Adaptable and non-adaptable gamified e-learning model using chatbots

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Abstract. Is true that human interaction can play a significant role in learning process. The lack of these interactions can lead to feelings of isolation and disengagement among learners. Several researchers have proposed gamified e-learning model as an effective way to increase learners' motivation by providing them with autonomy, relatedness, and competence. Basing on literature we can divide gamification models into two categories: adaptable models and non-adaptable models.
In order to help designers of gamified e-learning systems and teachers to choose the right games element to display, we propose a new model that incorporates game elements using the two models mentioned above. This model aims to address the limitations of traditional e-learning platforms by providing a more engaging and personalized learning experience for learners.
Our proposed system is based on the interaction between three main actors: the System, the Teacher, and the Learner. These actors are interconnected and can interact with each other in various ways to create an engaging and personalized learning experience. They can interact via the application settings or via direct communication or chatbot communication. In this way, our proposed system is designed to foster interactions between the three actors, to create a personalized, engaging and dynamic learning experience. The system continuously monitors and adapts to the learners' needs, while the teacher provides guidance and support, and the learner actively participates in the learning process.

Keywords: e-Learning, Gamification, Chatbots.

1 Introduction

E-learning is a broad term that refers to any form of learning that is facilitated through digital technology. It involves the use of electronic media, such as computers, smartphones, and tablets, to deliver educational content and to facilitate interaction between teachers and learners. One of the key advantages of e-learning is its flexibility. Learners can access educational content anytime and anywhere. E-learning also

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provides learners with the opportunity to learn at their own pace and to repeat content as many times as necessary to achieve mastery.

Overall, e-learning has become an increasingly popular and effective way of delivering educational content, it's are gaining significant attention and their use is on the rise for academic purposes as well specially during and after the covid lockdown [1]. It offers many benefits over traditional classroom-based learning, including greater flexibility, personalization, and accessibility. With the continued advancement of technology, it is likely that e-learning will continue to play a critical role in education and training in the years to come. One of the key challenges of this novel mode of learning is to maintain learners' motivation despite their physical distance from their teachers.

Maintaining student motivation and focus is a significant challenge for e-learning researchers, as learners can quickly lose interest [2]. To address this issue, many researchers have turned to gamification as a potential solution. This approach has been found to be an effective way of sustaining motivation during learning activities [3]. In a previous study [4], we examined the effectiveness of game elements in five gamified e-learning applications using existing gamification taxonomy [5]. The aim was to evaluate their usefulness and propose a new model for game elements based on the results of the experiment. The elements were divided into five dimensions: Measurement, Social, Ecological, Personal, and Fictional. The effect of each element on the learner's motivation was also discussed, whether it was intrinsic or extrinsic. In total, there were 19 elements, including Acknowledgement, Level, Progression, Point, Stats, Chance, Imposed choice, Economy, Rarity, Time pressure, Competition, Cooperation, Reputation, Social pressure, Novelty, Renovation, Sensation, Narrative, and Storytelling.

Even with social elements such as competition or cooperation, gamification remains limited in terms of interactivity. While these elements can connect learners through common objectives, they do not necessarily facilitate meaningful communication among individuals. Therefore, while gamification can be a useful tool for enhancing motivation and engagement, it should not be seen as a substitute for meaningful social interaction and communication.

A chatbot, as defined by [6], is a type of computer application that utilizes natural language (NL) and interacts with people in a way that resembles human communication. Also referred to as "talkbots," chatbots are designed to establish and maintain written or spoken communication with humans in order to help them achieve a particular objective [7][8]. These programs are considered to be a flexible form of artificial intelligence that leverages a set of rules or neural networks to monitor and enhance a service [9] or choose the most appropriate response to a customer inquiry [10]. The applications of chatbots can be broadly categorized into two types: task-oriented and non-task-oriented [11][12]. Task-oriented chatbots assist customers in performing specific activities by means of brief conversations, while non-task-oriented chatbots aim to provide customers with answers to their inquiries and offer entertainment.

2 Related works

A study [13] was conducted to investigate the effectiveness of "Termbot" a chatbot designed for online learning, specifically in the area of medical terminology. The developers aimed to create an interactive and enjoyable learning experience for students by integrating crossword puzzles into the chatbot. By utilizing this approach, students were able to engage with the material in a more fun and immersive way. During their interactions with Termbot, students had access to online crossword puzzles that aided in their understanding of medical terminology. The study found that students who used Termbot made significant progress in learning medical terms, which is valuable information for educators as it allows them to identify areas where additional support may be needed.

In [14] the authors discuss the potential benefits of using chatbot-supported communication in e-learning, specifically in the context of MOOCs. The study explores the reasons why some learners prefer traditional channels over e-learning services such as YouTube learning channels, and identifies the most important aspects of e-learning service delivery to learners. The study found that chatbot-supported communication can be effective if properly designed and integrated with personalized content, credibility, and human touch. The research also examines the impact of learner-chatbot communication style alignment and similarity on learners' perceptions toward adopting chatbot-supported e-learning services. The findings suggest that communication style similarity between chatbot and learner leads to positive perceptions of this communication type, including increased task value, informativeness, enjoyment, credibility, and personalization. Additionally, the study found that chatbot type as a text stream can moderate the relationship between certain factors and learners' intention to use such communication channels.

In order to teach children about healthy lifestyle, Authors in [15] utilized a gamified chatbot to establish a compelling social connection with them. The study's findings were encouraging, revealing that the gamified chatbot surpassed the paper-based version in terms of effectiveness.

An approach is presented in [16] that involve a custom chatbot linked to Moodle's platform through web configuration. The chatbot is designed to provide real-time responses to learner queries and offer relevant suggestions based on their specific needs. The system follows a set of commands, beginning with retrieving data from the database, then suggesting appropriate learning resources or requesting missing feedback, and finally recording computed recommendations for future analysis or similar queries.

The paper [17] proposes a joint open student-player model. In addition, a system architecture has been described that incorporates a validation of a dynamic machine learning system to increase adaptability to various digital applications while maintaining simplicity. The open model is one module of this architecture, which also includes a game learning analytics and personalization module and a contextual information collection module for personalization. The gamification engine is responsible for real-time personalization features. The proposed reactive chatbot architecture is based on this general architecture and includes multi-channel integration through an orchestra-

tor, enabling appropriate interaction and response with digital sources. The building blocks for this implementation are also discussed.

In [18], the authors examine the benefits of incorporating game elements into conversational learning chatbots, which can effectively motivate learners and facilitate self-regulated learning. The authors propose a structured framework for gamifying educational conversational agents. This framework is developed through the consolidation of multiple theories regarding games, digital learning, and conversational agents. The authors also provide practical implications for practitioners to consider when gamifying conversational agents.

3 Proposed approach

Despite the significant amount of research articles that emphasize the importance of personalization in gamification approaches for e-learning, the absence of a comprehensive model that incorporates the design and principles of adaptive gamification persists [19]. To address this issue and assist educators in developing gamified courses that effectively engage students and maintain the social interactions given their importance in maintaining focus in a course, our research proposes a novel adaptation model that integrates gamification and chatbots.

In order to promote intrinsic motivation, the teacher should utilize intrinsic game elements (non-adaptable model) that are not immediately noticed to the learner during their interactions with the Learning Management System (LMS) such as Chance, Competition, Cooperation, Reputation, Social pressure, Novelty, Renovation, Sensation, Narrative and Storytelling, while the system can suggest or not the extrinsic elements (adaptable model).

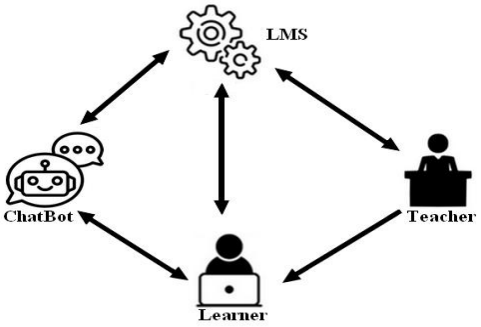

Fig. 1. Interaction between actors

Our proposed model, as depicted in Fig. 1, comprises of three primary actors: the system, the learner, and the teacher, along with a Chatbot. The interactions between the teacher and the system and between the learner and the system are bidirectional. On the one hand, the system is suggesting the course and inviting to create the course to the learner and the teacher, respectively. On the other hand, the learner is perform-

ing their tasks while the teacher is creating their course and selecting extrinsic elements to display within the system. The learner can also receive appreciation from the Teacher if they perform well (through the use of Narrative elements).

Finally, to provide learners with the opportunity for social interaction and communication, our model incorporates the use of a chatbot. Chatbots share some core functionalities, which involve: reading incoming messages, identifying relevant keywords and commands, searching for matching intents or expressions, carrying out specific functions accordingly and providing replies or sending answers as appropriate. During a conversation with the chatbot, the recommendation engine is triggered upon request, which has access to LMS database and stores the computed suggestions in a separate recommendation database, which will be used for further analysis[16]. The responses generated by the chatbot can come from pre-determined conversation paths or from using natural language processing and machine learning algorithms to identify the user's intents and entities. If the responses are pre-determined, they are sent based on specific rules. However, the chatbot can also generate intelligent responses by learning and recognizing new keywords and phrases.

In our model, the recommendation engine (RE) serves two primary purposes. Firstly, based on the learner's progression and questions, the RE can suggest additional materials, such as videos, documents or graphs that the teacher has initially uploaded as supplementary resources. Secondly, the RE recommends extrinsic game elements, and the amount of such elements suggested depends on the learner's interaction with them. If the learner responds positively to the suggested game elements, the RE will propose more of them, and vice versa.

In addition to analyzing the behavioral information of learners, the RE in our model can utilize various other parameters to make efficient recommendations for additional materials and extrinsic game elements. These parameters include personal information such as the learner's country, gender, and age, as well as the learner's user profile. The LMS can utilize the concept of learning style to define the user profile, which encompasses all the characteristics that define how a person learns. The widely accepted model for learning styles is Felder-Silverman's learning style [20][21]. Additionally, the activity of the learner on the platform, such as the time spent, number of connections, number of chapters viewed, and the duration of each visualization, as well as access period [22], can be considered in the recommendation process.

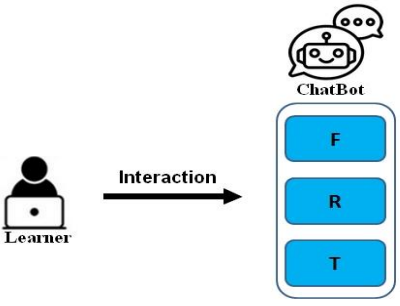

Fig. 2. Chatbot services

In Fig 2, the chatbot's services, which include greetings, receiving requests, user interactions, file sharing, and automatic feedbacks (such as suggestions, recommendations, and assistance), are abbreviated as "interactions". The chatbot operates based on a set of commands. The recommendation process through the RE begins by retrieving data from the database (Fetching), suggesting additional learning materials, extrinsic games elements or asking for missing feedback (Recommendation), Finally, the chatbot stores the recommendations it computed in a record for future analysis or to answer similar requests (Trace)[16].

4 Conclusion

Gamification and chatbots have become increasingly popular in the field of education as a means to enhance learner engagement and motivation. Gamification, which involves the use of game mechanics in non-game contexts, can turn learning into a fun and interactive experience. This, in turn, can motivate learners to stay engaged and committed to the learning process. On the other hand, chatbots, which are computer programs designed to simulate human conversations, can provide learners with personalized and responsive support. By answering questions, providing feedback, and offering guidance, chatbots can help learners stay on track and motivated throughout their learning journey.

While gamification and chatbots can be powerful tools for maintaining learner engagement and motivation, it is important to choose the right model to achieve the desired outcomes. Different learners have different needs and preferences when it comes to learning, and what works for one learner may not work for another. Therefore, it is essential to identify the learners' needs and preferences, and select the appropriate gamification and chatbot models that align with their learning goals and styles.

In our proposed model, we combined both adaptable and non-adaptable gamification approaches. The non-adaptable approach involves the system proposing and requiring the teacher to use all intrinsic game elements, given their importance in learner motivation. The adaptable approach utilizes the chatbot to suggest extrinsic game elements to the student, taking into account various criteria to determine whether to suggest them or not. Additionally, the chatbot also aids learners in better understanding the course. The model proposed in this work is currently being used to implement in a LMS. Moving forward, future work will focus on testing and evaluating the overall performance of the system.

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