Games and Multimedia in Foreign Language Learning

Using Back-story in Multimedia and Avatar-based Games to Engage Foreign Language Learners: A Pilot Study

L. T. Foti, R.D. Hannafin
University of Connecticut, Storrs, Connecticut, U.S.A.

***Abstract*—We set about to facilitate the learning of basic phrases in Mandarin Chinese among US college students in an interactive online environment. We designed two interactive web-based instructional modules that included animated movies, "listen and repeat" exercises, and interactive practice. One module used a back-story ("Mission Impossible" detective quest) and the other did not. Students in the back-story condition scored marginally higher than learners in the control group on a timed online posttest, but not a significant difference. After the assessment, students were introduced to an open multiplayer online game (http://clubpenguin.com) in which they had the opportunity to use what they had just learned to complete tasks cooperatively. This paper will describe the design of the instruction as well as the implications of the findings. In particular, the role back-stories is discussed in light of Mayer's coherence effect, which calls on designers of multimedia environments to avoid including extraneous information.**

***Index Terms*—Back-story, foreign language learning, multimedia, games**

I. INTRODUCTION

Behaviorism has been dethroned as the dominant learning theory in many domains. The ability of behaviorism to adequately explain language acquisition was especially criticized [1]. The more contemporary, and widely accepted view of human learning is that it is socially constructed; a process of building up and interpreting experience publicly over time [2], [3], [4], [5], [6]. Technology's potential to support this social approach has been well documented, with the recent development of content-rich scaffolded multimedia learning environments (e.g., *Alien Rescue*, *River City*). However, despite great promise, it is fair to say that in the main, computers are used in education primarily as tools for supporting drill and practices for factual recall, [7], and this is particularly true in the language domain.

The national standards of foreign language learning (www.actfl.org) emphasize communications, cultures, connections, comparisons, and communities (5Cs) and methods like those described by Yalden [8] as a "communicative approach and situational teaching". And while interactive and engaging programs are gaining popularity in foreign language education, drill and practice is the time-tested, and still predominant, method used in classrooms today. Although, an encouraging development is that more attention is paid to creating "contexts" in newer drill practice activities [9].

There is a growing body of research demonstrating the effectiveness of computer-assisted language learning (CALL) in promoting both fluency and accuracy in the target language as well as improving motivation and learner autonomy, particularly in the area of online reading, writing, web-search, electronic material dissemination, text chatting and online tests [10]. Although some educators argue that technology, or the instructional delivery medium itself, does not impact learning [11], [12], [13], others, notably Kozma [14], [15], [16] have argued that the medium in concert with other factors in the learning environment, do affect learning. In other words, Kozma and others argued that it is not the technology alone that contributes to learning, but rather the interactions among technology, the learner, and the environment (both virtual and real). Complex virtual learning environments, sometimes called multimedia environments, have grown in popularity in recent years, refueling hopes for elusive learning gains. Concurrent with this surge in multimedia learning environments has been another line of research that has focused on identifying factors that contribute to the design of effective multimedia learning environments. As the environments have become increasingly complex, there is evidence that learners can become disoriented, or overloaded, impairing with their ability to navigate and learn in such environments [17], [18], [19]. Mayer [20],[21] for example, building on Sweller's [22] cognitive load theory, proposed a model of multimedia learning based on three assumptions of how the mind works in multimedia learning: (1) *dual channel* holds that humans process verbal and visual information in separate channels; (2) *limited capacity* assumes that processing capacity is limited in both channels; and (3) *active processing* posits that learning requires substantial cognitive processing in the verbal and visual channels.

According to Mayer's definition, *multimedia* is not limited to the use of technology: "A multimedia instructional message is a presentation consisting of words and pictures that is designed to foster meaningful learning" [21]. However, most of Mayer's studies are based on research with computer-based learning environments. For our purposes, we will discuss the use of *technology* and *multimedia* interchangeably.

One characteristic of many multimedia programs is the use of a *back-story*. A back-story is an engaging storyline

that unfolds as participants navigate and work in the multimedia environment. For example, *Alien Rescue*, a multimedia middle school science program, opens with a video "news report" that depicts six species of alien life forms who are on spaceships orbiting Earth. Students learn that, because the home worlds of the aliens have been destroyed, the aliens have come to Earth to ask for help in finding new homes in our solar system. To add a sense of urgency, before they can establish contact with Earth, their spaceship is damaged, forcing them to enter a suspended state of animation. The student scientists are sent to the newly operational international space station orbiting Earth to participate in a multinational rescue operation to save the aliens. Their task is to use a variety of tools at their disposal to learn about the aliens and to explore the solar system to find a suitable habitat to match the unique characteristic of each alien species [23], [24].

Back-stories unquestionably motivate students and could be an important element for engaging learners in multimedia environments [24],[25], [26]. In a study that investigated use of 'scenarios' to teach social science to college students [27], Paulus, Horvitz and Shi found that using stories were effective. Students in the story group were more engaged in online discussions, and demonstrated better understanding of the subjects.

Interesting but "extraneous" materials are supposed to be eliminated to lower the burden of cognitive processing according to Mayer's "coherence effect" [?]. Although the purpose of using back-stories is to engage students, it does require additional processing. The question arises then, Will the extra information presented in the multimedia environment be extraneous and therefore a cognitive burden? This paper describes a pilot study that examines the effect of using a back-story in a multimedia learning environment on the attitudes and performance of 26 U.S. college students enrolled in a course to learn basic Mandarin Chinese.

II. METHOD

A. Participants

Twenty-eight undergraduates from an elementary Chinese course at a northeastern U.S. college participated in this project. Twenty-six (14 experimental, 12 control) students completed the program. Student gender was not recorded.

B. Materials

A multimedia program was created in Macromedia Flash and HTML that contained animated movies and listen-and-repeat exercises. Sixteen new words and three sentence patterns were introduced to the students. The instruction included two dialogues, both of which included animations and conceptual icons to help students comprehend a Chinese dialogue (e.g., Dialogue 1 in Figure 1) about asking directions. The practice exercises (see Figure 2) provided feedback to students when they clicked on the icon matching the word they heard. Each dialogue then provided an audio review of the vocabulary words and phrases that students heard in the dialogue.

The audio could be repeated as needed. Finally, a matching game to reinforce the learning of the new vocabulary was included in both dialogues.

Figure 1. Screen captures of Dialogue 1

Figure 2. Interactive exercise for Dialogue: learners are asked to click on the picture that matches the sound they hear and are given instant feedback.

The Flash program lasted about 24 minutes. A 12-minute, 16-item posttest and attitude survey was administered online (See Fig.3 and 4) after the Flash program. Finally, students engaged in a 10-12 minute multiple player online game after the posttest.

The difference between the experimental and control group instructional programs was that a fictional back-story was embedded in the experimental program using a 40-second Flash presentation movie on a spy story at the beginning as well as supplementary text that elaborated the story throughout. They were given the task of retrieving an important document in order to save their partner, and crucial to the success of the task, was understanding and using Chinese words and short phrases. Instead of the video back-story and supplemental text, the control group viewed a 15-second liner Flash movie that presented the learning goals at the beginning.

After the posttest, because of the exploratory nature of this investigation, students were introduced to a game environment (http://play.clubpenguin.com) where they could apply the vocabulary they learned in the instruction, i.e., giving and understanding simple directions in Chinese. The game environment, *Club Penguin*, is a web-based 2-D avatar-based game for multiple players designed to allow users to play, explore, construct, and socialize. (See Fig.5) In this game, they could also interact with players outside of this project. In an open

environment like *Club Penguin*, learning is not restricted to "target objects" [28], [29] meaning we could not predict in advance exactly what we were looking for and that "learning" can go beyond what traditional tests can measure. Our purpose was to see if students could use their newly-learned Chinese phrases (transfer) in this setting and if there is a difference in behavior between the two groups.

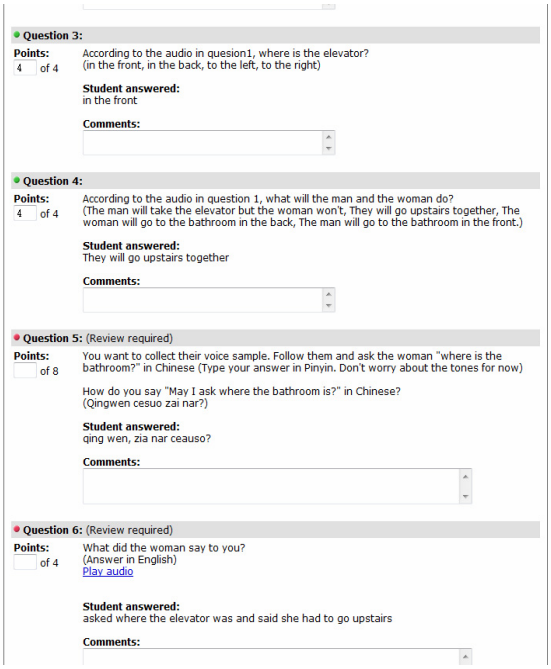

Figure 3. Sample of posttest questions (screen shot shows Quia grading mode)

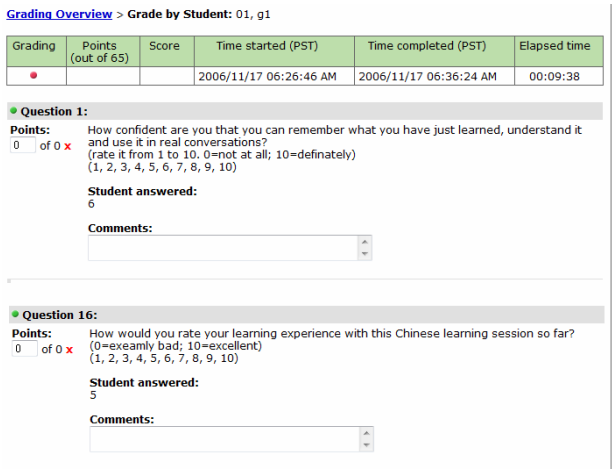

Figure 4. Attitude questions

C. Procedure

Students were randomly assigned to either the experimental or control treatment, resulting in group sizes of 14 (experimental) and 12 (control). As mentioned, students in the experimental group watched to a 40-second back-story designed to generate and sustain interest. Learners in the control group viewed the learning goals instead of the back-story. Both groups then completed the same instructional program, took the test, and participated in the interactive online game.

Figure 5. Post instruction game environment (students were encouraged to ask and give directions in Mandarin to help each other find certain objects in the game)

In the game, students were divided into groups of 3 or 4, logged on and entered the game with assigned penguin colors and account names that had the same prefix so that their avatars could be identified by fellow group members. They were asked to type in Pinyin (a Chinese spelling system) to converse with partners and help each other with the task of finding a painting and a potted plant in the game environment by using the Chinese phrases they learned.

When students finished the instruction, but before the posttest, they were asked to rate their confidence in the ability to use what they had learned in real situations. The posttest was a timed online task that consisted of listening comprehension questions and short translations, all questions are embedded in one fictional scenario. After the test, as depicted in Figure 5, learners were asked to rate how they liked the learning experience on an 11-point scale from 0 (extremely bad) to 10 (excellent).

III. Result

Students in the back-story treatment group scored marginally higher (M = 71.9) than students in the control group (M = 70.1), but not significantly so, $t(1, 24) = 0.34$, p = 0.37. The confidence level of students in the experimental group was a little higher than the control

group (M = 5.9 vs. M = 5.4), but didn't reach significance, t (1, 24) = 0.94, p = 0.18. When asked how they liked the experience, the responses of the two groups were both positive (M control group = 5.50, M experimental group = 5.43), but again not significantly different from each other, t (1, 24) = -0.12, p = 0.45.

In the game environment, students seemed interested and enthusiastic. However, our observations revealed that the assigned tasks were poorly carried out in the game. Students spent a large portion of time "playing," exploring the game environment, trying out things, and traveling within the game space. Most avatars used Mandarin to greet each other, but beyond that, only a limited number of conversations in Mandarin Chinese occurred in the game. A few students used phrases they learned to ask for or tell directions, but once students entered the game, they just enjoyed playing and ignored the tasks. Many students commented that the learning material was helpful, but the game was just for fun.

IV. DISCUSSION

Our findings did not show an advantage in learning with a back-story. Nor did the back-story impede learning. Presenting extraneous materials (back-story) did not seem to interfere with learning. The information the experimental group had to "process" (animation and embedded text information) was by design unrelated to the content of the lesson, but they did not impair learning. We do not know where to draw the line between "extraneous" information and an intrinsically motivating "anchor," as described by the CTGV [30]. Do back-stories compete for cognitive resources in the way that Mayer cautioned against [20],[21] or do they actually help students store and make sense of new information? The role of back-stories in cognitive load theory is certainly an area that warrants further investigation. Maybe learner attention and intention is a factor in addition to the sheer amount of information to be "processed."

We intended to use a back-story to engage learners; however, using animations to tell a story before providing them the learning material may not be enough. Learners may need more "interactions" with the learning environment to develop a sense of being part of it. In other words, if back-stories can promote learning, telling them the story may not be enough. The learners may need to have opportunities to create characters in the story and be able to change the story. Allowing learners to experience a fictional setting by using what they learn is probably more effective than telling them what they are supposed to do in a fictional setting.

Due to time constraints and other administrative difficulties, the exam was given before students entered the game. Students were tested without having opportunities in the game world to practice the words and phrases taught to them with classmates for real tasks. Perhaps practice in the game would have impacted achievement. Further research is needed to test this area.

V. CONCLUSION

For deep learning to occur -- to extend beyond mastery of content and knowledge acquisition -- some would argue [31], [32] that designers need to go beyond fostering initial learner engagement, motivation, and enthusiasm; that they need to provide opportunities for learners to transfer understanding into *action*. The idea of bringing students to the game environment was to provide them such an opportunity; to use what they had learned through collaborative practice inside the game. Unfortunately, we could not find an avatar-based online game that served our purpose for this learning unit. *Club Penguin* is not designed for foreign language learning. It did not, for example, provide guidance to help learners complete the task; nor were its avatar attributes ideal for the desired tasks to be completed. And the tasks in the game did not provide opportunities for students to reflect directly on the learning from the instructional program. Although we observed activities of socialization in the game, they can hardly be seen as moving from the peripheral circle toward the center of a learning community, in the way that Lave and Wegner [5] or Greeno [6] would like to see.

Multimedia environments should provide opportunities for exploration and discoveries and with high challenge. We believe that increasing learner attention and intention will make learning more active and effective, and we believe that using back-story and games to achieve this goal has great potential.

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AUTHORS

L. T. Foti, is a PhD student at the Department of Educational Psychology at University of Connecticut, Storrs, CT 06084 USA (e-mail: li-li.teng@uconn.edu).

R. D. Hannafin, is an Associate Professor at the Department of Educational Psychology at University of Connecticut, Storrs, CT 06084 USA (e-mail: robert.hannafin@uconn.edu).

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