and eliminate difficulties..."*

		• *"... to improve practice ... more questions to carry out more game-type tasks to develop my skills."*
To promote more educational digital games	2	• *"... teachers should promote the use of digital games; this would facilitate in understanding the learning content and the importance of ICT in education."* • *"... disseminate more game-type activities and include them in other courses."*
Recommendations for students to adhere	4	• *"... students to adhere and play frequently. You learn very quickly."* • *"... teachers should use it to engage students ..."* • *"... it will help to improve student performance."* • *"I recommend my peers to play the games because they have a lot of advantages such as stimulating team working and development of skills..."*
Other	2	• *"It is essential for teachers to pay attention to the opportunity to learn from students..."* • *"I would recommend allocating more devices for helping in learning."*

Table 4.7 shows six distinct codes of suggestions that emerged from the comments of the students, along with the corresponding number of students and some quotes. 18 students suggested improving the existing Quizventure game activity, while 13 proposed the creation of additional games and levels, indicating a desire for greater variety and complexity in the gaming elements of the course. On the other hand, two students suggested either removing or altering the Quizventure game activity from the Moodle course. Four students suggested providing additional details and instructions, to improve clarity and understanding of course content and activities. A student suggested the implementation of a system for rewarding students, to incentivize them to participate in online learning activities. Five responses fell under the category of Other, indicating suggestions that did not fit into the specified codes.

Table 4.7: Students' suggestions

Code	Number of Students	Selected Students' Comments
Remove or change the space ships game	2	• *"…remove the space ships game, it is very childish."* • *"… replace the spaceship game, I couldn't understand how to play it."*

Improve the space ships game	18	• *"Space ships games are interesting but they are difficult to play. They have to be little bit easier to play."* • *"... its quality should be better ..."* • *"…increase lives in the game."* • *"Space ships games should be more simple and less challenging. I had difficult in understanding how it works."* • *The answers came down very quickly. I ended up abandoning it"* • *"... improve the background image in space ships game…"*
Create more different types of games and levels	13	• *"... create games that promote active participation to retain student engagement and motivation and stimulate critical thinking and creativity."* • *"Create more activities that could motivate the use of platforms in education."* • *"Create games with different levels, from one and go on…"* • *"Create games easier to understand and manipulate."* • *"You should modernize the type of the games. For example: create games such as the Who Wants to Be a Millionaire? game"* • *"…. more type of game with positive effect, such as to promote active learning and motivate students to reflect on the course content."* • *".. More games to help to open the mind of student"*
Provide more details and instructions	4	• *"... I would like it if I had more explanation…"* • *"…. teachers should explain some difficult tasks, …., during the classroom lessons."* • *"Provide more details about the rules."* • *"You should put on the platform video explaining how to play the space ships game…."*
Adopt a system for rewarding students	1	• *"In addition to playing and gaining points, students could earn some rewards in the real world."*
Other	5	• *"Continue working to improve the platform to turn it attractive"* • "*Provide more time to complete the activities, particularly for students from night class."* • *"Evaluate the skills of the students to use computer…"* • *"Create a web page that is more practical and easier to use."* • *"Provide more training."*

4.1.4. Study Practitioners

As mentioned before, the study had the support of three teachers who actively engaged in creating activities in their online course in Moodle using gamification elements. Their contribution was crucial in encouraging students to participate in the intervention and in communicating with the participants during the study. Two teachers were teaching the ICT in Environmental Education course to the first-year students of the Licentiate in Environmental Education Programme, in the daytime and after-work classes at the Faculty of Education. Another teacher was teaching the Computer Networking course to the third-year students of the Licentiate in Informatics Engineering Programme at the Faculty of Engineering.

All the teachers were interviewed at the end of the intervention. They were asked open-ended questions about their previous experience with gamification in education, the challenges faced during the intervention, their reflections and satisfaction in using Moodle with game elements.

4.1.5. Teachers' perceptions toward gamification in education

The term gamification was new for most of the teachers involved in this study. Initially, there was some confusion about what gamification entails. However, after clarifying that it involves integrating game elements into a non-game context, such as in education to enhance student motivation and engagement, teachers eagerly embraced the proposal to implement gamification in their Moodle courses.

4.1.6. Teachers' reflections towards the experience of use Moodle with game elements

To help in understanding the teachers' reflections towards the experience they just had in using gamification elements in their Moodle courses, the transcriptions of the interview recordings were coded using the open coding method. The data were read and reread multiple times to identify the phenomena and determine the codes based on the teachers' responses. Furthermore, the interrelated codes were grouped into categories. Benefits, usability, challenges, motivation, and recommendations were the key categories that emerged from analysing the data collected from teachers' interviews.

Table 4.8 shows two codes of benefits in using gamification elements within a Moodle course that were determined based on the teachers' responses. The teachers said that gamification had a

positive impact on students' engagement and motivation. It helped to increase students' participation on online activities within the Moodle platform, even among those typically averse to technology. Additionally, teachers said that by encouraging students to engage with learning material to earn points, gamification contributes to improve student retention of course content.

Table 4.8: Teachers' reflections about the benefits of gamification in Moodle courses

Code	Teachers' responses
Useful in engaging and motivating students	• *"It was interesting because we wanted to engage students in using the platform. We have done it before, however as it is a first-year course, we work with a large group of students, hence we usually are unable to engage with all students whether discussing in online forums or providing feedback in other activities. Using gamification elements helped to accomplish it, we could manage to have more than half of the students (if not the entire class) engaged in the Moodle platform. Even students from the evening class, who are averse to technology, were able to engage in online activities."* • *"Many students today spend a lot of time on the Internet. Some of them get bored having to attend classroom lessons or to read learning material. However, as we could experience, using something linked to a game motivated students to interact with the course online learning material and activities. So, this is useful and easy way to motivate students to learn."*
Useful to promote retention of course content	• *"I visualise this type of activity as an opportunity to improve teaching because many students will not take it seriously but will be learning something related to the course content."* • *"While the student thinks he/she is relaxing, he/she is playing, he/she is learning…"* • *"Because students focus on earning points. To earn points, they have to read the content and understand it. So, that's it, there is a direct interaction between knowledge development and the game they are playing."*

Table 4.9 presents the two codes of usability of gamification elements in Moodle that were determined based on teachers' responses. Some teachers expressed that incorporating gamification elements into a Moodle course is not an easy task, particularly for teachers with a lack of ability to work with computers and related technology. However, despite the complexity, teachers believe that gamification elements in Moodle can be used to gamify different activities in distinct types of courses. They said that with sufficient practice and creativity, it is possible to incorporate this technology in courses from almost all fields.

Table 4.9: Teachers' reflections towards the usability of game elements in Moodle

Code	Teachers' responses
Not easy to use	• *"Many of us (teachers) are not well prepared, we are not familiar with this new practice involving using technology. So, when it comes to gamification in education, the process becomes more complex. It requires adapting a certain Moodle game element to a course learning content, which is not an easy task."* • *"The platform has a bit of complexity. It is very challenging for teachers because it requires a certain ability to understand how Information Technology works"*
Applicable in courses from diverse fields	• *"In my opinion, gamification can be applied to most of the courses, except for one or other. However, with a bit more research and creativity it is possible to find a way to apply this technology in any course. It may not even be applied in the entire semester or using all content, because even in practical courses with practical topics, there is theoretical content which can be taught using gamification elements."* • *"In my opinion, the game elements are applicable in courses of the engineering sector. The results can be seen. There were students who did not know what a switch, router or network card was. However, using gamification elements in Moodle helped a lot because students were able to visualise the networking devices while learning and playing games."*

Table 4.10 shows the three codes of challenges in implementing gamification elements in Moodle that were determined based on the teachers' responses. Teachers said that the lack of computer literacy among their peers and students is one of the challenges in implementing gamification in Moodle courses. According to the teachers, the lack of sufficient devices and problems with Internet access also negatively affect the adoption of this practice. Some teachers expressed concerns about the insufficient evidence of the impact of using Moodle with gamification elements on student knowledge development. They observed that time constraints and mandatory participation led students to focus more on completing the online activities to merely earn points on the platform than on genuine learning.

Table 4.10: Challenges teachers faced in using Moodle with gamification elements

Code	Teachers' responses
Varied levels of computer literacy among students and teachers	• *"Obviously we had some challenges, many students did not understand how to deal with some aspects from gamification elements. We had to provide support, however even for us teachers it was a little difficult, considering that it was our first experience dealing with this. We ended up discovering that we also had some difficulties."* • *"It is challenging considering that most teachers still have difficulty in using digital devices. So, it is still challenging. For example, there are some teachers who continue not accepting students to bring to classroom information consulted on the Internet."*
Lack of sufficient devices and problems with Internet access	• *"We have computers in the teachers' room and in some offices, but there are not enough. For example, 2 of our office mates don't have computers. Overall, we can say that half of the teachers in our Faculty do not have computers. It is a very critical situation. How can we disseminate the use of technology, if we as teachers do not have computers?"* • *"There are times that we do not have access to the Internet from the Faculty and we are forced to use our own resources. On the other hand, many students use the time at home to accomplish their tasks. Using the platform to carry out tasks involves more costs for students because to access the Internet they must have the famous megabytes from a mobile network operator."*
Platform login and access issues	• *"Many times students don't succeed to login to the platform, which is a headache for us as teachers. If we want to use gamification for example, the platform has to work properly. Imagine a situation where we tell the student, the task must be accomplished within a certain period from X to Z, and whoever enters after that period does not earn points. But a student has login issues at that time or he/she can't access the platform."* • *"Somehow, account issues on the platform can demotivate students in using it."*
Insufficient evidence of the effect of using Moodle with gamification elements on student knowledge development	• *"To be honest, I couldn't see if the student learned. Maybe because we had little time to explore. As I already said, we had this experience at the end of the semester, there was very little time left before classes ended. And it all happened very quickly, the students were put under pressure. So much so that they had to use gamification compulsively. It was mandatory and students were only worried about gaining points."* • *"In some questions, I doubt that their responses were based on knowing the answers. I think they just attempted to gain points. There was a lot of pressure. We did not give students enough time to engage with the learning material to be prepared to*

	respond to the questions within the games. We just put it there. So, I have doubts that they have read all the learning material, because time was short. I also think that because of the pressure, some may have even carried out the tasks in groups."

Table 4.11 shows the two codes of motivation that were determined based on teachers' responses. Overall, teachers expressed high satisfaction towards the use of Moodle with gamification elements and they were eager to repeat the experience. They appreciated the appearance of the Moodle course with gamification elements, particularly the ability to individualise student actions within the platform. After the experiment of this study, teachers said that they were ready to apply gamification in their course, although some of them had expressed a need of a little assistance to make it.

Table 4.11: Teachers' motivation towards the use of gamification elements in Moodle course

Code	Teachers' responses
Satisfaction	• *"I would rate myself as a 10 out of 10 in my satisfaction in using Moodle with game elements. It is worth it to invest effort in this type of thing."* • *"I really liked the way the Moodle course was configured in this experiment. Individualising the students' actions within the platform is interesting. Students felt that they were being controlled. The fact that when a student completed a certain activity he/she earned points (for example earning points for downloading a learning material) was awesome. When we are doing an activity and then see that our peers have already advanced or completed the task, and we can even see the names of these students, how do we feel? Worried, the thought that arises is that if my colleagues have already completed the activities, I have to do the same."*
Readiness to use	• *"We are very satisfied, and we even want to repeat the experience. We are a bit anxious because we wanted to start soon and monitor students from the beginning until the end of the semester. We are very motivated and the majority of students were motivated in using the game elements in Moodle."* • *"Look, I think we already have the basics to create online activities on the Moodle platform. So I can do it, but with a little help."*

Table 4.12 shows the three codes of recommendations for effective use of gamification elements in Moodle that were determined based on teachers' responses. The first recommendations from teachers were to adopt strategies that would encourage students to accomplish online activities, such as ensuring the access to Moodle without any additional Internet cost for students and, attributing value to online activities that would reflect on the students' final grades. The teachers also suggested providing training to them and their peers in using Moodle with gamification elements, as well as in computer skills. Furthermore, the teachers recognised the importance of educational technology and recommended its dissemination and more research in this field.

Table 4.12: Teachers' recommendations

Code	Teachers' responses
To adopt strategies to encourage the usage of Moodle with gamification elements	• *"One of the biggest challenges was that most students used the platform from home, using their own resources to access the Internet. Thus, if the access to the platform was for free, with no additional costs for students, which would help."* • *"In the evening classes, where students are slightly older, I have noticed a bit of resistance in using Moodle. However, knowing that it is an activity in which the student will have something to be evaluated, I think they will dedicate more time on it. It is important that the online activities be valued, it provides something that will reflect in the student's final grade."*
To train teachers in using Moodle with gamification elements	• *"We should start by building teacher capacity to effectively implement gamification in teaching practices. In my opinion, if we want to introduce a new technology for students, we have to be familiar with it."* • *"There is a need for training because some teachers can say they can manage to use Moodle, while they don't actually know how it works. And gamification entails more work in preparing the learning materials and adapting them to gamified activities. You know that we still have teachers with a lack of computer literacy (the ability to use technology), they need this training."*
To promote and explore more educational technology	• *"There are two essential actions to be taken: dissemination and training."* • *"Perhaps exploring more technologies that allow teachers to motivate students to accomplish practical activities would be helpful to promote active learning."*

4.2. Discussion

Advances in technology are having an impact on society. Education, being crucial for society, must constantly adapt to meet the challenges posed by rapid developments (Serdyukov, 2017). The introduction of new technology, such as gamification, into teaching methods and practical pedagogy is revolutionizing education and having a positive effect (Mikheeva & Pankova, 2021). Thus, teachers are required to be prepared and capable to participate in innovative educational processes (Alsawaier, 2017; Mikheeva & Pankova, 2021). While recognising the value of technology in education, researchers emphasise the importance of careful learning design for its proper integration into teaching (Laurillard, 2002 ; Alsawaier, 2017; Leung et al., 2022). In this study, the application of Laurillard's (2002) Conversational Framework assisted in providing teachers with implementation guidelines for designing learning activities using gamification elements in Moodle.

Overall, the results show that both students and teachers were satisfied with using Moodle with gamification elements. Most students enjoyed the experience of learning through gamified activities in the Moodle course. The high level of teacher satisfaction motivated them to continue using the gamification elements in Moodle courses, despite recognizing the need for additional support and training due to the complexity of the work it entails. This aligns with Demirbilek et al. (2022) findings, who suggest that gamification makes learning more enjoyable, and teachers incorporate it into their courses to make lessons more engaging.

The small group of students who did not enjoy the experience reported that they found the task difficulty to understand, and some activities were not easy to accomplish. This dissatisfaction among students may be related to the lack of computer literacy. About 44% of students said that they have difficulty in using computers and related technology. However, Kolhar et al. (2021) found that university students dedicate a lot of their time on social media, which also requires digital literacy, as well as digital devices and Internet connectivity. Students enjoy using WhatsApp, Facebook, TikTok and Instagram due to their attractive features (Orji et al., 2022).

Therefore, considerable effort must be made to design enjoyable, motivational and easy to use gamified learning environments, similar to the way social media platforms attract and engage users. This is also defended by Gupta & Goyal, 2022, who state that to advance the work of student

engagement, gamifying courses could involve incorporating additional tasks, game elements, and apply other learning theories to design gamified activities.

The results from this study were examined through the lens of the Laurillard's (2002) Conversational Framework to assess, from the perspective of teachers and students, how using gamification elements in Moodle contributes to enhance student engagement and effective learning. Table 4.13 provides a structured analysis of how each communication cycle in the Conversational Framework was enacted during the intervention conducted in this study.

Table 4.13: Analysis of the effectiveness of implementing gamification in Moodle through the lens of Laurillard's Conversational Framework

Communication Cycle	Data Source	Analysis	Enabling Technology
Teacher communication cycle (TCC)	Table 4.8 Table 4.12	Teachers shared the learning material with students, engaged in discussions with students, reflecting about the learning content and tasks. Both teachers and students adapted ideas accordingly.	Online learning material. Discussion forums and announcements. Points and leaderboard.
Peer communication cycle (PCC)	Table 4.5 Table 4.7	Students provided feedback and discussed their experiences with peers about the tasks designed using gamification elements.	Not enacted in the Moodle platform.
Teacher practice cycle (TPC)	Table 4.4 Table 4.5 Table 4.6 Table 4.7	Students applied concepts through gamified activities and received feedback from teachers, influencing their understanding and engagement.	Assignments. Points and leaderboard.
Teacher modeling cycle (TMC)	Table 4.3 Table 4.4 Table 4.5 Table 4.8	The use of Quizventure, H5P interactive content activities provided immediate feedback, helping students to adapt their responses and retain content. It also enhanced online student engagement.	Quizventure. H5P. Points and leaderboard.
Peer modeling cycle (PMC)	Table 4.6 Table 4.7	Students observed and learned from their peers' interactions with gamified activities, leading to shared strategies and collective improvement.	Not enacted in the Moodle platform.

The results show that the use of gamification elements in Moodle contributed to motivating the iterations in three of the five teaching and learning communication cycles in the Conversational Framework. This is aligned with Leung et al. (2022) findings, who found that gamification was useful in motivating learners to engage with learning activities. The gamification elements leveraged the iterations in teacher communication cycle (TCC), teacher practice cycle (TPC) and teacher modelling cycle (TMC), as detailed as follows.

4.2.1. Using gamification elements in Moodle to support TCC

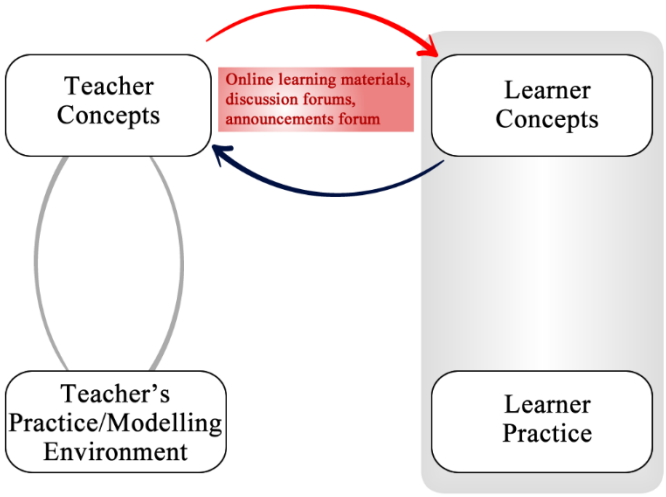


Figure 4.11: Gamification in Moodle supporting Teacher Communication Cycle

The teacher communication cycle enables students to refine their understanding by giving them access to the teacher's concept (Laurillard, 2002). To accomplish the gamified activities, students had to carefully read the instructions and engage with the learning materials available as resources in the Moodle platform. Teachers would upload texts or videos in which they explain concepts of a topic.

Through the integration of gamification elements, teachers would set up the Moodle course to automatically give points to students for completing certain activities or resources, which encouraged them to interact with the learning material. The use of gamification elements in Moodle thus enabled students to modulate their concepts by motivating them to consume the topic content, while their focus was on gaining points for each action taken in the learning materials.

After engaging with the online learning materials, students had the opportunity to interact with their teachers for clarifications of the topic content. In the experiment, students' questions and

teachers' feedback were enacted in the physical classroom. However, teachers would implement an online discussion forum on which students earn points for each question post or response within the gamified Moodle course. It can also enhance the communication between teachers and students, in the way that it provides a means for students who have not been able to attend the class or did not have opportunity to present questions within the classroom, to do so (Holmberg, 2017).

4.2.2. Using gamification elements in Moodle to support TPC

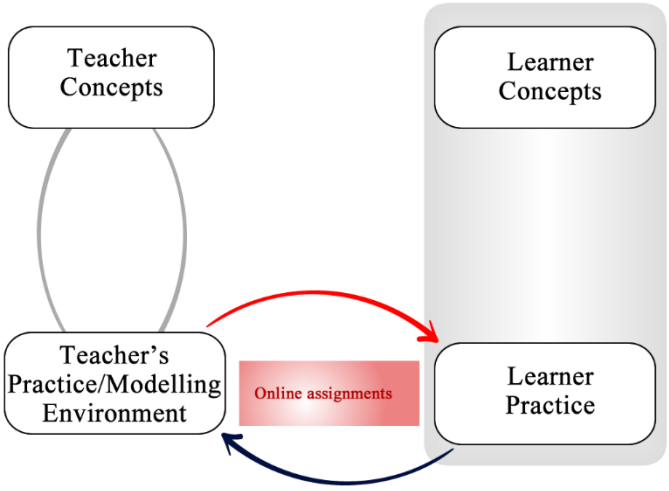


Figure 4.12: Gamification in Moodle supporting Teacher Practice Cycle

In the teacher practice cycle (TPC), students take practical actions by applying concepts and receive feedback from teachers (Laurillard, 2002). In the experiment, it was done by giving online assignments to students. Each student had to reflect on the concepts that they had just learnt and to submit in the Moodle course a summary of the topic. The summary would be written directly in the text field within the online assignment or submitted by uploading a file. Teachers could comment directly on the student work and give marks. To receive points for completing the activity, students had to obtain a minimum mark determined by the teachers. After having the feedback from their teachers, students could repeat the task until they get the minimum mark required to earn points.

However, despite the activity having been set up in the gamified Moodle course both students and teachers did not use it in the expected way. There were few students' submissions and no comments and marks in the students' works. The uncertainty about the students' levels of understanding of the topic associated with time management problems contributed to the low

engagement in this gamified activity. Teachers said that due the experiment was carried out at the end of the semester, students had a lot of pressure, and it was not known whether the students' responses were based on their understanding of the topic, or they were simply attempting to gain points. But they acknowledge the potency this way of interacting with students within the Moodle platform must motivate students to understand the concepts that are to be learned.

The TPC helps teachers to have insights into their teaching practices and to verify whether students are achieving the desired learning outcomes (Holmberg, 2017). The latter is one of the challenges teachers found in the experiment. This would not be a problem if both students and teachers had engaged with the activity designed for this purpose.

4.2.3. Using Moodle with gamification elements to support TMC

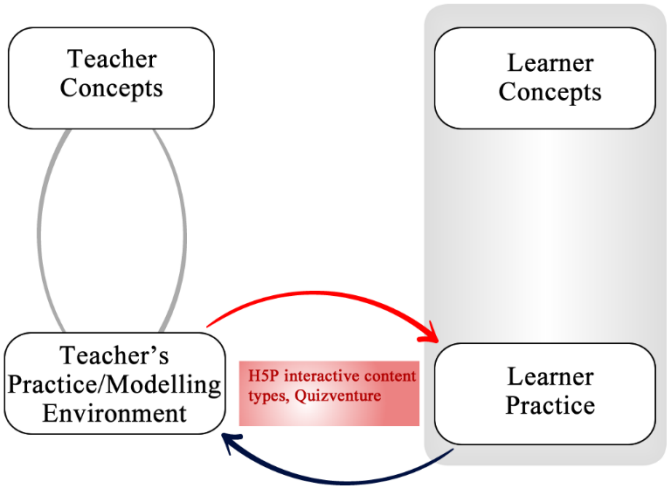


Figure 4.13: Gamification in Moodle supporting Teacher Modelling Cycle

Teacher modelling cycle (TMC) is when an educational technology provides students with feedback on their practices (Holmberg, 2017). In the experiment, gamification elements were used to promote the TMC within the Moodle course to a considerably higher degree than the TCC and the TPC. Indeed, the provision of immediate feedback in the gamified Moodle course was praised by students, as it helped, they understand their progress and performance.

In addition to earning instant points for accomplishing the tasks, there were two types of activities in which students received immediate feedback from the Moodle platform. There were created interactive content type questions using the H5P elements and spaceships games using the

Quizventure element. In each activity, students could attempt multiple times to find the correct answer.

The results show that both types of gamified activities contributed to a positive learning experience. Overall, students were satisfied with the practice of using interactive content type questions as learning activities, while they had considered the spaceships game challenging but motivating to have a deep understanding of the learning topic concepts. In addition, immediate feedback based on the user's performance helps the student to learn and to achieve their educational outcomes (Burgos et al., 2007) and assists teachers to overcome the challenge of engaging with a large group of students. After having immediate feedback from the Moodle platform, students could identify their mistakes and correct them without the intervention from the teacher. It made the learning activity more dynamic and interactive.

Thus, the interactive nature of gamification elements including immediate feedback made the learning activity enjoyable, stimulated students' engagement and motivation to learn in this study, as predicted by previous literature (Barghani, 2020; Putz et al., 2020; Gupta & Goyal, 2022).

4.2.4. Challenges in implementing gamification within the Moodle platform

Despite the positive impact of using Moodle with gamification elements on students' achievements (Poondej & Lerdpornkulrat, 2019), the results indicate that to gamify learning is not an easy task. Gamification requires a certain teachers' capability, technology availability and technical support (Paľová* & Vejačka, 2022).

However, it was found that there are diverse levels of computer literacy among students and teachers. Some teachers and students do not have the ability to operate computers easily. Therefore, it was difficult for them to manage to use gamification elements in their online Moodle courses.

As previous found by Demirbilek et al. (2022), the second gamification challenge identified in this study was related to technology access, particularly computers and Internet connectivity. Despite the UEM's efforts to promote the use of technology in teaching and learning, there are a considerable number of teachers that do not have access to computers in their work place. Some teachers' rooms do not have sufficient computers available. Internet access also remains a

challenge in some Faculties. Teachers reported varied situations in which students had to use their own resources to access the Internet, which had financial implications for them.

There were also found negative situations related to the lack of sufficient technical support for assisting teachers and students in using Moodle platform. The lack of support from the institution leads teachers interested in using gamification elements to do it on their own, based on their own experience (Svanberg & Bergh, 2023), and also contributed to demotivating them.

These challenges pose a barrier to incorporating, not only gamification elements, per se, but the technology into teaching and learning practices at UEM.

4.3. Chapter Summary

A mixed methods case study research was conducted to investigate ways to integrate gamification elements into Moodle platform to support in enhancing student learning engagement and academic results. This chapter presented the study results. It includes participants' background information, their satisfaction in using Moodle with gamification elements, challenges, and recommendations. Also, it illustrated the practitioners' reflections towards the intervention conducted. In discussion of the results, this chapter adopted the Laurillard (2002) Conversational Framework to analyse and explain the phenomena emerged from the data.

Chapter 5: Conclusion

The study investigated the application of gamification elements in Moodle platform to enhance students' engagement in higher education. In addition to the built-in gamification elements in Moodle, the plugins, Level up block, H5P interactive content and Quizventure game were integrated to incorporate more gaming mechanisms in the platform and to enrich the experience for teachers and students.

The research sought to answer two questions:

1. What gamification elements in learning management systems are most effective for enhancing student engagement in higher education?
2. How can teachers design and implement gamification in Moodle courses to enhance student engagement and support the achievement of learning outcomes in higher education?

This chapter presents the conclusion derived from the results and discussion chapter, along with a review of research questions. It also covers the limitations of the research and recommendations for further research.

5.1. Study findings

The study began with an exhaustive literature review as an effort to find studies showing the effectiveness of gamification in enhancing online student interactions in higher education. There were found various studies showing that gamification poses a positive effect on motivating students to engage in online learning in higher education. The outcomes of the consulted studies suggest that overall the application of the game mechanics, such as points, levels, badges and rewards, increases student motivation and engagement, leading to reduced dropout rates and to enhanced students' learning outcomes in higher education (Viamonte & Figueiredo, 2019; Paľová* & Vejačka, 2022; Adam & van den Berg, 2022). The use of leaderboard gamification element in online learning also enables some social aspects, such as student autonomy, voluntary collaboration and a sense of relatedness (Adam & Van den Berg, 2022).

To address the second research question, this research adopted the mixed methods case study approach and applied the Laurillard (2002) Conversational Framework to develop learning design principles to help higher education teachers to enhance students' engagement in online learning. As a result, the study provides indicative guidelines for a learning design practice using gamification elements within the Moodle platform. These guidelines are detailed in the Appendix A. They were tested and refined through an experiment carried out at Eduardo Mondlane University, a Mozambican higher education institution. The experiment conducted in this study involved three teachers as practitioners and 112 students as participants who voluntarily accepted to collaborate in this study.

The study found that the application of gamification created an enjoyable and meaningful online learning environment. Overall, students enjoyed the experience of using Moodle with gamification elements and demonstrated motivation in engaging with the gamified online activities. Although some students considered the activities difficult to understand and to accomplish, leading to them not having an enjoyable experience.

The Laurillard (2002) Conversational Framework also helped in examining how gamification elements supported teaching and learning in the experiment conducted in this study. The findings demonstrate that gamification elements in Moodle enhanced teaching and learning through supporting the TCC, TPC and TMC. In other words, the gamification elements in Moodle were used to support interactions between the teachers and students in three different communication cycles. Through the application of gamification elements, such as points, levels, rewards and leaderboard, teachers were enabled to motivate students to engage with online learning material and to participate in online discussions forums within the Moodle platform. This contributed to a more dynamic and effective TCC, leading students to learn and reflect on the concepts. The use of gamification elements to support the TPC within Moodle was less explored in this study. The way in which it was done was through the integration of scoring game mechanics in online assignment activities. However, despite teachers having considered this useful way to promote interactions in TPC, it was not significantly used as intended in this study due to academic pressure on students and time management issues. The way in which gamification elements supported TMC within the Moodle platform was by automating feedback through multiple choice type questions in H5P interactive content activities and the Quizventure game. This posed positive attitudes and

satisfaction among students and teachers. Students were more motivated to engage in activities of the TMC, in which they had immediate feedback, and they could correct their initial incorrect answers based on the information given from the platform. It was also found that by enabling a dynamic and interactive learning environment with automated feedback, gamification elements in Moodle not only enhance student learning, but also alleviate the workload on teachers, who in many times must work with a large group of students.

These findings can be related to the Franco (2022) study, who found that gamification makes a significant contribution to student motivation, performance, and learning commitment, potentially enhancing the quality of online learning in Mozambique.

5.1.1. Research Questions

The research questions were addressed, as detailed in the following.

First Research Question: What gamification elements in learning management systems are most effective for enhancing student engagement in higher education?

The results suggest that avatars, quests, challenges, points, levels, badges, and leaderboards are among the most frequently used gamification elements for enhancing student engagement in higher education. Specifically, the incorporation of points, levels, and quests, combined with immediate feedback in the Moodle LMS, was found effective for fostering interactions in online learning. The study demonstrates that using Moodle features such as Level UP, Game Module, Quizventure, H5P Interactive Content, Stash, Block, and the FastTest plugin, to incorporate gamification elements in higher education environments can significantly enhance student engagement and learning outcomes.

Second Research Question: How can teachers design and implement gamification in Moodle courses to enhance student engagement and support the achievement of learning outcomes in higher education?

The study presents a theoretical and practical approach to designing and implementing gamification in Moodle to enhance student engagement in higher education. It covers the underlying theories and concepts related to gamification, exploring how it can enhance student

engagement and learning results in higher education. The study adopts the Conversational Framework to provide teachers with guidelines to design and implement learning experiences that integrate gamification elements in Moodle. The outcome of the intervention demonstrates how university teachers can integrate these elements into their courses to support in enhancing student engagement and learning results.

5.2. Limitations of the study

There are some limitations of this study. The first limitation is that the intervention was carried out at the end of the semester when students and teachers were under pressure and did not have sufficient time to explore all the opportunities that gamification elements provide to teaching and learning in Moodle. Similarly, there were additional Moodle plugins, such as Stash and Block game, which incorporate game mechanics that were not integrated in this study.

Another limitation was that the study did not illustrate ways in which gamification elements in Moodle support the PCC and PMC in the Laurillard (2002) Conversational Framework. Despite teachers having mentioned that there were interactions between students and their peers in which they helped each other using WhatsApp groups and other means, there was no evidence showing that these communications cycles were enacted within the Moodle platform with the use of gamification elements. Thus, they have not been analysed. Furthermore, motivation in TCC and TPC was supported solely by points and rewards gamification elements, whereas in the TMC it was enhanced by these mechanisms as well as the additional features of H5P interactive content and Quizventure. To clarify, besides the benefits derived from using points and rewards, the study found no additional evidence of the effectiveness of gamification in Moodle in enhancing student engagement in TCC and TPC. Therefore, since each of the Conversational Framework communicative cycles is vital for students knowledge development in the learning process (Laurillard, 2002), there is a need for examine how to enact all these ways of interactions within the Moodle platform using gamification elements to support in enhancing student engagement and learning restults.

Lastly, the results indicated that the prototype solution should be refined and retested to address the concerns raised by teachers and students who participated in the intervention conducted in this

study. However, this refinement and retesting were not carried out due to constraints on time and the limit of words for this minor dissertation research.

5.3. Further research

Although the objectives of this study were successfully achieved, its findings and limitations bring some possible questions that could be explored. The following are some potential future studies that could be triggered from this study.

5.3.1. Investigate the factors that can contribute to demotivating the use of gamification elements in online learning environments

This study contributed to demonstrating how to use Moodle with the support of gamification elements to enhance student engagement and to promote effective learning. However, the results also show that there was a certain student demotivation posed by using Moodle with gamification elements. The typical challenges of computer literacy, access to the Internet, availability of digital devices and excessive workload were mentioned as factors influencing demotivation in using the gamified environment in this study. However, these negative situations were not discussed in this study. Adam & van den Berg (2022) found that there were some students who were demotivated by their peers to engage in a gamified online environment, a phenomenon which had not been widely explored in the literature. Therefore, apart from providing teachers and students with the required resources of technology to engage in online teaching and learning, it is recommended to investigate in-depth the factors that may create negative situations in gamification implementations within online environments supporting higher educational courses in Mozambique.

5.3.2. Explore more game mechanics to create different types of activities in Moodle

More efforts could be taken to improve the Moodle platform at UEM in order to make it more attractive for students. This study explored some of the varied plugins to incorporate game mechanics into Moodle platform. Additionally to this, this study only explored the gamification elements to support the TCC, TPC and TMC in the Laurillard (2002) Conversational Framework. Therefore, investigations must be carried out to explore gamification elements in Moodle to create effective learning experiences supporting the five communication cycles in the Laurillard (2002) Conversational Framework, including the PCC and PMC. Teachers should explore the affordances

of gamification mechanics that the different Moodle plugins and elements not explored in this study may provide to them and their students.

5.3.3. Develop strategies to promote the incorporation of gamification practices into higher education in Mozambique

This study found that gamification in Moodle increased student engagement in online learning. Furthermore, it was found that the students and their teachers spent increased amounts of time on the Internet compared to what they usually do. Thus, Internet connectivity is vital for the success of this type of educational technology initiative. However, the cost of Internet data in Mozambique is another pandemic. The UEM has been spending significant amounts of money on Internet costs, sometimes having to use project funds to pay for these expenses. In addition to this, most of the students depend on their parents, who must cover all their expenses, including the study fees and Internet costs. The increased time spent on the Internet driven by the integration of gamification practices in the online learning environment can cause a significant socio-economic impact on students and their parents, as well as on the UEM. Demirbilek et al. (2022) found that gamification implementations are not reaching the expected outcome, partly due to the financial and sociological obstacles. Therefore, there is a need for researchers to address questions related to the socioeconomic and cultural effects of gamification implementation in online learning, now that the Internet is increasingly impacting education. This is essential to develop motivational strategies, such as zero-rated sites and reduced data costs. Moreover, universities in collaboration with Internet service providers and telecommunications regulator institutions may have to develop strategies to ensure that the integration of the modern digital technology in learning does not cause barriers to students participating in activities that are typically easy to do in normal face-to-face classroom teaching.

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APPENDICES

Appendix A: Guidelines for Gamified Online Learning Design in Moodle

This document presents design principles to assist teachers in creating effective and engaging online learning experiences using gamification elements within the Moodle platform. The design principles are organized into two sections: conceptual and practice levels.

At the conceptual level, the teacher provides descriptions of theories, concepts and ideas, while also facilitating discussion with and between students within the learning environment. This can be enacted either online or in a classroom setting.

The practice level focuses on creating practical learning activities to engage students within the Moodle platform.

<table>
<tr><th colspan="2">Session Details</th></tr>
<tr><td>Topic:</td><td rowspan="3">Aims</td></tr>
<tr><td>Learning Duration:</td></tr>
<tr><td>Number of Students:</td></tr>
<tr><td>Description:</td><td>Outcomes:</td></tr>
</table>

<table>
<tr><th colspan="5">Teaching and Learning Activities</th></tr>
<tr><td rowspan="6">Section 1: Conceptual Level</td><td colspan="4">Activity Name:</td></tr>
<tr><td colspan="2">Type:</td><td>Tools and Resources:</td><td rowspan="2">Type:</td></tr>
<tr><td>Score:</td><td>Duration:</td><td>No. Students:</td></tr>
<tr><td colspan="4">Activity Name:</td></tr>
<tr><td colspan="2">Type:</td><td>Tools and Resources:</td><td rowspan="2">Type:</td></tr>
<tr><td>Score:</td><td>Duration:</td><td>No. Students:</td></tr>
<tr><td colspan="4">Activity Name:</td></tr>
<tr><td colspan="2">Type:</td><td>Tools and Resources:</td><td rowspan="2">Type:</td></tr>
<tr><td>Score:</td><td>Duration:</td><td>No. Students:</td></tr>
</table>

Section 2: Practice Level

Activity Name:			
Type:		Tools and Resources:	Instructions for Students:
Score:	Duration:	No. Students:	

Activity Name:			
Type:		Tools and Resources:	Instructions for Students:
Score:	Duration:	No. Students:	

Activity Name:			
Type:		Tools and Resources:	Instructions for Students:
Score:	Duration:	No. Students:	

Instructions for the teachers

In the first part of the model, the teacher must provide detailed information about the learning subject, including the topic title, overall descriptions, aims, learning duration, number of students and intended outcomes.

The second part of the model consists of the teaching and learning activities. For each activity, the teacher must provide its name and duration, the learning type, number of students, instructions for students, tools and resources intended to adopt to support the learning. The name must be related to the subject and the tasks of the students or teacher in the specific activity. Duration refers to the learning time in minutes. In the instructions for students, the teacher must provide a brief description of the activity, including the tasks for being accomplished and the role of each student. In the number of students, teachers must detail the student group size. If individual student must to work alone in the activity, one can be provided as the number of students. In the score, the teacher can set points for each learning activity.

There are six learning types: acquisition, inquiry/investigation, production, discussion, practice and collaboration. Acquisition occurs when students listen to the teacher or read learning material.

Inquiry involves students investigating or asking questions within the learning environment. Production is when students create something for the teacher to evaluate and provide feedback. Discussion is encouraged when the activity involves individual students communicating about concepts with their peers. In the practice learning type, students are required to generate actions, interpret the teacher's feedback, and sometimes reflect on the concepts, to modulate their actions in order to achieve the goal. Collaboration involves students working together, whether on a project or another type of learning task.

At the conceptual level, the teacher can indicate whether the learning involves acquisition, inquiry or production, to inform how they intend to communicate about the concepts with the students. Similarly, the teacher can apply the discussion learning type to promote interactions between students.

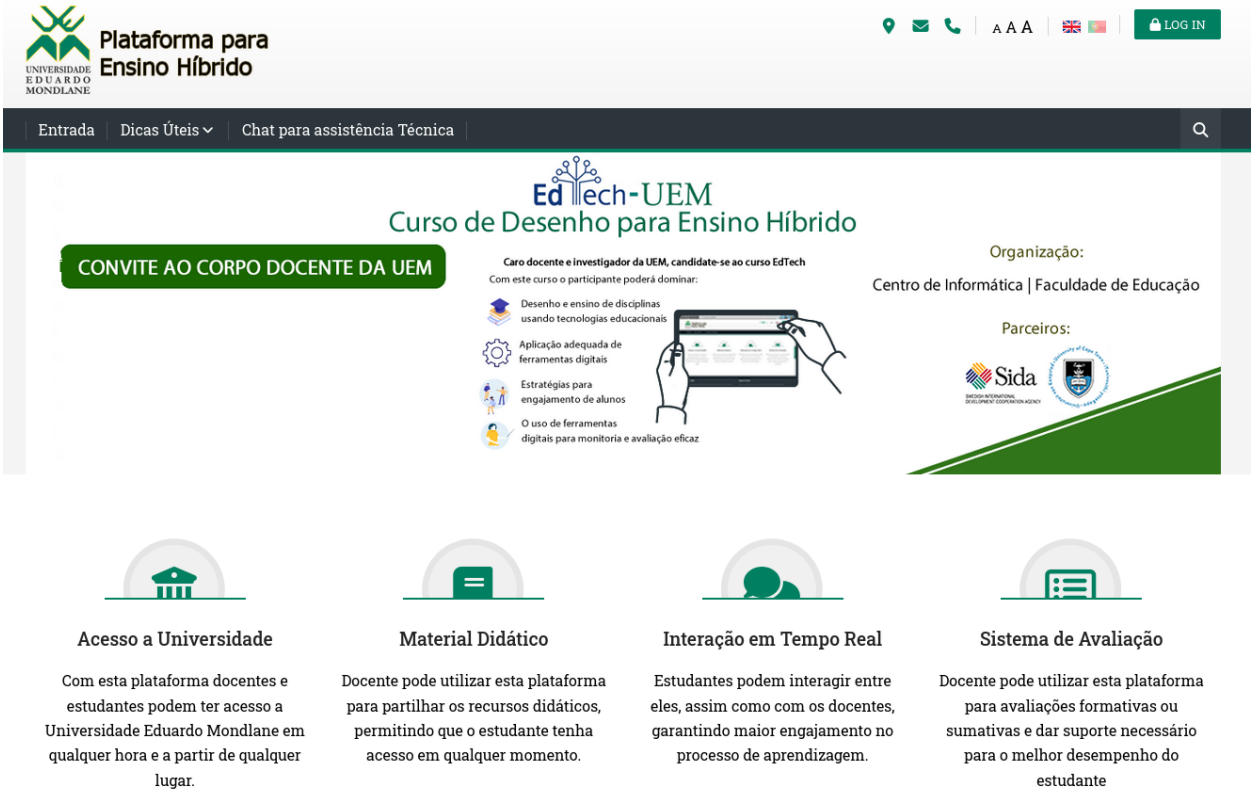
At the practice level, the teacher can indicate whether the learning type is practice or collaboration. For the practice learning type, it is important to specify whether students will receive feedback from the teacher or through the Moodle platform.

Tools and resources are directly connected with the learning type. Tool refers to the technology intended to use to support teaching and learning activities, while resource typically denotes the learning material. Resources may include uploaded files, online text (labels), pages or books, as well as offline materials. For instance, a teacher can use tools such as Quizventure game or H5P interactive content to support a practice learning type activity. More detailed information regarding the tools and resources can be obtained in the Moodle Tool Guide for teachers and educators, available online at https://moodletoolguide.net/en/.

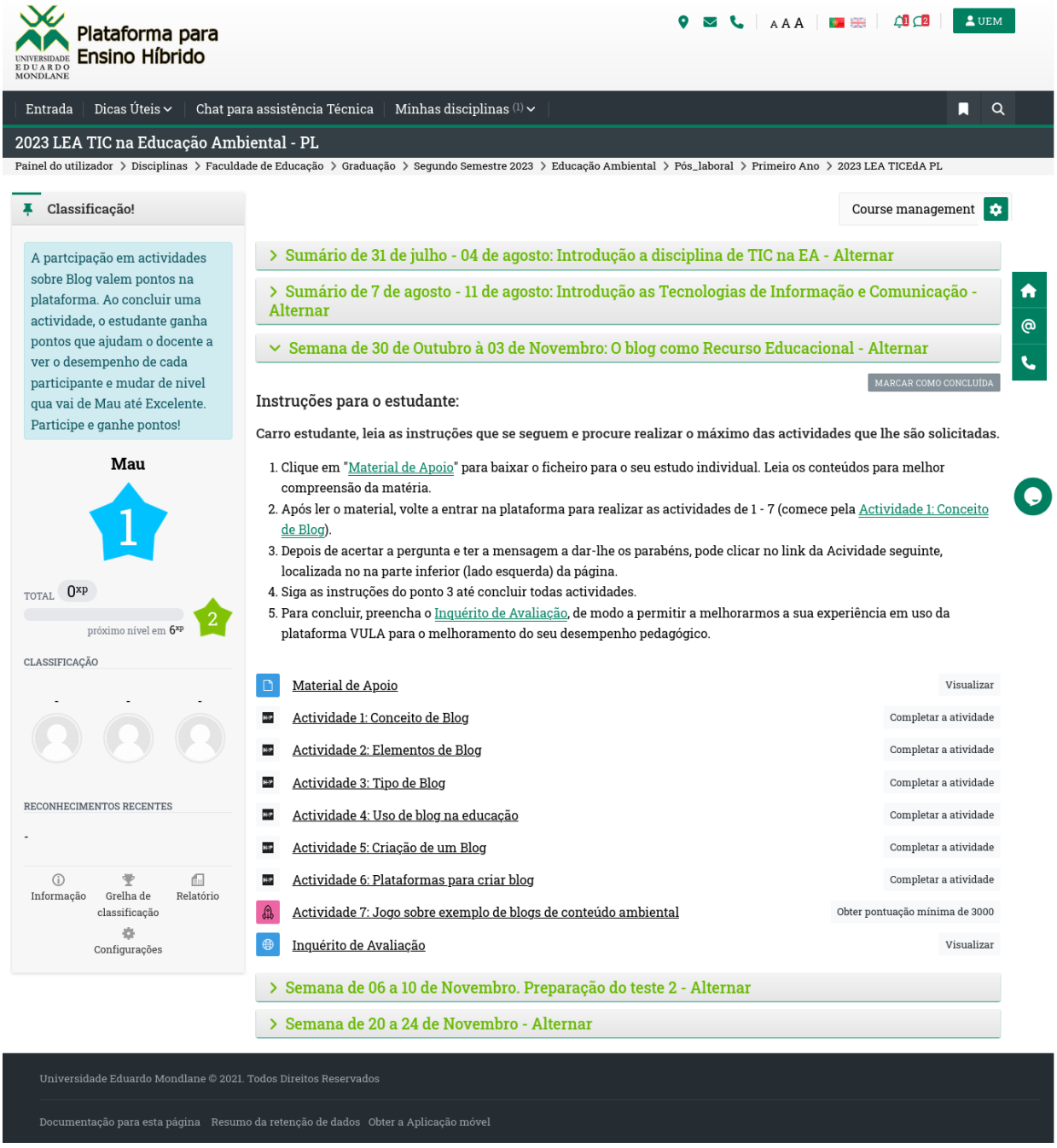
Teachers can utilize the interactive **Learning Designer** environment, available online at http://learningdesigner.org, to assist in creating effective learning designs applying this model.

Appendix B: Constructed Prototype Solution

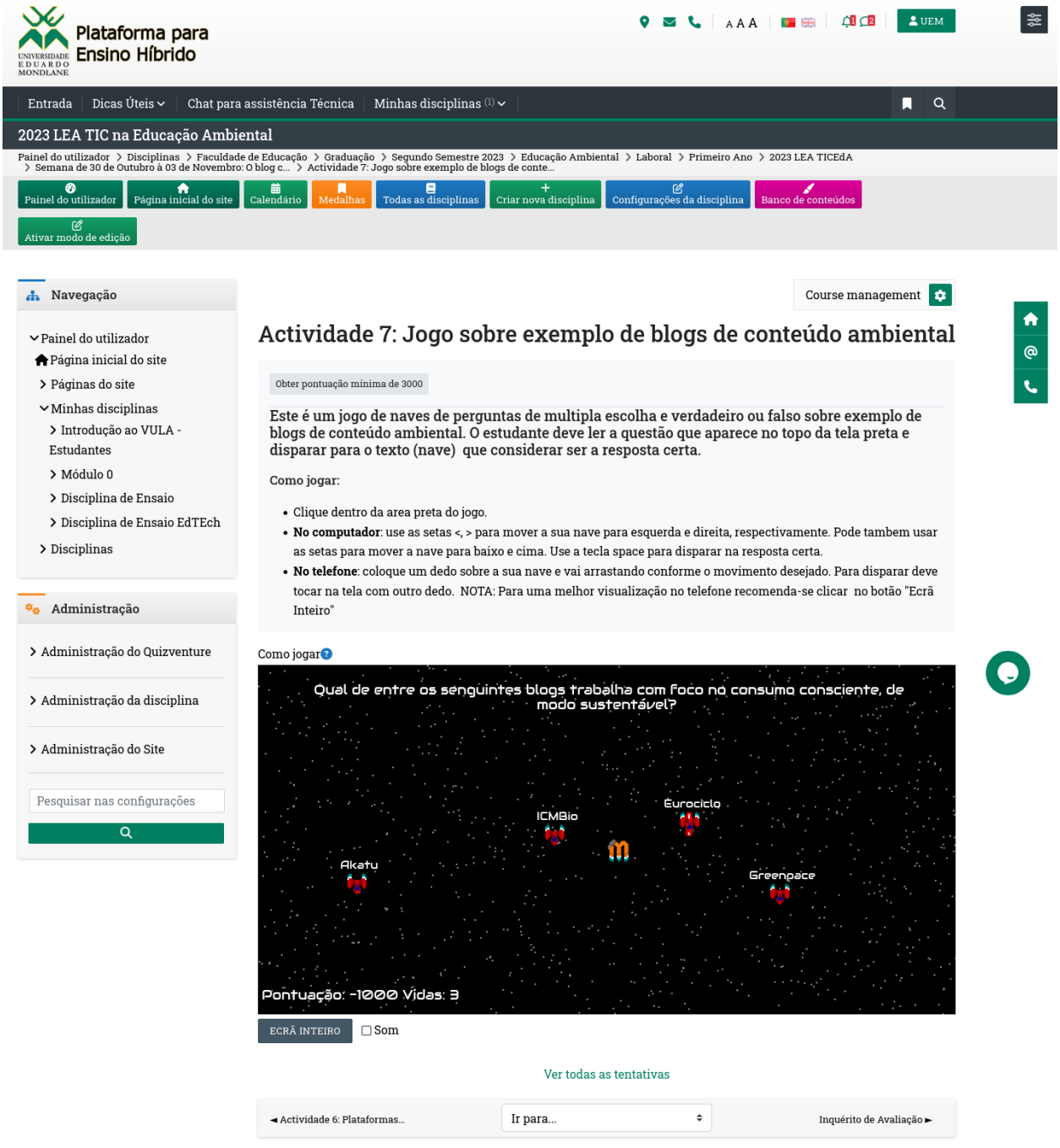
Home page of the UEM Moodle Platform, available at https://vula.uem.mz/



Gamified Moodle Course Home Page



QuizVenture Game Activity



H5P Interactive Content Activities

Actividade 1: Conceito de Blog

Completar a atividade

Preencha as palavras em falta

Blog é um _____ informativo, também chamado de _____ online, onde os conteúdos são apresentados em _____ cronológica inversa, ou seja, com destaque para as publicações mais _____, muitas vezes chamadas de blog _____.

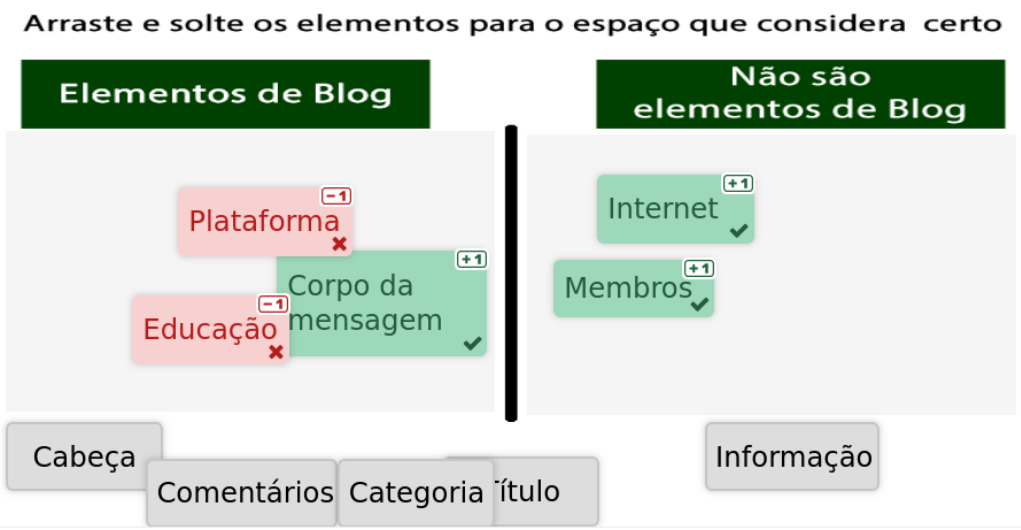
Blog é uma página na _____, frequentemente actualizada mediante a colocação de _____ ou _____ imagens_____ligações/links/hiperligações/ligacoes/ para sítios de interesse e/ou comentários e pensamentos Individuais, apresentando-se na _____ cronológica _____.

Check

Actividade 2: Elementos de Blog

Completar a atividade

Actividade 2: Elementos de Blog



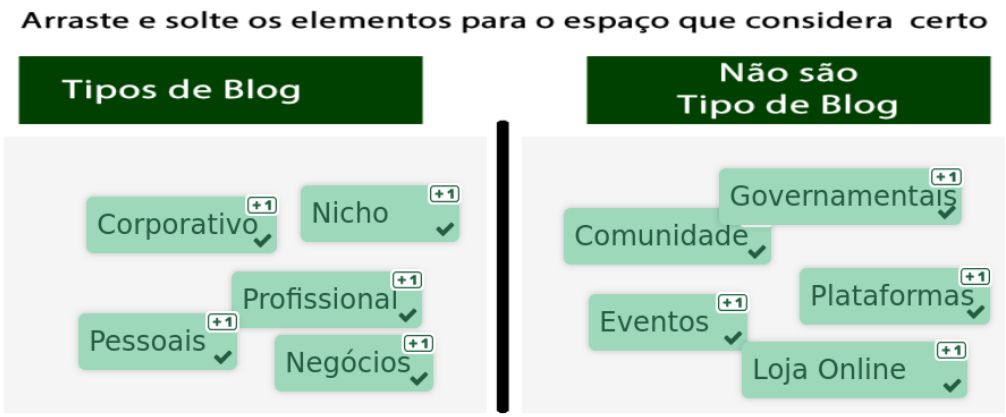
Desculpa, tem que repetir o exercício até ter a pontuação necessária.

1/10 Retry

Actividade 3: Tipo de Blog

Completar a atividade

Actividade 3: Tipo de Blog



Parabéns, você completou a tarefa. Pode avançar para Actividade 4.

10/10

Reutilizar <> Incorporar H5P

Actividade 4: Uso de blog na educação

Completar a atividade

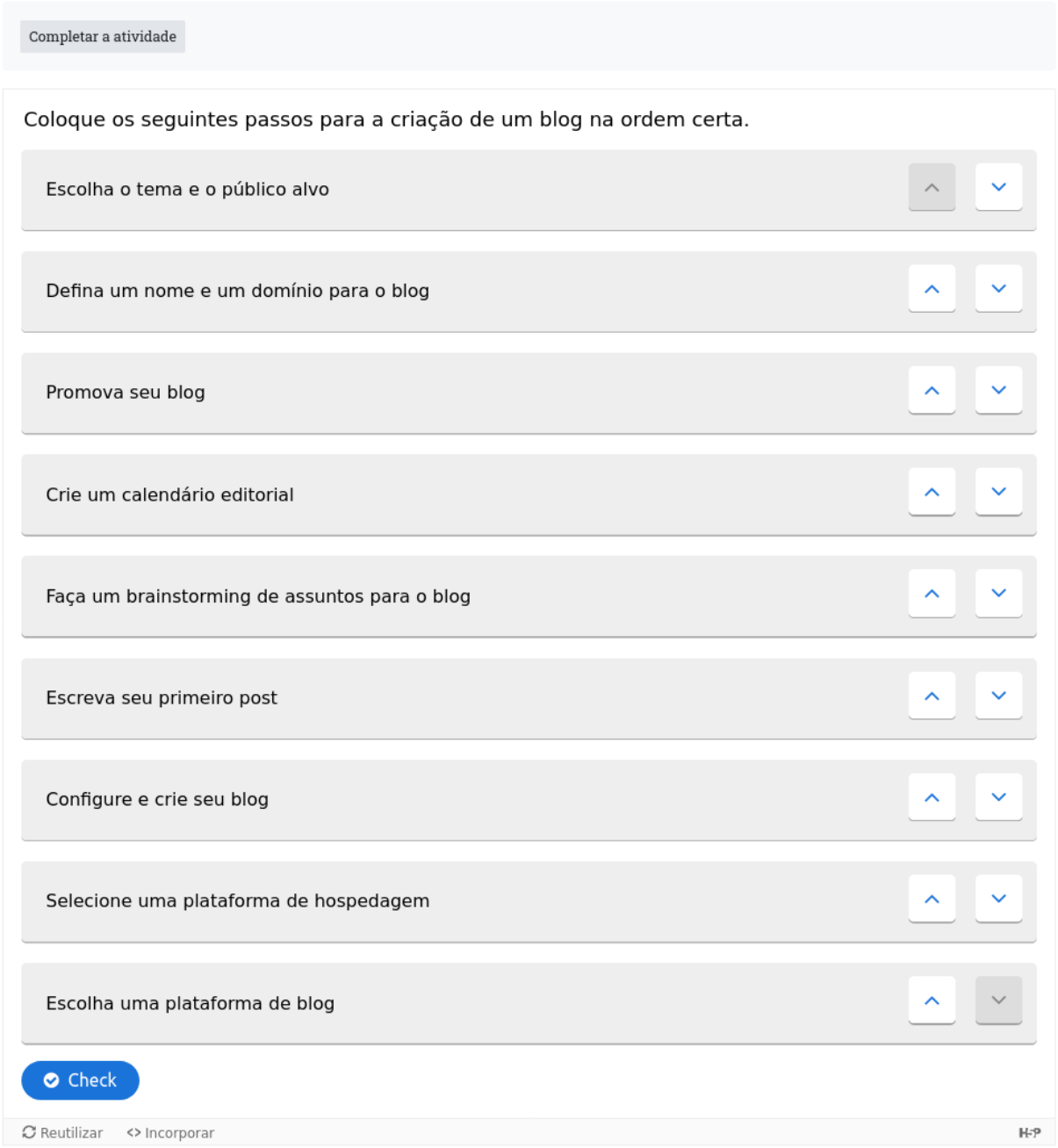
No campo educacional, o blog pode ser usado para:

- ○ Partilha de informação, estimulo a criatividade e pesquisa, assim como suporte a uso de TIC a comunidade universitária.
- ○ Partilha de informação, suporte a interacção, estimulo a criatividade e sentimento de partilha, espírito de comunidade.
- ○ Partilha de informação, suporte aos estudantes e docentes no uso de TIC para maior desempenho das actividades de ensino e aprendizagem.
- ○ Partilha de informação, suporte ao uso de tecnologia na educação, estimulo para uso de ferramentas digitais e alcance dos resultados de aprendizagem.

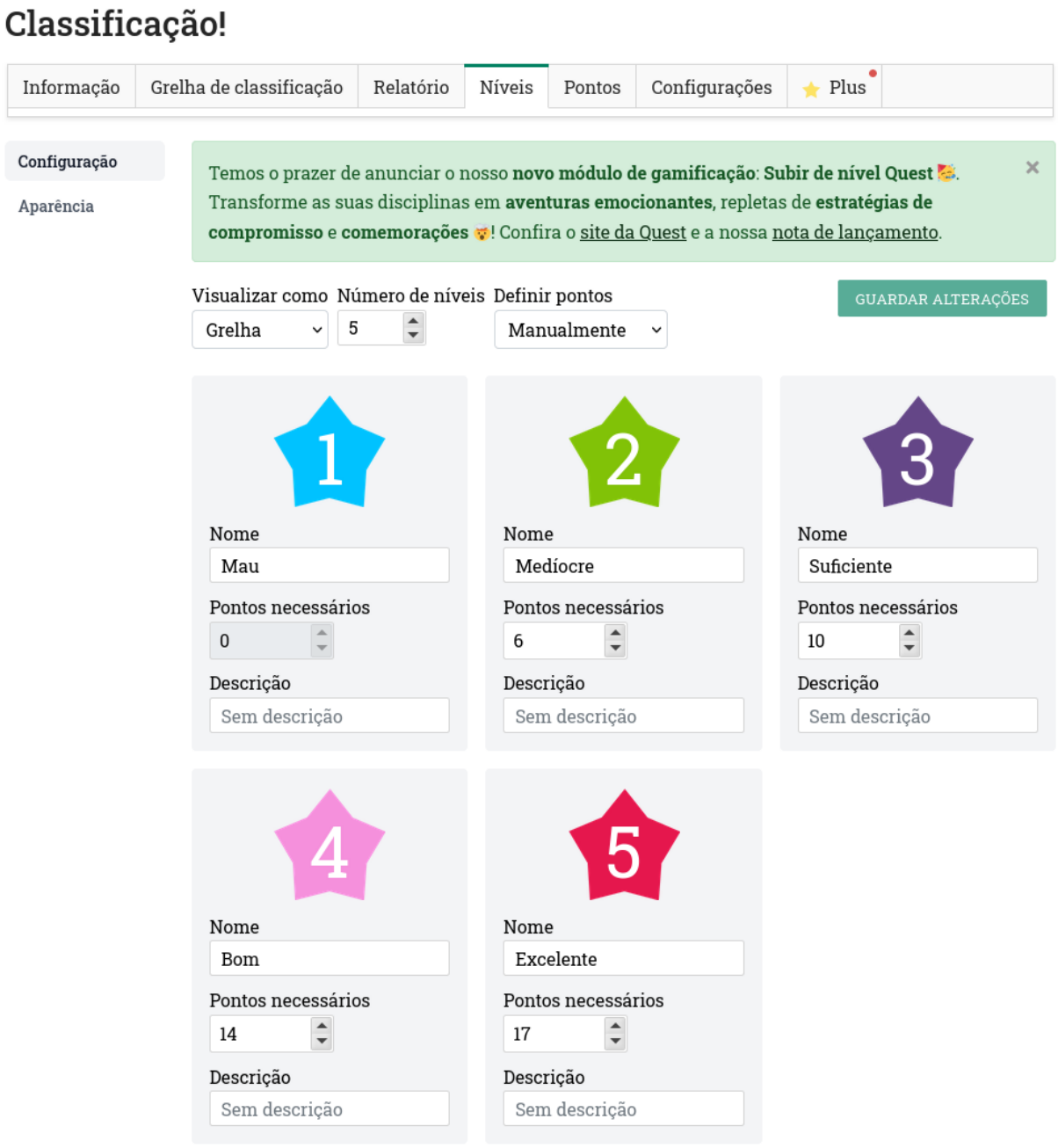
Check

Reutilizar <> Incorporar H5P

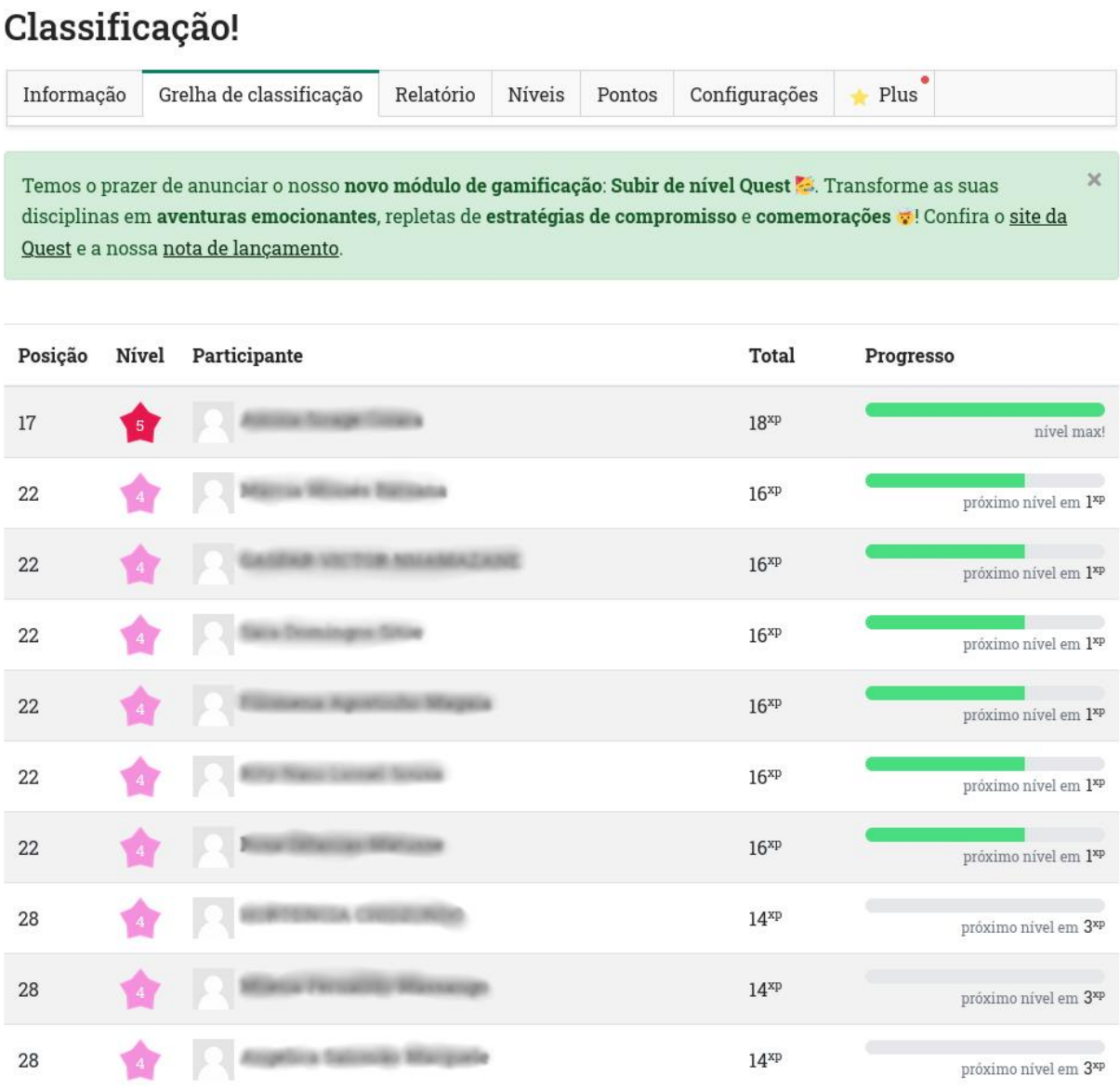
Actividade 5: Criação de um Blog



Level Up Classification Stages

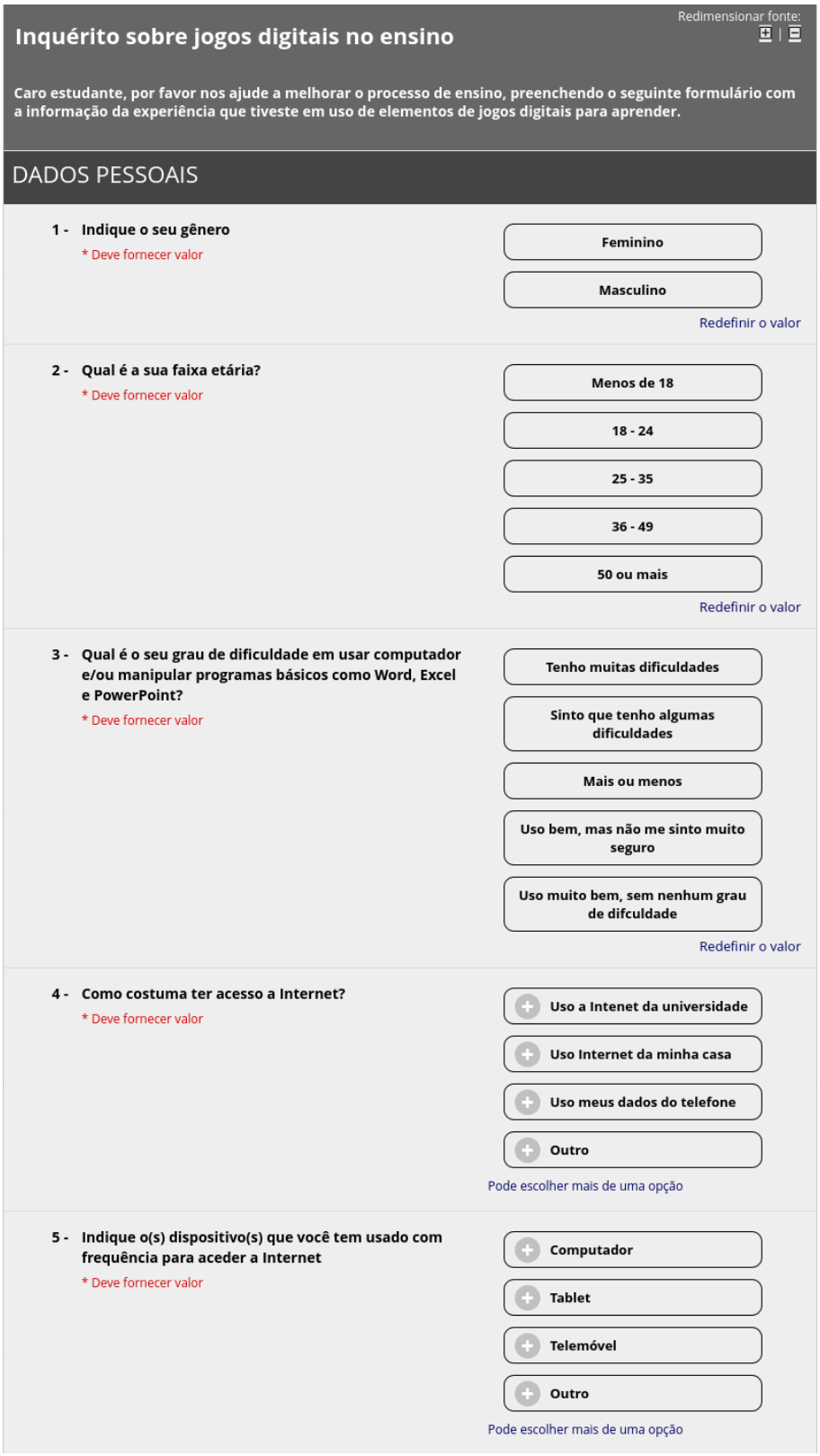


Level UP Students' Classification Page



Level UP Points Definitions Page

Appendix C: Student Questionnaire



Redimensionar fonte:

Inquérito sobre jogos digitais no ensino

Caro estudante, por favor nos ajude a melhorar o processo de ensino, preenchendo o seguinte formulário com a informação da experiência que tiveste em uso de elementos de jogos digitais para aprender.

DADOS PESSOAIS

1 - **Indique o seu gênero**
* Deve fornecer valor
- Feminino
- Masculino

Redefinir o valor

2 - **Qual é a sua faixa etária?**
* Deve fornecer valor
- Menos de 18
- 18 - 24
- 25 - 35
- 36 - 49
- 50 ou mais

Redefinir o valor

3 - **Qual é o seu grau de dificuldade em usar computador e/ou manipular programas básicos como Word, Excel e PowerPoint?**
* Deve fornecer valor
- Tenho muitas dificuldades
- Sinto que tenho algumas dificuldades
- Mais ou menos
- Uso bem, mas não me sinto muito seguro
- Uso muito bem, sem nenhum grau de difculdade

Redefinir o valor

4 - **Como costuma ter acesso a Internet?**
* Deve fornecer valor
- Uso a Intenet da universidade
- Uso Internet da minha casa
- Uso meus dados do telefone
- Outro

Pode escolher mais de uma opção

5 - **Indique o(s) dispositivo(s) que você tem usado com frequência para aceder a Internet**
* Deve fornecer valor
- Computador
- Tablet
- Telemóvel
- Outro

Pode escolher mais de uma opção

USO DE JOGOS DIGITAIS NA EDUCAÇÃO

6 - Como você avalia o seu grau de conhecimento, antes de ter esta experiência, sobre o uso de jogos digitais na educação?

* Deve fornecer valor

- Desconhecia totalmente
- Desconhecia
- Não conhecia, nem desconhecia
- Conhecia
- Conhecia muito bem

Redefinir o valor

7 - Como você avalia a o papel dos jogos digitais no aumento da participação do estudante em actividades de aprendizagem.

* Deve fornecer valor

- Não tem nenhuma importância
- Tem pouca importância
- Não sei
- Tem um papel importante
- Tem um papel muito importante

Redefinir o valor

8 - Como você avalia o impacto de jogos digitais para o desempenho académico do estudante?

* Deve fornecer valor

- Muito negativo
- Negativo
- Neutro
- Positivo
- Muito positivo

Redefinir o valor

9 - Já havia ouvido falar de uso de jogos digitais na plataforma VULA (ou MOODLE)?

* Deve fornecer valor

- Sim
- Não

Redefinir o valor

10 - Já alguma vez, antes desta experiência, havia usado um jogo digital para para fins educativos?

* Deve fornecer valor

- Não me lembro
- Nunca
- Raramente
- Com alguma frequência
- Com muita frequência

Redefinir o valor

REFLEXÕES SOBRE A EXPERIÊNCIA

11 - Você conseguiu realizar pelo menos um das actividades online do tipo jogo digital na plataforma VULA (ou MOODLE)?

* Deve fornecer valor

- [x] Sim
- [ ] Não

Redefinir o valor

11.1 - Como você avalia a qualidade da forma como o material e as actividades desta materia foram apresentados?

* Deve fornecer valor

- [ ] Muito Baixa
- [ ] Baixa
- [ ] Não alta, nem baixa
- [ ] Alta
- [ ] Muito alta

Redefinir o valor

11.2 - Como você avalia o grau de dificuldade para entender a materia usada nestas actividades online?

* Deve fornecer valor

- [ ] Muito difícil de entender
- [ ] Difícil de entender
- [ ] Não fácil, nem difícil
- [ ] Fácil de entender
- [ ] Muito fácil de entender

Redefinir o valor

11.3 - Como você avalia o grau de dificuldade para realizar estas actividade online?

* Deve fornecer valor

- [ ] Muito difícil
- [ ] Difícil
- [ ] Não fácil, nem difícil
- [ ] Fácil
- [ ] Muito fácil

Redefinir o valor

11.4 - O tempo que você dedicou para poder concluir as actividades online em relação ao tempo que costuma levar para estudar foi ...

* Deve fornecer valor

- [ ] Muito menos
- [ ] Menos
- [ ] Não mais, nem menos
- [ ] Mais
- [ ] Muito mais

Redefinir o valor

11.5 - No geral, qual é o seu grau de satisfação em relação a experiência que teve em usar jogos digitas na plataforma VULA (ou MOODLE)?

* Deve fornecer valor

- Muito insatisfeito
- Insatisfeito
- Não satisfeito, nem insatisfeito
- Satisfeito
- Muito satisfeito

Redefinir o valor

11.6 - Na sua opinião qual é o grau de dificuldade de jogar o game das naves espaciais?

* Deve fornecer valor

- Muito difícil
- Difícil
- Não fácil, nem difícil
- Fácil
- Muito fácil

Redefinir o valor

11.7 - Qual é o seu grau de satisfação em relação a actividade de jogo de naves espaciais

* Deve fornecer valor

- Não gostei completamente
- Nào gostei parcialmente
- Indiferente
- Gostei parcialmente
- Gostei muito

Redefinir o valor

11. 8. O bloco de Classificação (as estrelas) influenciou o teu desempenho nas actividades para sair de Mau para Bom

* Deve fornecer valor

- Sim
- Não
- Não sei

Redefinir o valor

CONSIDERAÇÕES GERAIS SOBRE USO DE JOGOS DIGITAIS

12 - Para as frases que se seguem, selecione a opção mais apropriada para descrever o seu sentimento.

	Não concordo completamente	Não concordo parcialmente	Não concordo, nem discordo	Concordo parcialmente	Concordo totalmente
As actividades do tipo jogo digital motivaram-me a usar a plataforma VULA (ou MOODLE). * Deve fornecer valor	○	○	○	○	○
Redefinir o valor					
Actividades do tipo jogos digitais torna os conteúdos da disciplina mais interessantes. * Deve fornecer valor	○	○	○	○	○
Redefinir o valor					
Devido as actividades do tipo jogos digitais tive que me empenhar mais para entender a matéria. * Deve fornecer valor	○	○	○	○	○
Redefinir o valor					
O uso de recursos de jogos digitais permitiram eu entender melhor a matéria. * Deve fornecer valor	○	○	○	○	○
Redefinir o valor					
Gostei das actividades do tipo jogo digitais, foi uma experiência muito interessante e positiva para mim. * Deve fornecer valor	○	○	○	○	○
Redefinir o valor					
Eu recomendaria aos professores passarem a criar actividades do tipo jogo digital na plataforma VULA (ou MOODLE). * Deve fornecer valor	○	○	○	○	○
Redefinir o valor					

13 - Indique o que gostou e não gostou nesta plataforma

Expandir

Escreva desafios encontrados durante esta experiencia de uso de jogos digitais para aprendizagem

14 - Que recomendações daria para melhor a pratica de actividades do tipo jogos na plataforma VULA (ou MOODLE)

Expandir

Escreva opiniões e dicas para os professores

15 - Outros comentários.

Expandir

O que gostaria de partilhar mais não foi perguntado?

Enviar

Powered by REDCap

REFLEXÕES SOBRE A EXPERIÊNCIA

11 - Você conseguiu realizar pelo menos um das actividades online do tipo jogo digital na plataforma VULA (ou MOODLE)?

* Deve fornecer valor

Sim

Não

Redefinir o valor

Partilhe connosco a razão que fez com que não conseguisse realizar as actividades online.

Expandir

Appendix D: Teacher Interview Questions

Appendix D1: Portuguese Version

Titulo: O uso de elementos de desenho de game no Moodle para melhorar a interacção do estudante em uma Universidade Moçambicana

Objectivos:

- Compreender a percepção dos instrutores em relação ao uso de elementos de desenho de jogos em cursos Moodle.
- Identificar os desafios enfrentados pelos instrutores durante a implementação da intervenção.
- Compreender as reflexões dos instrutores sobre a experiência em aplicar princípios de desenho de ensino usando elementos de desenho de jogos no Moodle para melhorar o engajamento e os resultados dos estudantes.
- Conhecer o grau de satisfação e de confiança dos instrutores em implementar os princípios de desenho de ensino usando elementos de desenho do Moodle.

Grupo	Objectivo	Questões da Entrevista
1	▪ Explicar o contexto e os objectivos da entrevista ▪ Assegurar o anonimato e confidencialidade da entrevista ▪ Solicitar permissão para gravar a entrevista	o Breve explicação dos objectivos e contexto da entrevista e da pesquisa. o Explicação sobre o anonimato e confidencialidade do conteúdo da entrevista. o Solicitação da autorização para gravar a entrevista.
2	▪ Compreender a percepção dos instrutores em relação ao uso de elementos de desenho de jogos em cursos Moodle. ▪ Identificar os desafios enfrentados pelos instrutores durante a implementação da intervenção.	1. Você acabou de ter uma experiência em implementação de princípios de design de aprendizagem usando elementos de jogos em um curso Moodle. Pode nos contar como foi essa experiência? 2. Que desafios você enfrentou nessa experiência? 3. Na sua opinião, até que ponto a prática de desenho de aprendizagem usando elementos de jogo no Moodle é complexa? 4. Na sua opinião, os resultados do uso de elementos de jogo em cursos Moodle compensam o esforço e o custo necessários para desenhar as actividades de aprendizagem? Explique a razão desta sua opinião? 5. Onde você costuma ter acesso a Internet: na universidade, de casa ou pelo celular? 6. Você acha que a prática de desenho de aprendizagem usando elementos de jogos no curso Moodle aumentou os custos de uso de Internet? Se sim, por favor explique? 7. Você possui computador ou precisa utilizar os recursos disponíveis na universidade para acessar a plataforma Moodle? 8. Como você avalia a qualidade da Internet da Universidade?

3	▪ Compreender as reflexões dos instrutores sobre a experiência em aplicar princípios de desenho de ensino usando elementos de desenho de jogos no Moodle para melhorar o engajamento e os resultados dos estudantes.	9. Que diferença(s) você notou em seus estudantes, resultante do uso de elementos de jogos em seu curso Moodle? 10. Considera útil para o seu curso, a prática de desenho de aprendizagem utilizando elementos de jogo no Moodle adoptada nesta experiência? 11. Até que ponto a prática de desenho de aprendizagem usando elementos de jogo no Moodle atendeu aos objectivos educacionais do seu curso? 12. Como é que os seus estudantes reagiram à integração de elementos de jogo no seu curso Moodle (aderiram com muita facilidade, houve alguma resistência ou muita resistência)? Em caso de resistência, quais foram os motivos apresentados pelos estudantes que resistiam ao uso da nova tecnologia? 13. Você notou alguma relação entre a implementação da prática de design de aprendizagem usando elementos de jogos em cursos do Moodle e o engajamento dos estudantes e os resultados da aprendizagem? Se sim, até que ponto esta intervenção afectou o engajamento dos estudantes e os resultados da aprendizagem? Esta experiência ajudou a melhorar o desenvolvimento do conhecimento dos seus estudantes? 14. Após esta experiência, como você se sente sobre a implementação da prática de desenho de aprendizagem usando elementos de jogos em cursos do Moodle para melhorar o engajamento dos estudantes e os resultados da aprendizagem?
4	▪ Conhecer o grau de satisfação e de confiança dos instrutores em implementar os princípios de desenho de ensino usando elementos de desenho do Moodle.	15. Como esta experiência o capacitou para futuras actividades de ensino? 16. Até que ponto você se sente motivado a continuar a aplicar os princípios de desenho de aprendizagem usando elementos de jogo em seus cursos Moodle? 17. Após esta experiência, você se sente capaz de implementar os princípios de desenho de aprendizagem usando elementos de jogo no curso Moodle? Se sim, com que grau de confiança: de forma independente, precisando de pouca ou muita ajuda? 18. O que você sugeriria para melhorar a prática de desenho de aprendizagem usando elementos de desenho de jogos no Moodle, implementada nesta experiência, para ajudar você e outros professores na melhoraria do engajamento de estudantes e resultados de aprendizagem?

Appendix D2: English Version

Title: Using game design elements on Moodle to enhance student interaction at a Mozambican University

Objectives:

- Understand instructors' perceptions toward the implementation of learning design practice using game elements in Moodle courses.
- Identify the challenges faced during the implementation of the intervention.
- Understand instructors' reflections regarding the experience of learning design practice using game elements in Moodle courses to enhance student interaction and results.
- Know the instructors' satisfaction and confidence levels in implementing learning design practice using game elements in Moodle courses.

Group	Objective	Interview Questions
1	▪ Explain the context and objectives of the interview ▪ Ensure the anonymity and confidentiality of the interview ▪ Request permission to record the interview	○ Brief explanation of the objectives and context of the interview and research. ○ Explanation about the anonymity and confidentiality of the interview content. ○ Requesting authorization to record the interview.
2	▪ Understand instructors' perceptions toward the implementation of learning design practice using game elements in MOODLE courses. ▪ Identify the challenges that faced during the implementation of the intervention.	1. You have just had experience on implementing a learning design practice using game elements in Moodle course. Could you tell us how was this experience? 2. What challenges did you face in this experience? 3. In your opinion, to what extend the learning design practice using game elements in Moodle is complex? 4. In your opinion, the results of using game elements in Moodle courses are worth the effort and cost required to design the learning activities? Explain what makes you have this opinion? 5. How do you usually access the Internet: at the university, from home or using mobile phone? 6. Do you feel that learning design practice using game elements in Moodle course increased the money you usually spent on Internet usage? If yes, please explain? 7. Do you own a computer or you have to use the resources available at the university to access the Moodle platform? 8. How do you rate the University's Internet quality?

3	▪ Understand instructors' reflections regarding the experience of learning design practice using game elements in Moodle courses to enhance student interaction and results.	9. What differences did you notice on your students resulting from the use of game elements in your Moodle course? 10. Would you consider the learning design practice using game elements in Moodle, adopted in this experience, useful for your course? 11. To what extent the learning design practice using game elements in Moodle met the educational objectives of your course? 12. How did your students react to the integration of game elements in your Moodle course (did they join very easily, was there some resistance or a lot of resistance)? In case in of resistance, what were the reasons presented by students? 13. Did you notice any relationship between the implementation of learning design practice using game elements in Moodle courses and your students' interaction and results? If yes, to what extend did this intervention affect your students' interaction and results? Did it help to improve students' knowledge development? 14. After this experience, how do you feel about implementing learning design practice using game elements in Moodle courses to enhance student interaction and results
4	▪ Know the instructors' satisfaction and confidence levels in implementing learning design practice using game elements in MOODLE courses.	15. How did this experience prepare you for further teaching activity? 16. To what extend do you feel motivated to continue implementing the learning design practice using game elements in your Moodle courses? 17. After this experience, do you feel able to implement the learning design practice using game element in Moodle course? If yes, with what degree of confidence: independently, requiring minimal or a lot of support? 18. What would you suggest to improve in the learning design practice implemented in this experience to facilitate you and other teachers in using game elements in Moodle courses for enhancing student interaction?

Appendix E: Ethical Clearance for Research Project granted by the School of Education Research Ethics Committee of the Faculty of Humanities

SCHOOL OF EDUCATION

Dr Carolyn McKinney
Associate Professor

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EDNREC20221101

22 November 2022

Claudino Tivane TVNCLA001

MEd

Dear Mr Tivane,

Re: Ethical Clearance for Research Project

I am pleased to inform you that ethical clearance has been granted by the School of Education Research Ethics Committee of the Faculty of Humanities for your research project entitled 'Using game design elements on Moodle to enhance student interaction at a Mozambican University. This approval is valid for one year ending 31 December 2023.

I wish you all the best with your study.

Yours sincerely,

Signed by candidate

Associate Professor Carolyn McKinney
Chair - School of Education Research Ethics Committee