Expert and Novice Users' Visual Attention in Online English Game Playing

Chia-Wen CHEN[a], Meng-Jung TSAI[a]* & Chin-Chung TSAI[a]
[a]*Graduate Institute of Digital Learning and Education, National Taiwan University of Science and Technology, Taiwan, ROC*
*mjtsai99@mail.ntust.edu.tw

Abstract: This pilot study employed an eye-tracking technique to examine expert and novice students' visual attention while playing online English games. An online interactive English game, Talking Island, was used as an experimental material in this study. Twelve primary school students, six experienced users and six novice users, in Taiwan participated in this experiment. This study focused on investigating the between-group differences regarding their visual attention allocated on the functional windows designed in the game. The results indicated that a significant difference existed between the expert and the novice groups while they were viewing the vocabulary and map windows. The novice players paid more attention on viewing the vocabulary windows than the experienced players. And the experienced players focused more on viewing the map than the novice players. This could suggest that an interactive online game may benefit children's vocabulary identification efficiency and improve meta-cognitive strategies for game-based learning.

Keywords: eye tracking, visual attention, online game, expert & novice

Introduction

In recent years, the developments of game-based learning environments and studies on related contents designs have received increasing attentions. Although learning motivations can be improved in such a learning environment, students' learning achievements were still reported with inconsistent results. This may be due to many factors such as the individual differences in the interactions with the learning elements provided in a game. However, little has been known about students' cognitive process while learning or playing in a game-based learning environment. Perhaps researchers need to consider the design of online game elements or functions from a cognitive loading dimension, because the cognitive capacities of students are limited [1]. Working memory can hold no more than about seven elements or items of information [2]. And the information in working memory could be lost within about twenty seconds if without any practice [3]. Therefore, examining how students paid their attention on various elements designed in a game could be an innovated approach to understand the problems or obstacles faced by individual students.

In this study, we used an eye-tracker to examine subjects' visual attention in online games, because eye-tracking method can provide valuable visual information about reading [4] and scene viewing behaviors. Prior studies showed that novice users utilized significantly fewer metacognitive strategies than experts [5] while searching information and many learning contexts. So, this study focused on comparing the visual attentions between the experienced users (the expert) and the novice users (the novice) on some specific learning elements (e.g., the vocabulary windows and map windows provided in an

online game for learning English) provided in an game-based learning environment. Therefore, the research questions of this study included:

- Is there any significant difference in the visual attention between experienced and novice users while viewing the vocabulary windows in an online English game?
- Is there any significant difference in the visual attention between experienced and novice users while viewing the map windows in the online English game?

1. Methodology

1.1 Participants

Twelve primary school students in Taiwan, from grade 3 to 5, participated as subjects in the eye-tracking experiment conducted in this study. The students were selected from two groups: one was from the students who had playing the Talking Island game for more than one year in schools (i.e., the experienced or expert group); and the other was from those who had no experience of playing this game (i.e., the novice group). Finally, six experienced and six novice users were included for this pilot experiment.

1.2 Materials

The "Talking Island" game designed by Island Technology Co. Ltd. was used as a material in the eye-tracking experiment. The game interfaces provide four functional areas (user information, online facilitator, fighting/upgrade tools, and a map) on four corners of a main scene background. A corresponding window will be popped out in the center of the screen once a function is clicked by a user. For example, when the map function is clicked, a big map window will be shown in the center of the screen, indicating the current location on the island and providing hyperlinks for jumping to other scenes. The map function is actually a scaffolding for developing metacognitive skills for self-control and self-management of game playing. Besides, the goal of the online game is to enhance the basic level of English language abilities such as vocabulary pronunciation. An interactive window is shown whenever the user wants to upgrade their fighting energy. The players need to speak out the vocabulary shown in this window via a microphone so that they can earn energy with feedbacks. The map windows and the vocabulary windows were the two learning elements which were mainly investigated in this study.

1.3 Equipments

In this study, we used ASL Mobile Eye to track and record participants' gaze data during individual game playing. The sampling rate was 60 Hz for the eye camera and 30 Hz for the scene camera. Besides, the Gaze Tracker 7.2 software was used to analyze the gaze data.

1.4 Procedure and Data analysis

All of the participants passed calibrations for the eye-tracker. Thus, all of them were included in the eye-tracking experiment in which the participants played the game in their own paces. The entire experiment lasted about 20 min. Participants' eye movement data were recorded by Gaze Tracker 7.2. A post-task interview was then conducted to have a vocabulary recall test for learning performance. According to the research questions, we defined two Look Zones, the Map and Vocabulary

windows (see Fig. 1) for data analyses. And the eye-tracking measures including TTIZ (i.e., Total time in zone / Duration actually shown) and PTFT (i.e., Percent time fixated related to total fixation duration) were calculated for data analyses. Finally, two T-tests were used to examine the research questions.

Fig. 1. Look Zones defined for Map windows and Vocabulary windows

2.   Results

2.1   Visual attentions on vocabulary windows between expert and novice groups

Table 1 shows the results of the t-test analyses and it reveals that the novice had significantly higher PTFT (t = -2.668, p < 0.05) than experienced students. This may be due to that novice students didn't have any experience about playing this online game. So they need to spend more time on reading the vocabularies popped out for testing and think carefully about how to pronounce them. On the other hand, the expert group had a playing experience of more than one year. They might be acquainted with the vocabularies shown in the game, so the experts did not fixate such hard as the novice did while viewing the vocabulary windows.

Table 1 Comparisons between the expert and novice groups on the percentages of fixation duration allocated within the vocabulary windows

Measures	Expert		Novice		t	p
	Mean	SD	Mean	SD		
TTIZ	0.004	0.004	0.005	0.002	-0.780	0.454
PTFT	0.187	0.130	0.387	0.129	-2.668	0.024*

Notes：*p < .05

TTIZ = Total time in zone / Duration actually shown
PTFT = Percent time fixated related to total fixation duration

2.2   Visual attentions on map windows between expert and novice groups

The results of t-test are presented in Table 2. It is shown that experienced students have significantly higher TTIZ (t = 2.493, p < 0.05) and PTFT (t = 2.541, p < 0.05) than the novice. The results show that experienced students looked at the map more often. This may be because they have already known how to play the game, they have known the feature of the game and the use of map. Experienced students can use map to move to another scene and fight with higher-level monsters. The novice users may have not known how to explore the area by using the map, so they showed a significantly lower attention on the maps.

Table 2 Comparisons between the expert and novice groups on the percentages of fixation duration allocated within the map windows

Measures	Experienced		Novice		t	p
	Mean	SD	Mean	SD		
TTIZ	0.010	0.007	0.002	0.002	2.493	0.046*
PTFT	0.594	0.442	0.106	0.157	2.541	0.029*

Notes： *p < .05

TTIZ = Total time in zone / Duration actually shown

PTFT = Percent time fixated related to total fixation duration

3. Discussion and conclusion

This study aimed to explore expert and novice's visual attention between map guide and pronunciation exercises in an online English game called Talking Island. The results suggested that novice students without any experience in playing online game; therefore, they need to spend more time on looking at the word and think slower about how to pronounce a new word. In the contrary, experienced students have already experience and memorized some vocabularies, so they don't need to really focus on viewing the word. Furthermore, experienced students have higher attention on the maps than novices, because experienced students looked at map more often. They already known how to play the game, they have known the feature of the game and how to use the map. That is, the experienced students have already known how to explore the area using map. On the contrary, novice students looked at map shortly and rarely perhaps because they don't notice there are map features in that game and they don't know how to use map properly. In sum, we explored visual attention of expert and novice in online English games. And the results showed that the expert and the novice users viewed the vocabulary and map windows differently. For future research, we can further explore how expert and novice play the online games by cross-analysis or mixed methods.

Acknowledgements

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