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# Designing a Collaborative Learning Platform Based on Learnersourcing and Gamification

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**Abstract.** In traditional, old-fashioned educational settings, students are passive consumers of learning content and do not actively contribute to the overall improvement of the learning process. While the situation has been changing lately and novel teaching approaches have been proposed, there are many educational systems in which the problem still persists. In this context, we introduce an innovative educational platform called ShaLe, which aims to provide comprehensive support for learnersourcing and gamification. More specifically, the ShaLe system allows students to share additional educational resources alongside those provided by the teachers. It features an integrated question-answer system to facilitate discussions and clarifications related to the teacher's materials. Additionally, the platform introduces a dedicated task that encourages students to create new assignments and evaluate solutions proposed by their peers. Furthermore, students can visualize their own performance metrics and can earn badges for exceptional achievements, adding a gamification component to the learning process. As such, the platform is designed to facilitate collaborative learning among students, stimulate learner engagement, while also decreasing the workload of the teacher.

**Keywords:** Learnersourcing, Gamification, Student generated content, Rewards, Badges, Educational platform, Collaborative learning.

## 1 Introduction

In recent years, innovative teaching methods and tools that foster collaboration among students have been devised, contributing to the development of various social and subject-specific skills [12]. Extensive literature on computer-supported collaborative learning showcases a range of teaching approaches that have been implemented across different subjects and educational levels over several decades [13, 14, 18].

A novel pedagogical approach, rooted in foundational studies on student-contributed teaching methods [14], involves students creating and sharing learning materials. This practice has gained recent popularity and is associated with two main benefits. Firstly, the generation of learning content requires cognitive effort, encouraging students to deeply engage with course concepts and demonstrate high-level behaviors according to Bloom's taxonomy of educational objectives [10]. Secondly, harnessing the creative abilities of numerous students can lead to the rapid and cost-effective development of

extensive repositories of learning materials, which can then be utilized for practice and to support personalized learning experiences [24]. Thus, the concept of "learnersourcing" represents a form of crowdsourcing in which learners collectively contribute new content to benefit their peers, while engaging in a meaningful learning experience [16].

In addition, various mechanisms, such as the integration of gamification, can be employed to motivate students to contribute useful information for other learners. In general, gamification refers to the incorporation of game design elements in a non-gaming context. In the realm of education, it entails the use of game-specific mechanisms, aesthetics, and game-like thinking to engage individuals, motivate actions, promote learning, and solve problems [6]. The theory behind using gamification in educational settings is that people learn best when they are having fun. In addition, having goals, targets, and achievements also encourages the learning process [7]. Over time, various studies have been performed that illustrate the improvement brought by gamification in education [7, 19, 23].

Therefore, in this paper we propose an innovative educational platform, called ShaLe, which is built upon these two fundamental concepts: learnersourcing and gamification; these are seamlessly integrated with the traditional features of systems designed for collaboration between students and teachers [25]. Thus, the platform incorporates various functionalities aimed at enhancing collaboration and eliciting high-quality content from the students, such as: a dedicated mechanism for asking questions and receiving answers from fellow classmates, the ability to add supplementary materials, and the inclusion of special collective tasks. In addition, elements related to gamification, such as badges and rankings, are also available to stimulate student engagement.

The remaining sections of this paper are structured as follows: Section 2 provides an overview of related work, highlighting similar systems in the field. Section 3 presents the mechanisms and workflow of the ShaLe platform, while Section 4 illustrates its key functionalities. Finally, Section 5 presents concluding remarks and outlines potential future research directions.

## 2 Related Work

Since our ShaLe platform is based on the integration of learnersourcing and gamification, in this section we will provide an overview of related platforms in these two areas.

With respect to learnersourcing, PeerWise and RiPPLE are two representative platforms that embody this fundamental concept. PeerWise, originating in 2008, facilitates the creation and distribution of formative practice questions among students in a user-friendly manner [4, 5]. As one of the pioneering learnersourcing systems, it has been extensively utilized in numerous courses, engaging hundreds of thousands of students in the generation and assessment of multiple-choice questions (MCQs). Students actively engage in the generation, sharing, and solving of MCQs alongside their primary instructional materials. Upon answering a question within PeerWise, students are prompted to assess its difficulty and quality while offering general feedback. These evaluations aid in identifying the most beneficial and pedagogically effective items,

while also flagging inaccuracies or ambiguities. PeerWise aims to guide subsequent learning endeavors by pinpointing areas of incomplete understanding and providing abundant opportunities for practice.

RiPPLE, an online adaptive learning platform, adopts learner-centered methodologies and pedagogically sound strategies to immerse students in authentic learning encounters [15]. Moreover, it endeavors to leverage students' creative potential and evaluative capabilities in order to cultivate a repository of quality learning materials. By embracing the learnersourcing paradigm, RiPPLE collaborates with students to establish a compendium of educational resources. The platform enables students to contribute a diverse array of resources, including multiple-choice questions, multi-answer questions, matching queries, worked examples, and open-ended annotations. Notably, RiPPLE distinguishes itself by fostering joint collaboration between students and faculty members in the creation of subject-specific content. Additionally, it employs an assessment mechanism allowing students to evaluate peer-generated content using a customizable set of rubric criteria tailored to the course and resource type [3, 9].

An alternative way in which students can assist their peers is through integrated question support and peer learning [22]. Students can ask questions based on any ambiguities they encounter in the materials provided by teachers, and fellow students can provide answers. These answers can be approved by the teacher or deemed helpful by other students. A similar approach can be observed on the renowned website for programmers, Stack Overflow[1], which is based on a question-and-answer model. The efficiency and benefits of Stack Overflow have made it increasingly popular and widely used among programmers.

Another interesting direction is related to gamification, which involves implementing elements derived from games and employing game design principles within non-game environments [6]. Numerous educational platforms have embraced gamification as a strategy to enhance motivation and foster increased engagement among learners, as summarized in [7, 19, 23]. There are also some popular commercial platforms that employ gamification for education, such as Duolingo and Kahoot!, as we describe next.

Duolingo[2], a language-learning platform, uses gamification techniques to engage and motivate users. Game elements within the system include rewards, such as lingots earned by completing lessons, leaderboards for comparing progress with friends, a level system to track daily activity and compete with peers, and badges to showcase acquired skills. These elements serve as effective motivators, encouraging users to return and continue learning while fostering a sense of investment in their study efforts [11].

Kahoot![3] is an online learning platform that allows users to create, share, and engage in quiz-style games, transforming the classroom into an interactive game show. Teachers have the option to create their own quizzes or utilize and modify public quizzes available on the platform. The free version offers basic functionalities such as creating multiple-choice quizzes, adding images as answers, and accessing analytics. However, to access more advanced features and options, teachers, schools, or districts may need

[1] https://stackoverflow.com/
[2] https://www.duolingo.com/
[3] https://kahoot.com/

to subscribe to a paid version. Quizzes can be presented live in a classroom setting or assigned for self-paced learning. During live Kahoot! sessions, quizzes are projected on interactive whiteboards for all participants to see, and students answer questions using their own devices. Typically, students must answer questions within a given time limit. After each question, students can view everyone's scores, and points are awarded based on correct answers and response time. At the end of the game, a podium displays the top scorers [17, 21].

Since both learnersourcing and gamification proved their value in educational contexts [7, 14, 19, 20, 24], our aim was to incorporate both of them in a fully-fledged educational platform, which provides comprehensive functionalities for the learning process. The novelty of our approach consists in the integration of learnersourcing and gamification in a general-purpose collaborative learning platform, which offers support for a wide range of educational activities and can be used in different instructional settings, as described in the following section.

# 3 ShaLe Platform – Mechanisms and Rationale

## 3.1 Designing an Approach for Collaborative Learning based on Learnersourcing

As mentioned before, the ShaLe platform was developed to support the core elements of a traditional e-learning platform, such as course and assignment management, while also incorporating features based on the concept of learnersourcing to facilitate collaborative learning among students. It encompasses various functionalities for sharing learning resources, managing tasks and communication between students and teachers within study groups, as well as providing rewards to stimulate student engagement. The name of the platform also comes from the two main activities it is based on: **Sha**re and **Le**arn.

The system accommodates two key roles in the educational process: the teacher and the student. Teachers are responsible for guiding students, managing communication, posting materials, and assigning introductory tasks to provide a starting point for students to delve deeper into specific subjects. On the other hand, students need to follow the teacher's instructions to develop their own knowledge and also assist other students in acquiring the information they have accumulated. Thus, the platform integrates functionalities that allow students to contribute to the improvement of their peers' learning process, based on learnersourcing. ShaLe focuses on three main aspects of direct student participation: proposing additional learning materials, asking questions based on the materials, and engaging in collective tasks, as detailed below.

The proposal of additional learning resources is facilitated through a dedicated section related to each material posted by the teacher. Students can supplement the materials with additional ones that contain useful information which may have been omitted or provide simpler explanations. However, a potential issue arises if students contribute resources that contain incorrect information. To address this, teachers can mark student resources as approved, signifying that the information is valid and can be used by other students without any concerns. Furthermore, if a material is helpful to another student,

they have the option to reward the author by marking it as helpful. This feature brings several benefits, including the development of students' critical thinking skills, the provision of simplified resources for students seeking specific knowledge, and the overall improvement of educational materials for future students.

Another important feature of the platform is a dedicated section where students can ask questions about the materials provided by the teacher. Students who post questions that prove to be useful for others can be recognized and rewarded by marking their questions as helpful, both by fellow students and teachers. In addition, students can also provide answers to questions posed by their peers. If a student offers a correct and comprehensive answer, the teacher can approve it, and students who benefited from the response can categorize it as helpful. This filtering process ensures that the best answers are highlighted. The benefits of this feature include providing a pleasant environment for students to ask questions and clarify ambiguities, as well as actively involving students by utilizing their acquired knowledge to assist their peers, with their contributions and merits being recognized and rewarded.

The collective task represents an innovative functionality in ShaLe, which is divided into three distinct stages:

1. In the initial stage, students are required to propose tasks based on the guidelines provided by the teacher in the assignment description. These guidelines may include factors such as difficulty level, theme, or other relevant aspects. After the students submit their proposed tasks, the teacher reviews them and approves those that align with the given instructions. If necessary, the teacher can provide further instructions to the students for revising and improving their proposed tasks. It is important to note that at this stage only the teacher has access to view the proposed tasks, while students can only see their own submissions.
2. Students who have had their tasks approved in the previous stage become eligible to proceed to the second stage. Each participating student is randomly assigned a task proposed by another student, whose identity is anonymized. Students are then required to solve the task assigned to them until the teacher determines it is time to transition to the next stage.
3. Moving on to the third stage, students are asked to evaluate the solutions proposed by their peers for the tasks created in the first stage. The evaluation process is double blind, meaning that the evaluator cannot identify the student who solved the task, and the student who solved the task cannot identify the evaluator. In addition to assigning a grade, students must provide feedback to justify their rating. Similarly, the teacher must assign a grade and provide feedback for the solutions submitted by the students. Once this stage concludes, each student can visualize the feedback and grades provided by the peer evaluator and the teacher for their proposed solution. Evaluators can also see the grade and feedback given by the teacher, facilitating a comparison with their own evaluation.

Hence, engaging in collective task assignments yields a multitude of advantages. Firstly, students have the opportunity to enhance their creativity and evaluation skills through the process of task composition. Secondly, by delving into the task description,

students are compelled to acquire knowledge about the proposed topic, enabling them to effectively design a task. Additionally, the peer review approach fosters the development of assessment skills and the ability to provide constructive feedback, while also cultivating a willingness to receive feedback [1, 8]. Furthermore, teachers are able to use the most well-crafted tasks for future cohorts of students or even for the current group.

### 3.2 Mechanism for Rewarding the Student Contribution

As previously mentioned, ShaLe also integrates gamification elements aimed at motivating students to contribute to the group's learning process. Thus, the application incorporates a range of rewards designed to acknowledge and incentivize active student participation within study groups, thereby enhancing the overall learning experience for all participants. As literature shows, it is important to stimulate and reward students for their contributions, as this fosters motivation and encourages optimal performance [19]. The following types of rewards (badges) can be granted to the students in ShaLe:

- ***Knowledge Investigator***: This reward is conferred on the student who submits the largest quantity of approved proposed materials.
- ***Resource Guru***: This reward is granted to the student who provides the most helpful proposed materials.
- ***Knowledge Seeker***: The student who poses the most useful questions receives this reward.
- ***Top Supporter***: This reward is given to the student who provides the largest number of approved answers to fellow students' questions.
- ***Helpful Hero***: The student who offers the most beneficial answers to fellow students' questions is honored with this reward.
- ***Task Master***: This reward is attributed to the student with the highest number of approved tasks.
- ***Accurate Evaluator***: This reward is given to the student whose assessment scores come closest to that of the teacher.

Each reward category is further divided into three award levels: *gold*, *silver*, and *bronze*; these are given to the top performer, second-best performer and third-best performer in the study group for the specific reward respectively.

With respect to implementation, the ShaLe system has an architecture built on the client-server model, using the Spring Boot framework for the server side and Angular for the client side. Communication between client and server is done through RESTful APIs. A relational database, implemented using PostgreSQL, was used to store the data in the application. More details regarding the system functionalities are presented in the next section.

## 4 Illustrating ShaLe Functionalities

The ShaLe platform has three user roles (administrator, teacher and student). The following three subsections describe the perspective of each role respectively, illustrating

the main functionalities provided by the system.

### 4.1 Administrator Perspective

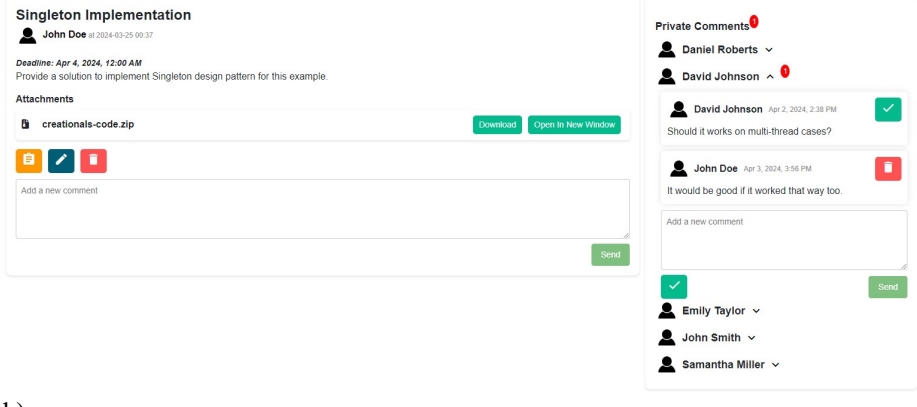
The system administrator is responsible for user management. The main actions that an administrator can do in ShaLe are:

- *Manage new account requests* – confirm or reject user requests to create accounts.
- *Account confirmation automation* – automate the confirmation of accounts with certain email domains.
- *Manage existing accounts* – view or edit some information about the platform users.

### 4.2 Teacher Perspective

The teacher is provided with the following main functionalities in ShaLe:

a)

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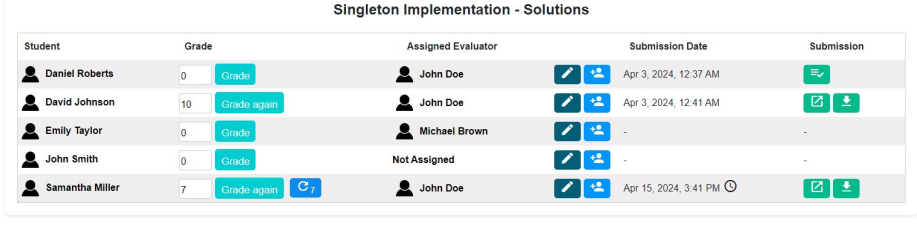
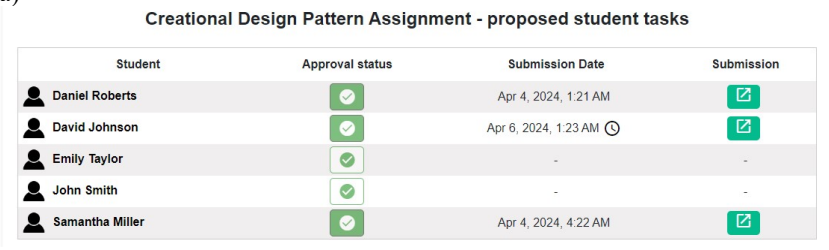



**Fig. 1.** ShaLe – Task management module: (a) create task and send private comments to students; (b) visualize and grade student solutions.

a)

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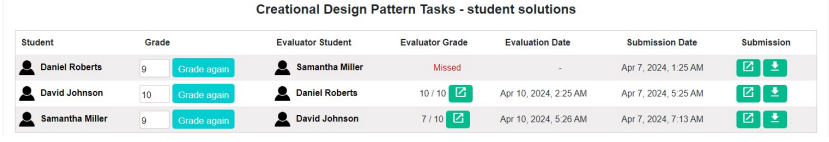


**Fig. 2.** ShaLe – Collective task management module: (a) approve student generated tasks; (b) evaluate student solutions.

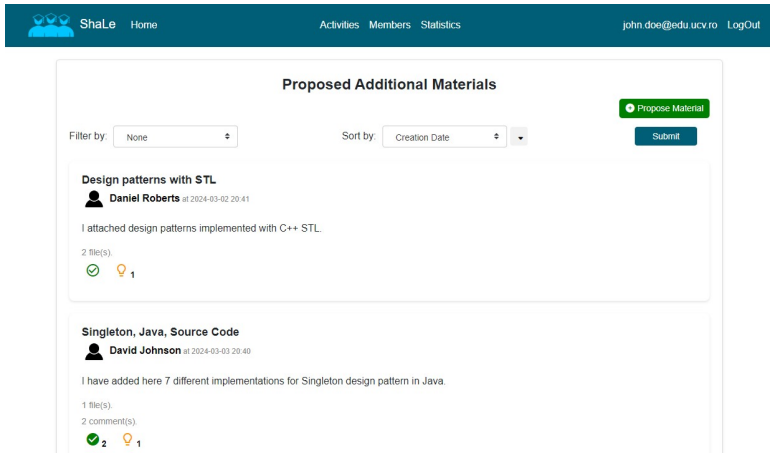


**Fig. 3.** ShaLe – Visualize learning resources proposed by the students

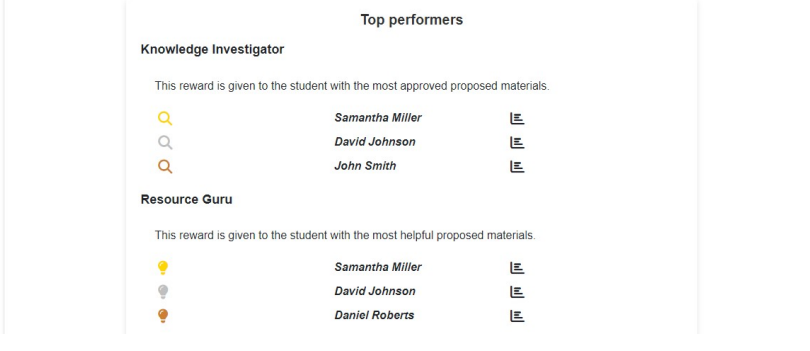


**Fig. 4.** ShaLe – Teacher dashboard - Visualize top performers in a study group

- *Manage study groups* - where the teacher can create new groups, manage existing ones and visualize group details, including all posts from a specific group.
- *Manage individual tasks* – which plays an important role for the correct assessment of students. The teacher has the possibility to create tasks, assign them to a selected group of students, visualize their answers and grade them. In addition, the teacher can communicate about the task with the students in the study group by means of public or private comments. This functionality is illustrated in Fig. 1.
- *Manage collective tasks* – This module refers to the tasks that are created by the students, following the learnersourcing approach described in the previous section. The teacher can coordinate all three stages of a collective task, as depicted in Fig. 2.
- *Visualize students' questions and learning resources* – The teacher can view the questions that students posted about the educational materials, as well as the additional learning resources proposed by the students, and approve them accordingly, as described in the previous section. An excerpt of this module is included in Fig. 3.
- *Statistics dashboard* – The teacher can see various details and charts regarding the activity in the study group, including an overview of the performance of the whole group and of each student in the group. An excerpt of this module is included in Fig. 4.

### 4.3 Student Perspective

The student is provided with the following main functionalities in ShaLe:

- *Access study groups* – where students can view the study groups in which they are enrolled, access each of them and see their details and activity
- *Manage individual and collective tasks* – where students can view the assigned tasks, create tasks for their peers, submit solutions, review peers' solutions and check the status and grades of their work. A part of this module is illustrated in Fig. 5.
- *Access and propose educational materials* – where students can view the materials posted by the teacher or by other students, propose additional learning resources, ask questions, or provide answers to peer's questions. A part of this module is illustrated in Fig. 6.
- *Visualize profile* – where students can see various statistics regarding their activity, the awards received (as depicted in Fig. 7) and their ranking in the study group.

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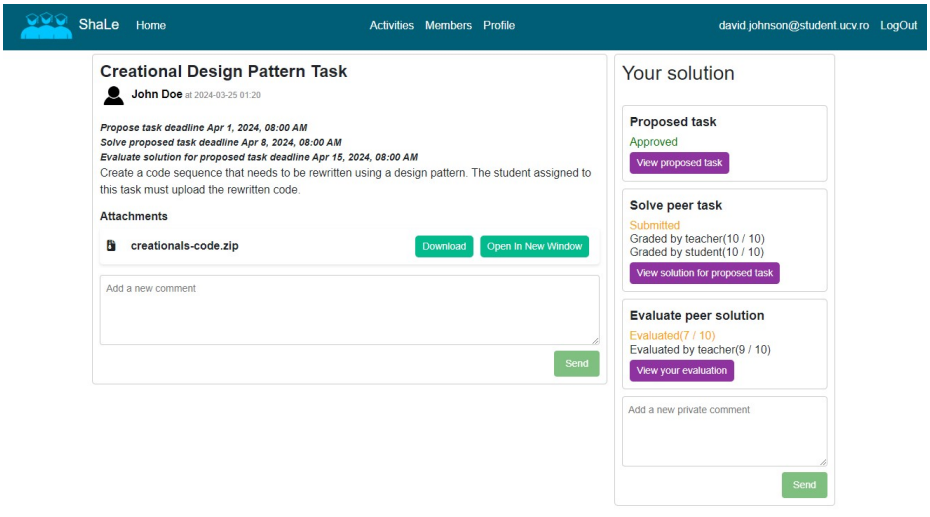


**Fig. 5.** ShaLe – Student view of a collective task

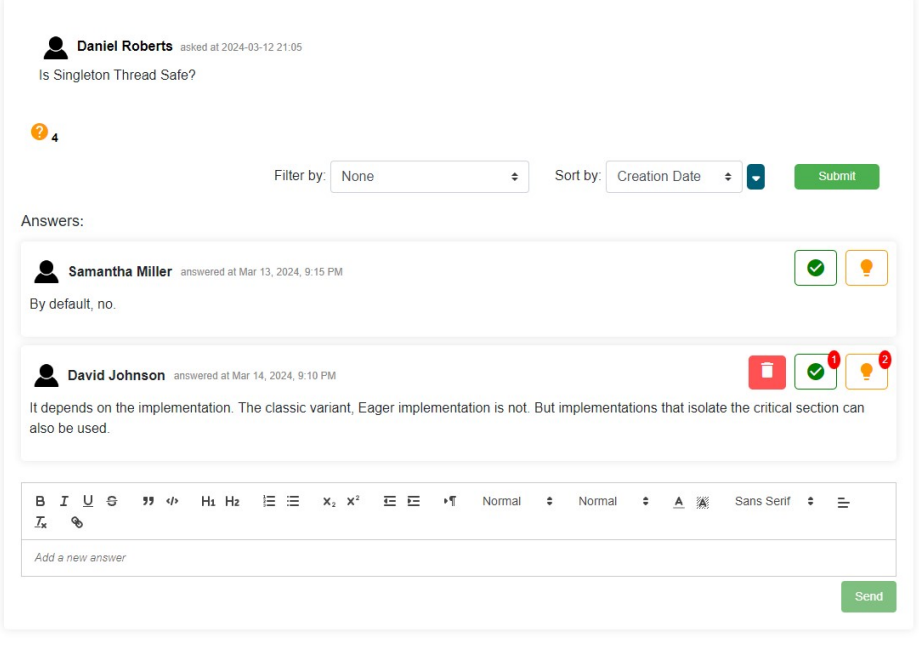


**Fig. 6.** ShaLe – Student perspective of question-and-answer module

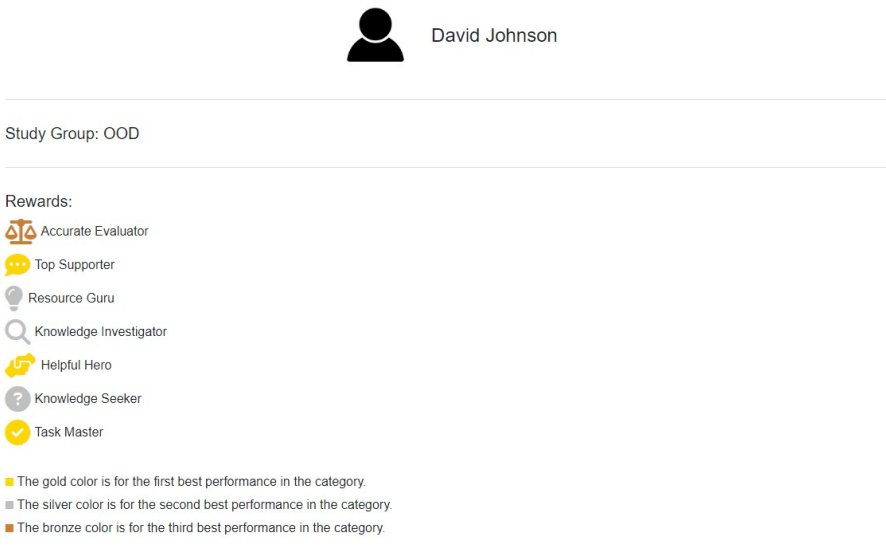


**Fig. 7.** ShaLe – An excerpt from the student profile page

## 5 Conclusion

We proposed an approach for integrating learnersourcing and gamification in a fully-fledged, general purpose educational platform. Thus, we designed and implemented ShaLe system, which provides support for collaborative learning and student generated content. The novel features include a mechanism for creating, solving and assessing tasks, a module for asking questions and receiving answers from peers, and the ability to add supplementary learning resources, in addition to the educational materials provided by the teacher. Furthermore, a gamification component is included in ShaLe which aims to boost student engagement.

As future work, we plan to extend the system with a generative AI component [14]; for instance, ChatGPT[4] could be integrated into the platform for answering student questions and evaluating student work, under teacher's supervision. This could provide instant feedback to the students, while also encouraging critical thinking and content filtering. In addition, we plan to use the platform in real-world settings, with students from the Computers and Information Technology Department at the University of Craiova, Romania. We will thus be able to assess the usability and effectiveness of the platform and gather student feedback that could be used for further refinements and improvements. Subjective student data will be collected by means of dedicated surveys (e.g., System Usability Scale [2], student satisfaction questionnaire); we also plan to analyze student behavioral data (e.g., their interaction with the ShaLe platform), in order to evaluate learners' involvement and the quality of their contributions. We also

[4] https://openai.com/chatgpt

aim to investigate the usefulness and effectiveness of each individual feature of the platform; in particular, we are interested to see whether the collective task feature will be considered too complex by the students and how the display of badges and rankings is received by average or below average students. Finally, we will also collect teacher feedback, in order to understand potential adoption challenges. In the long term, the use of the system could be extended to different instructional settings, disciplines of study and educational levels.

**CRediT Authors Statement. Alexandru Smarandache:** Conceptualization, Methodology, Software, Writing – original draft preparation. **Elvira Popescu:** Conceptualization, Methodology, Validation, Resources, Writing – review and editing, Supervision.

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