

Moodle's Modern Gamification Toolbox: A Practical Application

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Abstract

Over the recent past a lot of work has been done around the topic of gamifying online learning. There are a number of useful papers discussing either the benefits of the process or the details of how to carry it out but there seem to be few dealing with both. In this paper the authors present the results of a lengthy research process which has culminated in the implementation and the delivery of a fully gamified Moodle-based course. The questions the researchers have addressed in their work attempt to determine the kind of influence gamification can have on the process of learning. In the experiment they have conducted, the gamified version of a key university course is delivered to a test group of 65 students, whereas a control group of 125 students takes the regular non-gamified version of the same course. The presentation of their work starts with an introduction to the key concepts and a review of some of the work done already, followed by a discussion of the complete set of gamification tools currently available in Moodle. The gamification of the UX Design course is then described in detail. Finally, the authors discuss the results of the experiment they have conducted and draw some conclusions that link the use of gamification to increased student motivation and engagement in the course, a lower level of attrition, and a significantly improved student success rate.

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1 Introduction

For centuries games have been a source of enjoyment and fun and are likely to continue to be so in the foreseeable future. They evoke positive emotions in people, making them feel focused and successful [1, 2]. It has been shown that people are more engaged and productive when playing games [3, 4] and that games have the potential to motivate people [5–7]. The potential of games can be harnessed through the concepts of gamification. One of the main goals of gamification is to increase user engagement [8, 9]. Poor student engagement and lack of motivation are serious problems teachers face in academic institutions at all levels [10]. This is also why when gamification is studied or discussed, it is usually done in an educational context [11, 12].

What exactly is gamification? One of the most frequently cited definitions of the term gamification describes it as a process of applying game design elements to non-game contexts in an effort to improve user experience and engagement [13]. Gamification studies significantly gained speed towards the end of 2010 [14]. Since then, there has been a substantial amount of research in contemporary blended learning and some of it claims, and proves, using various experiments, that gamification can be beneficial to student involvement and student success [15–18]. Most of these published works, however, seem to be missing one thing – an accessible beginner-friendly presentation of the gamification tools available to course designers. Such a presentation, in the authors’ opinion, would be succinct yet comprehensive, easy to understand, and up to date. This paper is an attempt at providing one such summary of what gamification tools instructors using Moodle currently have at their disposal.

Today, digital technologies are practically ubiquitous and their integration in education is widespread. They influence all practices related to education and produce tons of data, mostly due to the widespread use of online learning environments that can be used to improve teaching and learning [19, 20]. For their experiment the authors chose the Moodle Learning Management System (LMS) due to its popularity, its accessible interface, its open code approach facilitating the introduction of additional functionality, and its compatibility with all types

of devices. Moodle also seemed to be the LMS offering the greatest selection of gamification tools and the system of choice for most scientists researching gamification – a fact, evident in the literature review discussed in the following section.

2 Review of previous work

The impact of gamification on learners' motivation has been studied extensively in recent years. There are a few studies indicating intrinsic motivation, satisfaction, or autonomy of learners in a gamified course may decrease slightly faster as compared to those of learners in a regular course [21, 22]. However, most of the research proves this is an exception to the rule. Gamification elements such as leaderboards, badges, and performance graphs have resulted in an increased motivation to achieve higher levels of performance [23] and increased satisfaction of competence needs [24]. In [25] a comparison of the results concerning motivation and autonomy in a gamified versus a non-gamified flipped course turned out to be in strong favor of the former. Gamification has shown positive results in enhancing student engagement and performance in [26] and [27] respectively as well.

In their review of previous work, the authors paid special attention to studies performed on the implementation of gamification in Moodle. What they observed was that the three most discussed gamification elements were badges, leaderboards, and points [28–33]. In [34] the researchers succeeded in boosting student motivation and engagement by gamifying a Moodle-based course on the Unified Modeling Language. Students were rewarded with points based on the tasks they completed. Badges and levels were part of the experiment. The results showed that learning was successful and that the students were satisfied with the course and found it useful.

The authors of [35] discuss yet another gamified online course, this time at the University of Plovdiv. Each week in the course corresponded to a level and included individual as well as group-based quests and assignments. The gamified course was taught alongside a non-gamified version of it. The results showed that students who were enrolled in the gamified section understood the subject matter better than those in the other section, had higher grades, and were more engaged with the activities in the course.

The author of [36] has written an entire textbook around the topic of creating gamification in Moodle. The information in the book may be a bit outdated by now, but the book writer who happens to be a Moodle administrator and

a freelance educational gamification consultant at the same time, has done an excellent job distilling the community experience on the topic into a system that she believes would help build learner resilience and motivation. The book is dedicated entirely to “provide teachers with the skills and knowledge to understand basic gamification techniques, reduce administrative workload, quickly identify learner progress, and provide personalized learner paths” [36].

According to several authors [37–39], evidence on the motivational effects of gamification remains scarce and there is limited empirical evidence on the motivational influences that lead students to participate in game activities.

In some of the more recent works that have been reviewed, [40] presents a study utilizing gamification in an SQL course within Moodle. The paper describes a detailed statistical analysis of the results and concludes that “usage of gamified self-training in SQL courses gives the opportunity for higher final achievements of the students”. Unfortunately, the discussion of what gamification elements were used and how is quite limited.

The authors of [41] examine the challenges of e-learning with an emphasis on gamification’s link to student engagement and performance. An experiment has been conducted with an Information Literacy Skills course. The findings have shown a significant improvement in online interaction and a direct link between the use of gamification in Moodle and student engagement and success in the course.

The researchers in another relatively recent study presented in [42] have also focused on the effects of utilizing elements of gamification for the purpose of stimulating educational achievements and increasing student motivation. In an experiment with a Foreign Language Course in Moodle that spanned multiple years, the authors were able to conclude that the use of gamification in the educational process creates an enormous potential because “students are internally ready for this, as a generation brought up on computer games” [42]. They go on to conclude that gamification takes students outside of the routine and even “encourages them to continue their education voluntarily and independently” [42].

3 Moodle’s set of modern gamification tools

This section presents the gamification toolkit currently available to users of Moodle’s Learning Management System. It adopts a purely theoretical approach and creates what could be tentatively referred to as a comprehensive “gamification cheat sheet”. Its purpose is two-fold: one, it introduces the entire

set of gamification tools in a beginner-friendly manner, and two, it serves as a starting point and a quick reference guide to anyone who may be considering conducting gamification experiments in Moodle.

3.1 Activity completion

The most fundamental gamification technique used by online course designers is to guide student progression through the course based on how well students perform in various activities that are part of the course. Completion tracking must be enabled in the course settings for Activity Completion to work. This allows an activity to be marked as complete based on criteria defined by the instructor. Depending on the activity, the criteria can be based on whether the student has viewed it, has received a specific grade on it, or has manually marked it as complete. In configuring the completion settings, most instructors will usually require that assignments be submitted, quizzes be graded, and lessons and other files be viewed.

Restricting access to a resource, an activity, or an entire course section can be based upon one or more criteria. By default, restrictions can be based on date and time requirements, on specific student grades, on the student belonging to specific groups, on information saved in the student profile, or on a set of all these restrictions. Assuming the gamification plugins have been enabled, access to an activity can also be restricted based upon the student's current Experience Level or one or more Stash items being part of the student's inventory. Using access restrictions, course designers can create separate paths in the course for regular students, high achievers, and struggling students. The H5P Branching Scenario discussed later is a very powerful alternative that may be used for creating paths, but it only allows the use of a few specific content items within its branching maps.

Using quizzes to test students' knowledge is crucial in setting up a meaningful path via the use of Activity Completion and Access Restriction. Quizzes provide instant feedback but should be used with care if progression depends on the score. Displaying an Activity Results block on a specific quiz encourages competition and helps with gamification. Each such block shows results from a specific graded activity. The results can be anonymous, or the system can use student ID's instead of names. The block displaying the results can be placed anywhere. Multiple Activity Results blocks may be created, but it is probably a good idea to only share one with the students that changes in time to reflect current activities in the course.

3.2 Course badges

Badges are used to celebrate achievements and to show progress within Moodle. They are displayed in the user profile and on the student dashboard. The process normally involves the creation of badge images in image-editing tools such as Photoshop, the creation of the actual badges in Moodle, and configuration of the badge settings. A word of caution here: once published, a badge may not be unpublished. It can only be deleted. If a student has already won the badge, the student keeps it even if it gets deleted by its creator. Careful planning of when and why badges should be awarded, before they get activated in the system, is strongly recommended.

3.3 H5P interactive content

The use of rich interactive content is crucial to making one's course an interesting and engaging one and this is where H5P comes in. Today H5P is included as part of every Moodle distribution. It allows one to create interactive, fun, and engaging HTML5 content, such as interactive videos, quizzes, games, and presentations. Sharing H5P content between H5P-capable websites is a breeze. Here is the list of H5P types currently available. The brief description accompanying each item was borrowed from <https://h5p.org/> [43]. New types of activities get added to the list monthly.

- General type of interactive content:
 - Documentation tool – Create a form wizard with text export.
 - Accordion – Create vertically stacked expandable items.
 - Advent Calendar – Create surprises that will be unveiled daily.
 - Branching Scenarios – Create dilemmas and self-paced learning.
 - Chart – Quickly generate bar and pie charts.
 - Collage – Create a collage of multiple images.
 - Column – Organize H5P content into a column layout.
 - Course Presentation – Create a presentation with interactive slides.
 - Dialog Cards – Create text-based turning cards.
 - Dictation – Create a dictation with instant feedback.
 - Flashcards – Create stylish and modern flashcards.
 - Iframe Embedder – Embed from a URL or a set of files.
 - Interactive Book – Create small courses, books, and tests.
 - Summary – Create tasks with a list of statements.
 - Timeline – Create a timeline of events.

- Multimedia-related content:
 - Agamotto/Image Blender – Present a sequence of images and explanations.
 - Audio – Upload an audio recording.
 - Audio Recording – Create an audio recording.
 - Image Juxtaposition – Create interactive images.
 - Image Slider – Present a collection of images using an image slider.
 - Interactive Video – Create videos enriched with interactions.

- Quiz-related content:
 - Arithmetic Quiz – Create time-based arithmetic quizzes.
 - Drag and Drop – Create drag and drop tasks with images.
 - Drag the Words – Create text-based drag and drop tasks.
 - Essay – Create an essay with instant feedback.
 - Fill in the Blanks – Create a task with missing words in a text.
 - Find the Hotspot – Create image hotspots for users to find.
 - Guess the Answer – Create an image with a question and answer.
 - Image Choice – Create a task where the alternatives are images.
 - Mark the Words – Create a task where users highlight words.
 - Multiple-choice Question – Create flexible multiple-choice questions.
 - Personality Quiz – Create a personality quiz.
 - Sort the Paragraphs – Create a set of paragraphs to be sorted.

- Game-related content:
 - AR Scavenger – Augmented reality fun.
 - Crossword – Create a crossword puzzle.
 - Find the Words – Grid based word searching game.
 - Image Pairing – Drag and drop image matching game.
 - Image Sequencing – Place images in the correct order.
 - Memory Game – Create the classic image pairing game.

3.4 Level Up and experience points (XP)

The XP block tool (also known as the Level Up tool) offers an easy way to add gamification to any Moodle course. Learners receive points for their actions, visualize their progress, compete with others, and unlock content based on their individual needs and experiences. Per its description on Moodle's site, this block can help motivate learners through experience points and individual leaderboards. Its features include automatic attribution of points based on student actions, a block that displays current level and progress towards the

next level, a leaderboard to show the ranking of the learners, and notifications to congratulate learners as they level up. Features that allow the instructor to keep track of progress and to steer students' learning experience include: a report summarizing learners' levels, the ability to customize the number of levels, the points they require, and their appearance, control over the points earned per action, experience points earned per course, and the ability to unlock content when a certain level is reached [44].

As with Badges, careful planning on how to use XP is a must. While the Level Up block allows the instructor to create and manage the way points are assigned, what levels exist, and when they can be attained, the Level Up Availability tool gives the instructor the option to restrict access to resources or activities based upon the level achieved by the student. It implements the link between XP earned in the course and access restriction.

3.5 The Stash

The Stash block is a good way to encourage more interaction with activities and is invaluable for teachers looking to gamify their course. This plugin introduces a block that shows students items that they have picked up throughout the course. The instructor can create items and then place them in activities and resources for students to find. Items can be set to be collected once or multiple times. The Stash encourages active student exploration of the course material.

The Stash Availability tool is used to allow items from the Stash to determine the availability of course activities. Shortcodes, which is a separate but related plugin, allows users to inject and modify content anywhere in the course using code provided by other plugins, including Stash (it can be used for stash item and stash trade insertion).

3.6 Completion progress

The Completion Progress block is a time-management tool for students and teachers. Its features include: a visual representation of activities to be completed, color codes for quick reference, overview for teachers who can use it to identify students at risk, and a combined progress view on the Dashboard page. Completion Progress can show some or all activities in a report on all users and is a great tool for teachers who can use it to see whether someone may have fallen behind.

3.7 Activity results

Activity Results is a block that instructors can add and configure to display the results of a graded activity in the course. You have the option to set how many of the highest and how many of the lowest scores are included in the block, and whether to list the students' real names. A block displaying the top scores on a quiz, or an assignment can be very useful in stimulating competition in the course and is an excellent example of a tool that helps gamify the learning experience for the students.

3.8 Quizventure

Quizventure is an activity module that loads questions from the quiz question bank of the course it has been added to. Possible answers zoom in like spaceships from the top of the screen and the user must find and shoot the correct answer. Meanwhile, the ships fire back at the user. The game looks like a simplified version of Space Invaders. For this game to be available as an activity, the Quizventure add-on must be installed. The questions you use can only be of the Multiple-Choice Question or True False type.

3.9 The Game activities plugin

Per the definition provided by the author of this tool [45], the Game activity module makes use of questions, quizzes, and glossaries to offer a variety of interactive games, including Hangman, Sudoku, Snakes and Ladders, Crossword, Millionaire, and The Hidden Picture. The idea here is admirable. Unfortunately, the contributing author relies on donations to support his work, which seem to be lacking, and that really shows in the overall quality of the games.

4 Gamifying UX Design – a case study

The previous section presented a comprehensive overview of all currently available gamification features in Moodle implemented as either built-in functions or plugin libraries. This section discussed the methodology behind the case study, followed by a discussion of the findings and a summary of conclusions.

4.1 Study participants

In the experiment the authors gamified the 2022-23 course on UX Design offered at the University of Library Studies and Information Technology, Sofia.

The 65 students enrolled in it represented the Test Group in the experiment. The 58 students enrolled in the 2020-21 UX Design course and the 67 students enrolled in the 2021-22 one made up the Control Group. All three sections of the course covered the same content and were delivered via Moodle. The only difference was that the 2022-23 version of the course was fully gamified whereas the other two sections were not.

4.2 Research questions

The experiment represented an attempt to test the usefulness of gamifying blended university courses and at validating some of the many claims made in previous research with respect to the benefits of gamified learning. Here is the list of research questions the researchers tackled in this study:

- RQ1: Will the use of gamification lead to a higher level of engagement and increased student participation?
- RQ2: Will the use of gamification lead to a better understanding of the subject matter and improved student success (including higher overall final grades)?
- RQ3: Will the gamification features allow students to have more fun while learning?
- RQ4: Will the level of attrition in the gamified course be different than that in the other two courses?

4.3 Implementation details

The initial, and most important, phase in the process of gamification is the planning one. Arguably, the best approach when gamifying a course is to plan the course's entire structure and content alongside the process of gamification. This allows for more flexibility and better control over what resources and activities are to be made available to the students, when, and under what circumstances. After careful consideration the authors decided to proceed with adding gamification features to the already existing course, without making substantial changes to its structure or content, so as to ensure that the Test group and the Control group were in fact getting the exact same learning experience, save for the elements of gamification. Luckily, the course on UX Design, with its specific subject matter, and its modular weekly structure landed itself quite nicely to being gamified and turned out to be an easy choice for the researchers.

4.3.1 Interactive content

Creative use of H5P interactive activities is the backbone of gamification and is probably the one feature that can bring a course to life all on its own. Figure 1 shows the H5P activities that were added as part of the experiment. The titles are listed in the left column whereas the activity types are listed in the right column.

4.3.2 Item Stash and resource availability based on the Stash

It is safe to say this is the authors' favorite gamification feature in Moodle. The idea with the Stash is that the course designer creates various items that he or she can then hide around the course. As students browse the various activities and resources, they can find and pick up these items. The items can be set to respawn, if necessary. Trade areas may be set up so that students can trade items they have already collected for other items, based on predefined trade rules. The best part of the Stash set of tools is that it allows access to activities and resources in the course to be limited based upon item availability in students' inventories.

Several UX-related items that are presented early in the course as part of one of the lectures – Empathy, Definition, Idea, Prototype, and Testing – were implemented as stashable items and hidden inside various resources and activities across the course. Students had to find and collect one of each type, to be able to make a trade at a virtual “UX Design Laboratory” and receive the Implementation item, which allowed them to progress to the next area in the course. There were three limited-access sections in the course that took advantage of this type of control. Figure 2 illustrates the item configuration screen showing the list of items that were created for the course.

4.3.3 Experience points and levels in the course

The Level Up plugin in Moodle allowed the authors to create a sophisticated system for awarding the students with XP points based on the kinds of activities performed in the course. Students engaging with an H5P activity received three points, creating an item in the course was worth two points, editing or reading an item one point. The final list of levels included Rookie, Scholar, Expert, Guru, and Master, and the rewards for the students included access to bonus resources, along with course-wide recognition in the form of medals and ladder-based reports. The letter created a healthy level of competition among students in the class. Attaining the highest level in the course gave students access to

Име	Content Type
Лист на Мьобиус	Find the Hotspot
Етапи в процеса на UX Design (drag the words)	Drag the Words
The Six Stages of the UX Design Process	Accordion
UX Design Stages Memory Game	Memory Game
Stages of the UX Design Process - Sort the Paragraphs	Sort the Paragraphs
Кръстословица - UX Design Glossary	Crossword
Карта на емпатията	Dialog Cards
Поставете въпросите в правилната зона	Drag and Drop
Are you an independent learner?	Personality Quiz
Мини-тест за модул Въведение в уеб технологиите и поведението	Question Set
Google UX Design Professional Certificate	Iframe Embedder

Figure 1: The list of H5P activities used in the gamified course. Screenshot by the authors.

List of items

Item name ▾	Locations ⓘ
📄 Test	Stages of the UX Design Process Кръстословица - UX Design Glossary
🔑 Prototype	UX Design Stages Memory Game Кръстословица - UX Design Glossary
🚀 Implementation	-
💡 Idea	The Six Stages of the UX Design Process Мини-тест за модул Въведение в уеб технологиите и поведението
👤 Empathy	Етапи в процеса на UX Design Мини-тест за модул Въведение в уеб технологиите и поведението
🔍 Definition	Лист на Мьобиус Мини-тест за модул Въведение в уеб технологиите и поведението

Figure 2: The Stash configuration screen. Screenshot by the authors.

Level up!

Info Leaderboard Report Levels Points Settings ★ XP+

Setup View as Level count Set points [Записване на промените](#)

Visuals List 5 Manually

Level	Points required	Level name	Level description
	0	Ниво 1 - Начално	UX Design Rookie
	25	Ниво 2 - Бронз	UX Design Scholar
	50	Ниво 3 - Сребро	UX Design Expert
	75	Ниво 4 - Злато	UX Design Guru
	500	Ниво 5 - Диамант	UX Design Master

Figure 3: A view of the Level Up configuration screen. Screenshot by the authors.

Управление на значки

Име	Състояние на значка	Критерии	Получатели	Действия
Авантюрист	Налично (критериите са заключени)	Да завърши ВСИЧКИ от: <ul style="list-style-type: none"> Завършено: "Интерактивно съдържание - Етапи в процеса на UX Design (drag the words)" Завършено: "Начинаещ" 	50	
Гросмайстор	Налично (критериите са заключени)	Да завърши ВСИЧКИ от: <ul style="list-style-type: none"> Да завърши ВСИЧКИ от: "URL - GenericFrame - създаване на прототип", "URL - Draw.io", "URL - Giffy - diagrams", "URL - Axure", "URL - InVision", "URL - balsamiq", "URL - MockFlow", "URL - UXPin", "URL - xmind - предметни карти - mind map", "Форум - Подбор на платформа за изграждане на интерфейс" Завършено: "Майстор" 	30	
Звезда	Налично (критериите са заключени)	Да завърши ВСИЧКИ от: <ul style="list-style-type: none"> Да завърши ВСИЧКИ от: "Файл - Виктор Молев - портрети-характери", "Файл - Илюзии - M.C.Escher", "Файл - Илюзии" Завършено: "Изследовател" 	48	

Figure 4: A partial view of the badge configuration screen. Screenshot by the authors.

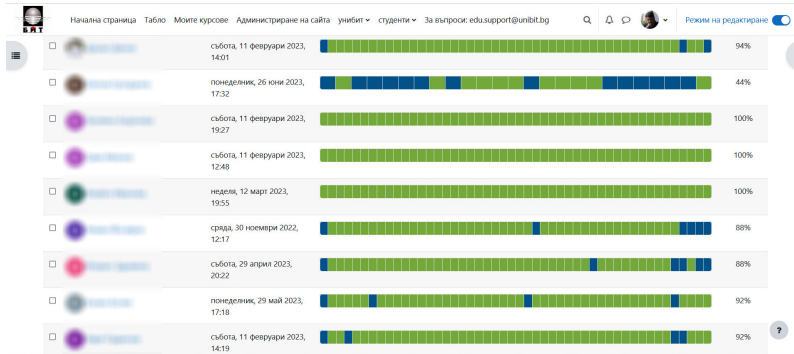
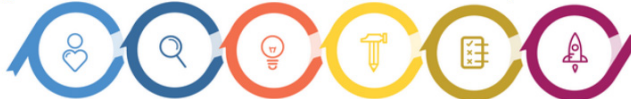


Figure 5: The instructor's course progress report. Screenshot by the authors.

Gamification Elements in the Course



1. **Badges.** Badges are automatically awarded based on the completion of specific course activities. The 'Badges' section provides specific information on the requirements for each badge.



2. **Stash.** The first five items in the list represent the stages in the Implementation process (Empathy, Definition, Idea, Prototype and Test). These are scattered throughout the various activities and resources in the course. To unlock the locked course sections, you need to collect all five items and exchange them for the last one in one of the two 'UX Design Labs' in the course.



3. **Levels** based on experience points. The system awards points based on most of the activities you perform in the course following a predefined algorithm (adding or modifying items, interacting with HSP, etc.). You can see exactly what points you get and why in the Level Up block located on the right.

Figure 6: The gamification elements were introduced on the front page. Screenshot by the authors.

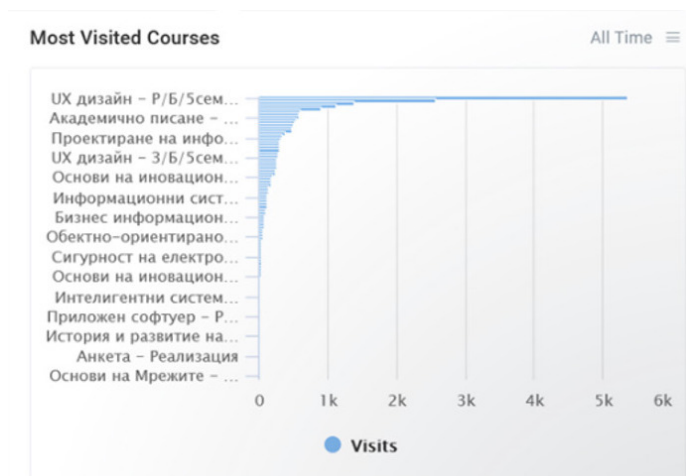


Figure 7: Most visited courses on <https://edu.unibit.bg/> at the start of the term. Screenshot by the authors.

complimentary resources such as a free online course or an exciting quiz-based game. Figure 3 shows the configuration screen of the Level Up plugin.

4.3.4 Badges

A total of eight badge levels were implemented in the course: Beginner, Novice, Explorer, Adventurer, Star, Superstar, Master, and Grandmaster. Each badge required the completion of specific activities in a predefined order and provided the students with well-deserved recognition amongst their peers. Figure 4 shows a partial view of the Badge configuration screen.

4.3.5 Course progress and activity completion

Another couple of useful tools the authors took advantage of were the Course Progress and Activity Completion blocks. Course Progress is used to visually summarize progress through the course for each student by coloring the various activities appropriately. The instructor has access to a report for all students in the class, whereas individual students can only see their own progress, along with tips on what still needs to be completed.

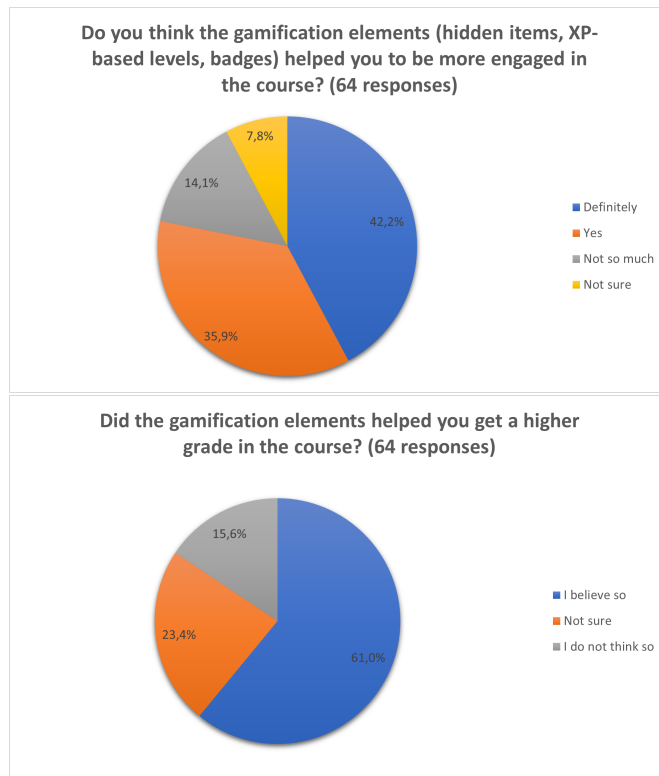


Figure 8: Two of the student responses received via the survey. Screenshot by the authors.

Имя / Инициал	Дълг Бали	Организиране на курсове - 3А	Продуктивност	Тест: Ръководство	Платформа за обучение	Тест	Общ за курс
[Avatar]		Оценени (8,00)					Оценени (8,00)
[Avatar]		Оценени (8,00)					Оценени (8,00)
[Avatar]		Оценени (8,00)					Оценени (8,00)
[Avatar]		Оценени (8,00)					Оценени (8,75)
[Avatar]		Оценени (8,00)					Оценени (8,50)
[Avatar]		Оценени (8,00)					Мн. добър (9,00)
[Avatar]		Оценени (8,00)					Оценени (8,75)
[Avatar]		Оценени (8,00)					Оценени (8,00)
[Avatar]		Оценени (8,00)					Добър (8,75)
[Avatar]		Оценени (8,00)					Мн. добър (9,50)
[Avatar]		Оценени (8,00)					Оценени (8,00)
[Avatar]		Оценени (8,00)					Оценени (8,75)
Общ среден		Оценени (8,88)					Оценени (8,75)

Figure 9: Final grades of the students in the Test Group. Screenshot by the authors.

Activity Completion is a block that summarizes details about the high and low grades received by the students on a specific activity. Here the instructor has the option of using students' real names, student ID's, or no identification at all. Figure 5 illustrates the course progress view for the instructor.

4.3.6 Instructions for the students

It is critically important that students know what is expected of them. The purpose of the gamification features in the course should be clearly communicated, and help should be one click away. Figure 6 shows the gamification elements' introduction screen.

4.4 Assessment

The two main tools used to assess student performance as well as students' view of the course and its gamification features included a Google's Forms-based survey administered at the end of the course and Moodle's built-in analytics tools. The latter provided valuable insights into student behavior, engagement, and involvement in the course.

IntelliBoard, which happens to be one of the more popular LMS Learning Analytics tools today, was included with Moodle, and the authors originally had high expectations of its capabilities and the kind of data it could be used to collect. Unfortunately, the installed version of the software turned out to be designed around the idea of collecting data about the university website as a whole and had very limited functionality when it came to data extracted from individual courses. One of the early reports the authors managed to extract from it showed the level of interest the gamified UX Design course had generated among students using the University website (see Figure 7). About one month into the semester, the course had registered 5357 visits while the closest one in the graph had 2560 visits. Enrollment numbers for these courses were similar so they could be safely ignored.

Figure 8 shows a partial summary of student responses received via the anonymous Google Forms survey. The survey was designed to help the authors collect data relevant to the research questions posed at the start of the study. Students were asked the following questions. (1) Do you believe the gamification features helped you be more engaged in the course? (2) Do you think the gamification features made the course more fun and more interesting to you? (3) Do you believe the gamification features helped you get a better grade in the course? (4) Were the instructions regarding the gamification elements easy

to understand and follow? (5) Do you think the gamification features may have changed the difficulty of the course? (6) Any other feedback you wish to share with us?

The amount of data produced by Moodle's built-in analytics tools is nothing short of mind-boggling. Moodle collects and reports information about every action the course participants take, including but not limited to, what items they access and when, what pages they visit and for how long, when they log in and when they log out, what graded activities they attempt and what scores they receive. Figure 9 illustrates one of the most important reports accessed by the authors – the one showing the final overall grades. The final class grade for the students in the Control Group ended up being 5.0 (on the 2.0 to 6.0 scale), both for the 2020-21 and 2021-22 sections. The final class grade for the Test Group (the 2022-23 course section) turned out to be 5.75 (on the 2.0 – 6.0 scale)!

5 Discussion and conclusions

This paper introduced the topic of gamification inside Moodle's Learning Management System and reviewed some of the work done in the area, along with the need for a new, more accessible, and more up-to-date discussion of Moodle's gamification toolbox. This was followed by a comprehensive presentation of Moodle's modern gamification toolbox available to course designers today. Using the tools described in this work, the authors went on to conduct an experiment by fully gamifying a course in a live university setting. Their work was guided by several key research questions. The authors tried to either confirm or disprove claims that gamification could be beneficial to student engagement and motivation in the learning process, that it made learning more fun in general, it helped students get better grades, and it lowered the overall level of attrition.

The literature review of gamified learning in higher education revealed a number of key findings that showed that the influence and adoption of gamification and game-based learning in education is growing. Research in this area has increased in recent years, with the benefits of using this approach in higher education becoming more established and more recognized. The successful implementation of gamification and game-based learning gives reason to be enthusiastic about its application in higher education across countries, student cultures, subjects, and formats. One of the main conclusions the authors were able to make is that the current generation of students is different than ones

that came before it in that gamified education seems to be a natural academic habitat for them – one in which they flourish more easily and develop their potential for learning more successfully.

With respect to the experiment, there were some challenges encountered along the way, which confirmed the researchers' expectations that gamifying a course was not a trivial task and should not be taken lightly. It is in fact a process that requires careful planning and mapping of the course structure and content alongside the gamification elements that will be added to the course. Ideally the gamification process should take place at the same time the course is being designed, although that is not a hard requirement. To be efficient and to reduce the need for follow-up maintenance to a minimum, one must know exactly which tools are at one's disposal as well as what the finished version of the course should look like. Having students provide the instructor with constant feedback on their experiences during the semester is invaluable to the instructor's efforts to tweak and improve the gamification features but mid-term alterations should be made with care if student work in the course must be graded. For gamification to succeed in attaining its goals, it is crucial for the students to be well informed and to know exactly what is expected of them in completing the various tasks. Keeping an eye on student participation and performance helps to ensure no one gets stuck or frustrated in any one area of the course. Testing the gamification features using a "student" account is very important and can help the instructor catch and correct issues early on in the process.

Based on results in Moodle's numerous analytics reports as well as on student feedback provided in the survey, and presented in the Assessment section of this paper, the authors were able to conclude that the gamification of the UX Design course has been a success. The reports showed a greater level of student involvement in the Test Group, which also testified to an increased motivation to learn. The number of students abandoning the course went down as well, and overall success, in terms of final grades, went up considerably. The survey and the verbal feedback received from the students confirmed they had a lot of fun and enjoyed completing the activities in this course.

The purpose of using gamification in e-learning is to encourage instructors to use elements of gamification in their courses, interact with colleagues, improve learning flexibility, and inspire students. The use of gamification improves the educational process and helps to meet the requirements and expectations of the current generation of learners. The present study recommends that designers pay more attention to scientific content but also to exercise caution in using game elements in the educational process so that they can obtain the desired

results. It is necessary to encourage both students and teachers at all academic levels to become familiar with the concept of gamification.

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