Towards Integrating Learnersourcing, Microlearning and Gamification in Moodle

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Abstract. In this paper we aim to address the need for a switch in the educational system from a content-centred to a student-centred approach by peeking into the current trends and perspectives of integrating pedagogical approaches such as learnersourcing, microlearning and gamification in a widely-used LMS, such as Moodle. We present an overview of the recent literature treating the issues related to learnersourcing, microlearning and gamification and analyse existing shortcomings and challenges of the current approaches. We also aim to show the development capabilities that Moodle LMS encompasses and how it might serve our proposed solutions which deal with assisting the teachers in searching for micro activities that will suit the students' needs, on the one hand, and with the creation of a safe space in which students can express freely, collaborate and be assisted in their work, on the other hand.

Keywords: Moodle plugins · Learnersourcing · Collaborative learning · Microlearning · Gamification

1 Introduction

Sir Ken Robinson is widely acknowledged for advocating a more creative and innovative approach to education. He argues that the traditional educational system fails to meet the diverse needs and interests of the students since it is usually based on standardised approaches and he calls for a shift to a student-centred approach that emphasises creativity, critical thinking and innovation [1].

Integration of learnersourcing, microlearning and gamification in learning management systems is aligned with Sir Ken Robison's ideas in several ways. Learnersourcing involves empowering students to have an active role in their learning by contributing to content creation [2], which aligns with Robinson's call for students to be seen as co-creators rather than passive recipients. Microlearning and gamification, on the other hand, promote engagement and motivation by delivering small chunks of enjoyable and challenging information [3,4], reflecting on Robinson's belief that learning should be fun, engaging and relevant to students' interests.

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A learning management system (LMS) is an online environment, usually a web-based platform, that facilitates learning by providing customised online instructional materials and interactive activities. More than 200 commercial LMSs offer features such as assignments, chat, resources, courses and forums [5]. Among these, Moodle is one of the most frequently used LMSs due to its easy access from mobile or laptop, the organisation of learning materials, the features for assignments and feedback, students' analytics, capabilities for collaborative learning and cost-time efficiency [6]. The platform can also be extended using plugins to create a personalised experience for the students and adapt to their particular needs [7]. Many studies attempted to address the issues related to the adaptability of learning using Moodle plugins due to its general technical stability [8–10]. Their results support the correlation between students' performance and the adaptation of learning materials according to the student's preferences, indicating the need for a student-centred approach to learning rather than a content-centred approach.

Despite the potential for Moodle to provide a personalized and adaptable learning environment, studies have shown that teachers often lack didactical knowledge of the platform and use it primarily as a resource repository, as shown by the survey conducted by Almenara et al. [11]. This highlights the need for teachers to invest effort in designing activities that use Moodle's capabilities for personalized and adaptive learning, which can be supported by the pedagogies related to learnersorcing, microlearning and gamification.

The rest of the paper is assembled to provide an overview of the current trends and approaches in learnersourcing, microlearning and gamification (Sect. 2), outline the existing Moodle plugins that facilitate these pedagogies (Sect. 3), summarise the shortcomings identified and propose several solutions and starting points for future work (Sect. 4).

2 Current Trends in Learnersourcing, Microlearning and Gamification

In this section, we provide an overview of the progress that has been made in the area of smart learning environments, highlighting the benefits and pitfalls of instructional approaches, such as learnersourcing, collaborative learning, microlearning and gamification.

Learnersourcing is a pedagogically supported crowdsourcing that empowers learners with an environment that allows them to contribute to teaching and learning while actively involved in learning activities themselves [2]. This type of learning was intensively studied in the latter years as it opened many opportunities for modern education. Singh et al. [12] propose a theoretical framework for learnersourcing by engaging the main stakeholders of the learning process and their contribution. Their results show that simple tasks are more effectively done when the system provides a high level of guidance, for example, by suggesting, editing or voting. The complex tasks are more suitable for proficient and expert learners requiring little guidance, but a group of learners could also complete

these complex tasks by working collaboratively. Thus, the systems should foster collaboration between the learners. The studies show that learners who choose to contribute and create new high-quality learning artefacts do so because they are interested in the novelty of the task and want to help future learners. The students who choose not to do it invoke motives like lack of time, confidence or interest.

Moore et al. [13] also have an opinion regarding the challenges faced by learnersourcing. They state that participation in learnersourcing tends to be low when the activity is optional. It is hard to evaluate how students act on the provided feedback, and it proved to be a challenge to integrate students' evaluation of the materials into the learning process; thus, the students require assistance in creating high-quality resources.

As Singh et al. [12] mentioned in their study, learnersourcing activities usually imply **collaborative learning**, especially since it has been proven to increase motivation, promote active work, and foster creativity [14]. However, multiple factors might influence the success of this approach, and a couple of aspects should be taken into account. Collaborative learning implies organisational work in choosing the appropriate tasks and resources, which usually becomes time-consuming for the instructors, leaving aside the technical knowledge required [14,15]. There is also the worry of assessing the students' work as the current system still requires quantitative results such as grades and points [14].

The students' prior knowledge also influences the success of collaborative learning [15]. Research shows that this type of learning is proper when the participants have complementary knowledge they can share with their peers while acquiring new knowledge simultaneously. However, it is redundant for those with complete understanding and requires a high level of engagement for investing mental effort in transactive activities [15–17]. Bause et al. [18] attempt to balance the discussion bias caused by prior knowledge and raise the discussion intensity and duration by using a multi-touch table and controlled conditions for collaborative learning. Their work was successful as the participants were more engaged and involved in the task, and the percentage of correct answers was high.

Whatever the challenges, studies show that learners are more likely to recall and remember information if they construct it themselves rather than having it given by somebody else [12]. Further development in this field will make education more accessible and beneficial to students. Endless types of activities could be created and evaluated using learnersourcing techniques. Spreading these methods worldwide in educational environments will lead to millions of resources that could be used to create more and more personalised learning experiences [13].

Significant research was also conducted in the direction of **microlearning** and **gamification** as a solution to the educational system's cognitive challenges nowadays, such as students' cognitive overload, short attention span and the need for instant gratification. The human brain has evolved to seek instant gratification, and microlearning activities provide immediate satisfaction, which increases

the probability that the action will be repeated. Tracking progress is another way to motivate learners to engage in the activities, as it provides instant rewards [19].

Recent literature reviews analyse the progress that has been made in this area. They summarise the benefits and threats of these pedagogical approaches and draw guidelines for developing successful systems that could facilitate these theories. De Gagne et al. [3] analysed 17 studies from 2011 to 2018 in health professions education. The review showed positive results in students' reactions to microlearning, knowledge and skill acquisition and overall behaviour. These results are also supported by the study conducted by Garshasbi et al. [20]. They review a significant body of literature on STEM education, starting from a couple of pedagogical theories, such as Sweller's Cognitive Load Theory [21,22], Mayer's Cognitive Theory of Multimedia Learning [23], Ryan's Self-Determination Theory of Motivation [24], Bouillion and Gomez (learning in the context of daily habits) [25], Collaborative Cognitive Load Theory [26], and draw essential guidelines in designing a system that facilitates microlearning.

Their investigation shows that microlearning should be flexible enough to facilitate learning in multiple ways: it should support various learning needs and encourage lifelong learning while connecting diverse pedagogical theories and approaches. It should also not be dependent on the environment and context. It should support both online and face-to-face learning, as well as academic, corporate or individual education, allowing the learner to take control over their learning process and thus enhance their motivation and preference for lifelong learning. It could be a complement to overcome certain shortcomings of the curriculum. It should be robust and scalable to be easy to integrate into existing or upcoming learning platforms. This will allow the designers to track learners' progress and feedback.

However, it is not suitable for in-depth training or complex concepts. While the benefits of using microlearning are noticeable, the results show that these activities should be complementary. Taylor et al. [27] discovered that the systems that use only microlearning produced lower satisfaction levels than those that use microlearning as a part of an extensive learning ecosystem.

Gamification is another pedagogy that can act combined with learnersourcing and microlearning to increase their effectiveness. Most studies attempt to prove a direct correlation between the gamification of an educational tool and an increase in the motivation and engagement of the students, leading to a rise in their academic performance. The study by Denny et al. [4] supports Landers' theory of gamified learning [28]. It proposes a model that explains how gamification triggers a behaviour that might generate a specific outcome. In the study context, the gamification of the learning process will increase self-testing and question authoring behaviour, improving exam performance. The study addresses one criticism of gamification, which argues that using external rewards, such as points and badges, might harm the learners' intrinsic motivation. They conclude that while giving external rewards will trigger a sense of competence, it might also reduce that students' autonomy. On the contrary, the

study by Van Roy and Zaman [29], based on the self-determination theory [30], concludes that game elements do not necessarily increase motivation. Rather, individual personality traits influence this. One of the main insights that Gordon et al. [31] demonstrated in the last decade refers to some of the primary responses of the brain. Their research shows that the brain is built to "minimize the danger and maximize the reward" [31], which might be reliable evidence supporting gamification.

However, the systematic reviews conducted by Majuri et al. [32] and Manzano et al. [33] concluded that most researches show a positive effect of using gamification elements to increase students' motivation and engagement, leading to an improvement in their academic performance.

3 Relevant Moodle Plugins

As Moodle representatives state, their mission is to "empower educators to improve our world" and "give the world the most effective platform for learning"[1]. Because of that, Moodle already facilitates various learning activities for learnersourcing, microlearning and gamification through numerous plugins developed by their employees or by their worldwide community.

Learnersourcing is an activity highly dependent on students' behaviour, and it usually goes hand in hand with **collaborative activities**. Moodle provides plugins that empower students with tools for creating and sharing learning resources and providing feedback. *"Student Blog"*[2] and *"Student Wiki"*[3] allow the creation of public posts that foster self-expression and sharing knowledge and ideas. *"Student Journal"*[4] encourage self-reflection and self-assessment. *"Student Quiz"*[5] allows students to create quiz questions that could be used in class. *"Poll"* plugin[6] promotes students' autonomy by allowing them to vote on topics of interest or further learning paths. *"Student Feedback"*[7] and *"Point of View"*[8] gives the students the freedom to express their satisfaction with a topic or learning activity. All of these plugins encourage active participation and thoughts sharing.

Moodle also provides a set of plugins that aim to facilitate group work and collaboration. The *"Group Choice"* plugin[9] gives the students autonomy to choose the group they want to work with based on their interests. On the other hand, The *"Group Self-Selection"* plugin[10] provides the students with complete control over the group formation. *"Team Assignment"*[11] allows the teachers to

[1] https://moodledev.io/general/community/mission.
[2] https://docs.moodle.org/35/en/Blog_settings.
[3] https://docs.moodle.org/35/en/Wiki_activity.
[4] https://docs.moodle.org/35/en/Journal_module.
[5] https://moodle.org/plugins/mod_studentquiz.
[6] https://moodle.org/plugins/block_poll.
[7] https://moodle.org/plugins/qbehaviour_studentfeedbackdeferred.
[8] https://moodle.org/plugins/block_point_view.
[9] https://moodle.org/plugins/mod_choicegroup.
[10] https://moodle.org/plugins/mod_groupselect.
[11] https://moodle.org/plugins/assignment_team.

create and manage group assignments. The *"Collabora"* plugin[12] enables students to collaborate on a shared document in real-time. The *"Big Blue Button"* plugin[13] provides web conferencing and collaboration tools, such as video, audio and screen sharing.

Karampa and Paraskeva [34] successfully integrate multiple Moodle plugins (theme, blocks, grids, badges) to incorporate the ARCS (Attention - Relevance - Confidence - Satisfaction) model in a collaborative learning environment. They take advantage of the flexibility of the Moodle platform as it promotes active learning through the generation of content in a collaborative manner. Badea et al. [35,36] propose a solution to overcome the grading issues during the peer assessment process by extending the *"Workshop"* plugin[14] from Moodle. They use an API based on the Bayesian Network model, which computes the students' Competence and Assessment capability during a collaborative task.

Verdu et al. [37] developed a Moodle plugin through which students can access social media without losing their LMS presence, and teachers can analyse the students' social interactions to improve the learning process. Nalli et al. [38] propose a plugin for creating heterogenous groups to enhance students' performance in collaborative learning activities. Constapel et al. [39] support collaborative work through a plugin that supervises and provides intelligent feedback to students with the purpose of improving teamwork and interactions. Hasan et al. [40] explore Moodle's game mechanics and develop a gamified discussion environment suitable for collaborative learning.

Microlearning activities are the most versatile since they take various forms, such as games, short videos, quizzes, or flashcards. Multiple plugins offer the possibility of creating quizzes, questionnaires or flashcards. Out of these, *"H5P"*[15], and *"Lesson"*[16] are the most used, offering interactive and multimedia-rich lessons that make it easier for learners to focus on small chunks of information at once. Polasek and Javorcik [41], and Hudson [42] test the effectiveness of microlearning using the H5P plugin. Their results showed that this approach creates a student-centred environment that motivates students to engage and be more proactive.

Some Moodle plugins offer support for **gamification**, either by creating activities presented in a game format, such as crosswords, hangman and quizzes[17] or by gamifying the entire course through leaderboards, points or badges. The *"Quizventure"* plugin[18] provides the tools to create quizzes with game mechanics such as time limits, lives and power-ups. *"Block Game"*[19] adds gamification elements to a course through avatars, rankings and points.

[12] https://moodle.org/plugins/mod_collabora.
[13] https://moodle.org/plugins/mod_bigbluebuttonbn.
[14] https://docs.moodle.org/35/en/Using_Workshop.
[15] https://moodle.org/plugins/mod_hvp.
[16] https://docs.moodle.org/35/en/Lesson_activity.
[17] https://moodle.org/plugins/mod_game.
[18] https://moodle.org/plugins/mod_quizgame.
[19] https://moodle.org/plugins/block_game.

The plugin proposed by Kotama et al. [43] enhances Moodle *"Quiz"* plugin to create a multiplayer matching quiz. Songkram et al. [44] present an integration of Virtual 3D Classrooms into Moodle environment. Zaric et al. [45] developed a gamified recommendation system to assist students during the learning process and foster self-regulated strategies.

In their review, Sinnott and Xia [46] evaluate the effectiveness of the Moodle plugin *"Level Up"*[20] in increasing the engagement and motivation of the students. The plugin creates a gamified learning space for the students by adding game elements, such as badges, points and leaderboards. The authors identified the most significant weakness as the difficulty of creating an actual educational game in Moodle environment, which is more complex than the simple tasks available.

Overall, the growing body of research conducted in this area focuses on the extension of Moodle capabilities through plugins to overcome shortcomings or implement novel strategies aimed to enhance the learning process.

4 Conclusions and Perspectives

Integrating learnersourcing, microlearning, and gamification in LMSs like Moodle holds great promise for promoting student-centred learning and aligns with Sir Ken Robinson's ideas for education. This paper sheds light on Moodle's existing capabilities and limitations in facilitating these pedagogical approaches. The results of our literature review indicate that there is still much work to be done to fully realize the potential of Moodle as a student-centred LMS. However, the findings of this paper suggest that with suitable investments in technology and pedagogy, it may be possible to achieve a more creative, innovative, and engaging learning experience for students.

The analysis of the state-of-the-art also underlines several challenges. Rodriquez et al. [14], and Retnowati et al. [15] identified in their research that instructors face difficulties in choosing appropriate activities that will suit the need of the students and will help them achieve the goals of the course at the same time, since it can be time-consuming and not suitable for every student. Based on the studies conducted by Singh et al. [12] and Moore et al. [13], there is also a challenge to motivate the students to contribute to the learning process and create high-quality resources since the students sometimes require assistance for complex tasks. From the studies conducted by Rodriguez et al. [14], and Moore et al. [13], we can mention the issues related to assessment, especially in the context of learnersourcing and collaborative learning, since the current educational system still requires quantitative data, such as grades.

To answer these challenges, future steps in our research will be the development of several Moodle plugins, which will help us provide solutions to the issues identified during our review.

We stated earlier in this paper that one of the most significant issues that teachers encounter is that creating learning activities is time-consuming and

[20] https://moodle.org/plugins/block_xp.

requires careful planning. Our solution is a plugin that will assist teachers in the retrieval of activities suitable for their courses. This system will work with multiple possible settings to suit the user's needs. The first approach might be a simple parameter-based search on existing Learning Object Repository, as De Medio et al. [47] propose in their paper, but targeted on micro activities and gamified learning. The direct extension of this solution is an ML algorithm that will scan the existing resources on the course (lessons, labs, books) and recommend activities suitable for the existing content. This will address the concern of using microlearning activities complementary to other resources and activities as highlighted by Taylor et al. [27]. OpenAI's APIs, such as ChatGPT [48], could also serve as a great virtual assistant for the teacher in choosing suitable activities.

The second issue identified is related to students' engagement during a collaborative task and the assessment of their work, as this activity is prone to various threats, such as knowledge bias and self-regulation abilities. Bause et al. [18] propose a solution to balance the knowledge bias of the students using a multi-touch table to prove the efficiency of collaborative learning in a controlled setting where students are provided with different pieces of information that they have to put together to solve the given task.

Inspired by their idea, we propose an activity plugin that creates a virtual private space for each student where they can take notes, work on assignments and develop ideas, and a common public space, where the students can share the notes from their private space and potentially discuss it with their peers. The private space will take the form of a list of notes that could be created or edited using an essential toolbox for text editing, media insertion, attachments, and other interactive features. These notes could be kept in the private space or moved to the public space as topics on a discussion forum. Some potential use cases for this plugin are knowledge sharing, collaborative work and activity tracking that could assess students' critical thinking and creativity in such settings. Since we found out from Singh et al.'s [12] research that some students might require guidance, we also propose the integration of ChatGPT [48] in the students' private space to fill in the knowledge gaps the students might have.

Another future direction for our research could be related to the assessment of skills such as creativity and critical thinking which is a complex topic of discussion that was intensively studied [13,14,35,36]. Some of the challenges that we identified are the difficulty of quantifying and comparing students performance and the subjectivity of assessment that can not be standardised. There is also the need for time and resources, such as specialised training for the teachers, suitable tools and materials, which often requires financial support that many institutions do not have, but technology can play a significant role in making these solutions more accessible.

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