Rodrigo, M. M. T. et al. (Eds.) (2021). Proceedings of the 29th International Conference on Computers in Education. Asia-Pacific Society for Computers in Education

The Development and Evaluation of an Online Educational Game Integrated with Real Person-NPC mechanism for History Learning

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Abstract: The study developed an online educational game, 1946 Base Exploration(beta), integrating real person-NPC (Non-Player Character) as scaffolding and simulated environment to promote learners strategic planning ability and the history of military monuments. We investigated learners' learning performance and flow state in the game through preliminary empirical research. The results showed that learners' learning effectiveness for the knowledge of history and the capabilities of strategic planning had significant improvement after the game. Moreover, learners had high level of flow during the activity.

Keywords: Real person-NPC, online educational game, situated learning, history learning

1. Introduction

In recent years, the education system has been greatly changed from face-to-face to an online approach due to the global pandemic of COVID-19. However, if the online instructional design remains in the traditional slides or video teaching approach, the learning performance may be inferior because of the absence of interaction and situated experience (Chang, Tsai, Yu, Tsai, & Chang, 2020; Dhawan, 2020). In particular, environment and history courses that require outdoor exploration should be the most severely (Day et al., 2021). Moreover, the games that integrate situated learning with context and authenticity are thought to cause learning transfer that can further enhance learners' learning performance (Lave & Wenge, 1991; Dawley & Dede, 2014; Lin, Hwang, Fu, & Chen, 2018). If the authenticity of the interaction can be increased for role-play based situated learning, the learners will be more empathetic and engaged in the learning (Hou, 2021; Hou, 2015). A real person-NPC for game-based learning, may be a potential solution. A real person-NPC (i.e., a real person as NPC and participating in online in-game role-playing) can provide players with more realistic verbal dialogues and behavioral interactions. This mechanism can also be used as a dynamic scaffold, providing players with real-time realistic feedback and guidance to facilitate their reflective and planning thinking, as well as to diagnose and monitor learners' progress at any time. Nevertheless, research on the real person-NPC in education is still limited. Therefore, our research team (Mini Educational Game development group in e-Learning Research Center, National Taiwan University of Science and Technology, NTUSTMEG) applied Gather Town (http://gather.com) to develop an online educational game, 1946 Base Exploration (beta version) (Figure 1), which was integrated the real person-NPCs in situated learning. Learners play the role of a group of military officers and investigate an abandoned base in northern Taiwan under the guidance of the real person-NPCs a "commander" and a "soldier" (played by two trained researchers) (Figure 2). By visiting various military sites in the game, observing the appearance, topography, and clues left behind, they need to complete three tasks and learn about the background of the military base's establishment, base structure, and geography. In addition, the task will also require the learner to plan the further use of facilities, attack positions and patrol routes that can improve learners' spatial orientation and strategic planning abilities. Besides, if learners encounter difficulties while on a task, they have limited opportunities to call the real person-NPCs who will give them the appropriate clues and scaffolding to complete the task according to their needs or learning status. The aims of the study are not only to develop an educational game in military monuments

learning but also to analysis the learners' learning performance, flow as a preliminary empirical evaluation.

Figure 1. Game screenshot of 1946 Base Exploration(beta)

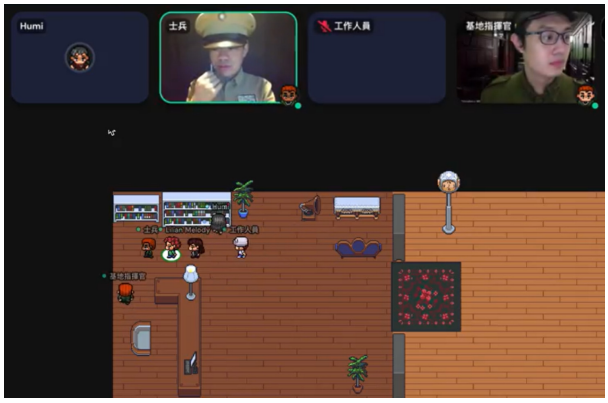

Figure 2. Real person-NPCs as scaffolding

2. Method

Participants in this study were 12 adults in Taiwan (9 males, 3 females). They were grouped with three members in each group. Each group participates with a personal computer and uses a microphone to communicate with each other for the learning activity. In the analysis of learning performance, the contents of pretest and the posttest were the same. The test was designed referring to the case of investigating the virtual military base, including 4 major tasks, 18 questions in total. To evaluate the learners' flow, this study referred to Kiili's flow scale (2006), which was translated and revised by Hou and Chou (2012). The flow scale includes two dimensions, namely the flow antecedent and flow experience. All scales were scored on a five-point Likert scale. The reliability of the flow questionnaire (Cronbach's alpha=0.931) showed high internal consistency. The procedure of the learning activity firstly had the pretest (20 minutes), and played the game (60 minutes), which was followed by the posttest (20 minutes) and the flow questionnaire (10 minutes).

3. Results and Discussions

For learning performance, a Wilcoxon signed rank test was used to compare the results of learning performance between the pretest and posttest. The results showed there was a significant difference in the score for the pre-test and post-test ($Z=-2.77$, $p<0.01$) (see Table 1), and it suggested that learners' knowledge of history and the capabilities of strategic planning improved through this game. As for the flow, the overall flow score (M=4.23), flow antecedent sub-dimension (M=4.18), and flow experience sub-dimension (M=4.28) were all above the median (the median in a five-point scale =3) (see Table 2). The results indicated that learners were deeply involved in the game.

Table 1. *The Mean and Standard Deviation of Learning Performance.*

	M	SD	Z	Sig.
pre-test	5.50	3.63	-2.77	.006**
post-test	9.00	3.54		

**$p < .01$

Table 2. *The Mean and Standard Deviation of Flow State Scores.*

Dimensions	M	SD
Flow antecedents	4.18	0.58
Challenge	4.17	0.91
Goal	4.25	0.54

Feedback	3.88	0.88
Control	4.42	0.51
Playability	4.17	0.89
Flow experience	4.28	0.46
Concentration	4.50	0.55
Time distortion	4.33	0.49
Autotelic experience	4.54	0.53
Loss of self-consciousness	3.29	1.05
Overall Flow	**4.23**	**0.49**

4. Conclusion

The study developed an online educational game, 1946 Base Exploration$_{(beta)}$, integrating real person-NPC mechanism and simulated environment, trying to enhance the learners' situated experience of learning under the COVID-19. The results revealed that the game can be helpful to enhance students' learning in the knowledge of history and the capabilities of strategic planning. The results of the flow analysis also showed a high level of learner engagement. These preliminary findings showed that an online educational game integrated with real person-NPC mechanism for history learning are effective in promoting learners' learning performance. Future study would employ the quasi-experiment design to compare the effectiveness of this game with control group (e.g., teaching approach, role-playing method), and continue to explore learners' geographic awareness, historical empathy, and learning motivation.

Acknowledgements

This research was supported by the projects from the US Air Force Office of Scientific Research (AFOSR) project (20IOA038) and Ministry of Science and Technology, Republic of China, under contract number MOST- 107-2511-H-011 -003 -MY3, MOST-108-2511-H-011 -003 -MY3.

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