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InteractDiff: a 3D Sandbox Game for Online Teaching and Campus Life Experience

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Abstract. The coronavirus pandemic forced teachers to use online meeting software to teach courses remotely. However, without on-site supervision from teachers, students can get distracted and lead to learning inefficiencies. Distraction also leads to low interaction, and teachers may lose enthusiasm in teaching. In addition, social interaction is necessary for campus life. To address these problems, we present InteractDiff, a 3D sandbox game to improve the online teaching experience and interactivity. We designed several school scenarios and mechanisms where users act as an avatar inside to imitate real-life interactions in university. Our preliminary study shows potential feasibility and positive feedback from users.

Keywords: Gamification of learning · Online learning · Synchronous learning · Virtual worlds.

1 Introduction

Almost all school activities are being cancelled or run in virtual due to the coronavirus pandemic. Teachers are forced to use online meeting software like Zoom[4] and Google Meet[5] to teach courses. Although this way reduces infection risk, it also brings new challenges in learning. We categorised three issues between teachers and students from the literature review, observation in online university classrooms and a user journey map we created.

1. In the synchronous online class, many students choose not to turn on the video camera and microphone [2]. Teachers cannot understand their learning status through observation [10]. They may lose enthusiasm in teaching because of lacking verbal and non-verbal feedback from students.
2. Without on-site supervision from teachers, some students feel hard to stay concentrated in the online class [10], which may affect their learning efficiency.

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[4] Zoom Video: https://zoom.us
[5] Google Meet: https://meet.google.com

3. Interaction with peers plays a vital role in school life [6]. Current online meeting software only offers a one-to-many communication mode. It is difficult for students to discuss with others privately and deprive their belonging needs [1].

Inspired by gamified learning [9], we propose InteractDiff to tackle these problems. InteractDiff is a sandbox game for imitating different school scenarios. Every user in the system acts as an avatar to represent themselves, such as Second Life [5] and The Sims[6]. Teachers can switch to different scenes and adapt their purposes, such as a laboratory or exhibition hall. Students can express their thoughts and interact with peers by controlling the avatar.

Previous studies have been proven the feasibility of 3D virtual learning environments, especially in non-higher education [3]. Also, VR (Virtual Reality) technologies have been commonly used to improve the learning experience [7, 4]. However, Circles [8] pointed out the accessibility concerns in VR classroom. Based on the popularity of head-mounted display, InteractDiff is designed to be a PC video game for university students instead of a VR application.

This work aims to explore the feasibility of popularising a 3D virtual environment in universities, combining learning and campus life into one virtual space. We believe that this gamified learning approach can improve the learning experience and disadvantages of online meeting software.

2   InteractDiff

We built InteractDiff by Unity[7] to realise the virtual campus. Users can control the avatar by mouse and keyboard to imitate real-life behaviours and campus life, including social activities, attending class and interact with NPCs (non-player character). Several school scenarios and functions were also designed:

Environment: In addition to traditional classrooms, two virtual environments were designed for teaching. Based on Savanna Preferences and Biophilia Effect, we provided an outdoor grassland (Figure 1a) for multiple uses, such as exhibition and presentation. This greenery environment could reduce the anxiety of learning. In Figure 1b, we also created a virtual laboratory and common room for experiment demonstration and social interaction. This is an alternative and cost-effective way to experience different lectures or occasions without spending time in commute.

Group Mode: When teachers need to hold a group discussion, Group Mode allows everyone to form a group by controlling their avatar close to each other in the classroom. Only group members can hear each other. Teachers can also join the discussion by moving the avatar to a specific group (see Figure 1d). This feature imitated face-to-face discussion, offering a space for social interaction to makes students feel affiliated.

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[6] The Sims 4: https://www.ea.com/games/the-sims/the-sims-4
[7] Unity: https://unity.com

Draw Lots and Vote: Teachers can randomly select a student to answer questions using Draw Lots, which helps teachers know their understanding of the course content. In addition, teachers can also hold a vote and visualise the results. Floating bubbles on avatars (Figure 1c) show the response from students. Students can express their emotion and idea through the bubble. Teachers can know their thoughts rapidly and avoid missing questions from students. These features not only enhance teacher-student interaction but also reduce distraction possibilities.

Incentive System: Teachers can grant badges or award Concentrate Points (CP) to students who achieve corresponding goals or give good responses. CP is the virtual currency in InteractDiff, allowing users to purchase the new outfit and dress up their avatar. This feature encourages class participation by fulfilling their different needs [1, 6].

Fig. 1. Functions of InteractDiff (from left to right): (a) A outdoor grassland for class project presentation, (b) common room for gathering, (c) Voting and (d) Group Mode aim to improve in-class interaction.

3   Preliminary User Study

To evaluate the motivation for using InteractDiff, we recruited five university lecturer with online teaching experience. A long-term systematic user study is currently in progress. For the students, 50 participants between the ages of 20 and 30 were recruited, all university students. In the evaluation, each participant was asked to watch our demo video and assume they were simultaneously using our

system. After the video section, participants were given ten minutes to operate our prototype and try all the functions mentioned above. Finally, participants completed a questionnaire in System Usability Scale (SUS) and a short interview that focuses on interactivity and concentration.

The average System Usability Scale score is 82. In Question 1, "*I think that I would like to use this system frequently*" and Question 9, "*I felt very confident using the system*", we both received 4.4/5 points on average. For the interview results, we invited an expert to code the transcripts to identify obvious themes emerging from the conversations. Partial themes show in the following result. Regarding the motivation, 95% of participants showed their willingness to use InteractDiff: "*That's awesome, I can dress up my avatar and go to class.*"; "*Can't wait to use this system (to have class).*" (P12, P46). About the interactivity, 86% of participants believed that students might have more interaction with teachers, "*I am afraid to ask questions in class, this (the system) is a great way to interact with the teacher.*" (P27).

Consideration in using the system was also pointed out. Some participants (14%) are worried that InteractDiff may distract them during class: "*The system is fun. But I wonder if my class use this system, I might lose concentrate because there have many functions.*" (P34). The results indicate that although the system received positive feedback, the distraction possibilities in using InteractDiff have to be evaluated in future. Future work also included an internet-connectable prototype, a comparison with traditional meeting software, and a comprehensive study between teacher and student.

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