Game-Based Learning about 19th Century Poets

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Abstract

Video games have been shown to be an engaging and educational medium. The *Time Historian* video game was created for the Armstrong Browning Library to be an entertaining way to teach about the 19th century poets Robert and Elizabeth Browning. In this game players relive moments of the Brownings' courtship and learn about the couple's poetry. This game was designed to educate the public and to generate interest in coming to the library and was compared to their existing advertisement media: their website and a self-guided tour packet. It was found that people who played the game showed statistically significant improvement on their knowledge about the Brownings and reported a greater interest in learning more about the subject matter compared to those that used the existing advertisement media. This demonstrates the game's effectiveness at providing instruction and sparking the player's interest in poetry.

Introduction

Video games are an engaging medium which have been used to create interactive, compelling instruction. Games have been created to teach, raise awareness, and provide personalized learning experiences. *Time Historian* was created to teach people about the 19th century poets Robert and Elizabeth Browning and to generate interest in visiting the Armstrong Browning Library to learn more about them. In this game, players are a time historian who needs to go back in time to ensure that the courtship of Robert and Elizabeth is successful so that the poetry that they produce after they are married is preserved. They play through four levels which address key points of the Brownings' courtship while the players learn about Robert, Elizabeth, and their poetry.

The game was evaluated against the existing promotional material that the library advertises, which includes the library website and a self-guided tour packet. It was shown that participants who played the game showed statistically significantly higher learning gains on a pretest/ post test survey about the Brownings than those who read the website ($p = 0.03$) and those who read the self-guided tour packet ($p = 0.01$). Additionally, participants who played the game reported a greater interest in learning about 19th century poetry after playing the game than those who read the website ($p = 0.08$) or the self-guided tour packet ($p=0.01$). This demonstrates that an educational video game can be an effective way to promote interest and augment learning.

Related Work

Interactive digital environments such as games have been used extensively to increase learning gains. Well-constructed educational game environments can lead to increased learning and other positive outcomes. The Lightspan partnership created learning games to supplement elementary school curriculum and showed an increase in performance in vocabulary, language arts, and mathematics (Godin 1996). Click Health demonstrated increased self-care and awareness in children with diabetes who played their educational game on diabetes health issues (Lieberman 1998). Scientific Learning found an increase in standardized testing scores in children with reading problems who played their Fast ForWard game (Merzenich 1993). Annetta et al. showed increased student engagement in their game designed to teach high school genetics over traditional instruction (Annetta et al. 2009).

Games have also been explored to various levels of success as learning tools for libraries. Smith et al. (Smith and Baker 2011) describe two such games created by Utah Valley University. The first is *Get A Clue*, used to teach freshmen about the layout of their library building and how to access basic library services. 90% of the participants reported that they were more comfortable with their way around the library after playing the game. The second game, *LibraryCraft*, is a narrative video game styled like World of Warcraft and was created to teach students how to use their library website. There is also a basis from this study that successful library games can capture students' interest: 87% of students wanted to share the game with their friends.

There is also good documentation of some of the complications that can arise when creating library games. The University of Alabama created an augmented reality game called *Project Velius*, a narrative game where players had to use library resources to find a fictional missing person (Battles, Glenn, and Shedd 2011). The students that played the game reported that they enjoyed it, but relatively few of them played it to completion. Fletcher Library created a learning game to help students locate library journal articles (Gallegos, Allgood, and Grondin 2009). The results indicated that

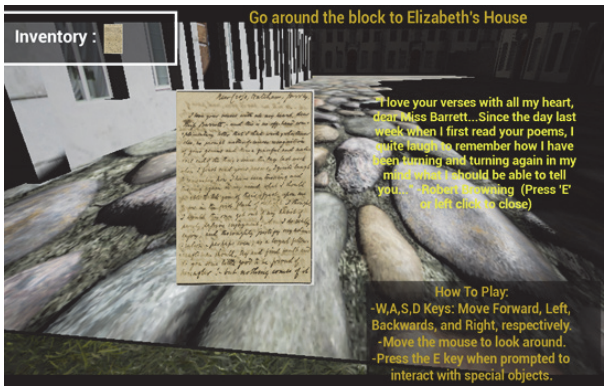

Figure 1: A screenshot of the *Time Historian* Game. The player needs to save Robert and Elizabeth's poetry which is being destroyed by a time storm by going back in time and ensuring the success of the Brownings' courtship. It is intended to be an educational and publicity tool for Baylor's Armstrong Browning Library.

the students were confused about how to search these articles and the researchers attributed this to the game format. These observations indicate that games can be successful in a library context, but considerations like player retention and clarity of game instruction are paramount.

Game Development

Time Historian, a game designed to teach about the 19th century British poets Robert and Elizabeth Browning and their courtship, was developed during a summer independent study by two undergraduate Computer Science students at Baylor University. This independent study was offered as a replacement for a senior-level game design class for those students due to a scheduling conflict they had. It was created to be an educational and publicity tool for Baylor's Armstrong Browning Library (ABL). The game was made available online to the public so that they could learn about the Brownings and be interested in visiting the library.

Time Historian was evaluated in its instructional and promotional capabilities against existing library advertisement resources intended to bring people into the library: the library's website and their self-guided tour packet. The website offers images of paintings and furniture from the library, as well information about the library itself, Robert, Elizabeth, and their courtship. There is a short biography of Robert and Elizabeth, a "Quick Facts" page about their life and works, and excerpts of some of their most famous poetry. The information is presented as a series of hyperlinks with no real ordering imposed on consuming the material.

The self guided tour packet contains extensive information about the library and its collection, as well as the same historical information from the website about the Brownings. It is presented as a combination of narrative descriptions about the Brownings and the library and a series of lists and descriptions about the library's artifacts. The ordering of the packet is meant to assist a directed, physical walkthrough of the library.

While the *Time Historian* game will present the same information available as these existing publicity tools, we believe that the interaction available in a video game and a special focus on the narrative of the Browning courtship will make a difference in learning gains. Additionally, we want to try to generate interest and excitement in the material instead of merely providing a presentation of data.

The game was developed in Unreal Engine 4 and made available as a stand-alone executable from the ABL website. It is available for download here: http://www.browninglibrary.org/timehistorian. It was designed for a wide variety of audiences, even those not familiar with video games, and takes about 20 minutes to play. A screen shot of the game is shown in Figure 1.

Time Historian is a 3D, first-person adventure game where the player navigates the environment while solving puzzles. In the game, the player is a futuristic time historian who is curating the Browning poetry collection. A time storm prevents the Brownings from getting married and consequently the poetry they produced after their marriage is disappearing. The player must ensure the success of key actions in the Browning courtship to ensure that Robert will marry Elizabeth.

The game takes place over the course of four levels. In each level, the player must complete a small task while learning more about the Brownings' poetry and courtship. During the first level, the player is introduced to the plot, the Brownings, and the game's objective. They navigate to Robert's house where they send a letter back in time written from Robert to Elizabeth. This letter details Robert's admiration of Elizabeth and instigates their courtship. In the second level, the player pieces together a love letter from Robert to Elizabeth. This is done by having a scan of an actual love letter written by Robert broken into pieces for the player to reassemble. At the beginning of the third level, true to history, Elizabeth rejects Robert. The player sends mementos to Elizabeth on Robert's behalf to encourage her to reconsider Robert's proposal. The item that successfully causes Elizabeth to reconsider Robert is a collection of his poems. In the final level, the player helps Elizabeth escape the family manor to allow her to elope with Robert. There is a minigame where the player has to successfully pick a lock in a dramatization of her escape.

The game's dialog is fully voice acted. Animated cutscenes connect each level, giving some of the plot of the story and presenting the player with voiced-acted audio from the Brownings' love letters and poetry.

Time Historian was designed with the expectation that its means of interaction and story would aid in learning. The game offers a very immersive experience: players move around in a virtual environment designed to look like the Brownings' house, interact with their surroundings and text from Robert's poetry, and listen to the Brownings' poetry being read to them. The tasks were selected with the help of the ABL staff, and the poetry was recorded by professional Browning scholars. Robert and Elizabeth's courtship was selected by the ABL staff as well, since they believe it to be essential to understanding the Brownings and their poetry.

Survey Design

The survey was constructed in conjunction with the library's subject matter experts and carefully evaluated. A 12 question survey was created with the Armstrong Browning Library staff to test a subject's knowledge about the Brownings and their courtship. The survey, an excerpt of which is listed in Figure 2, contains a mix of objective and subjective questions. For the subjective questions (ie "Which words best describe Robert?") the consensus among the library staff was considered to be the "correct" answer. This is because the purpose of the instructional tool is to move the subjects from a novice understanding of the Brownings to one that mirrors that of the experts.

1. What is Elizabeth Barrett Browning's most famous work?
Sonnets From The Portuguese / *The Ring and the Book*
"The Pied Piper of Hamelin" / "My Last Duchess"

3. Which word best describes the attitude Elizabeth's father took towards her marriage?
Supportive / Indifferent / Accepting / Hostile

11. Which words best describe Elizabeth? Select all that apply.
Political / Motherly / Outgoing / Religious / Romantic / Energetic

Figure 2: An excerpt of the survey given to the participants as a pre and post test. This survey was designed to test knowledge about the Brownings and their courtship.

The survey was taken by five Browning experts and ten people unfamiliar with the Brownings. Multidimensional scaling (MDS) was performed on the subjects' responses. MDS is a qualitative way of visualizing similarity among data sets with categorical data. Figure 3 shows the results of the MDS. The closer the data points are spatially, the more likely they are to belong to the same group. The experts show tight clustering, implying that they share a common feature which is taken to be knowledge about the Brownings. The other participants are unclustered, meaning that they do not share this Browning knowledge attribute or any other unifying feature. The black triangle represents one expert before a correction. It is believed that an expert misread one of the questions. Excluding that question for that particular expert shows the expert clustering tightly with the other experts.

Multiple correspondence analysis (MCA) was also performed on the response set. MCA is another qualitative test that shows groupings of responses in data sets with categorical data. It shows the responses that were most discriminatory at identifying a grouping among the participants. The five experts were tightly clustered around common unifying responses. These evaluations showed the survey would be suitable at being used in an experimental evaluation.

Experimental Design

This survey formed the basis for the evaluation of the game, website, and self-guided tour packet as instructional tools to teach about the courtship of Elizabeth and Robert Browning and their poetry. Participants were recruited from undergraduate English classes that take a trip to the library as part of

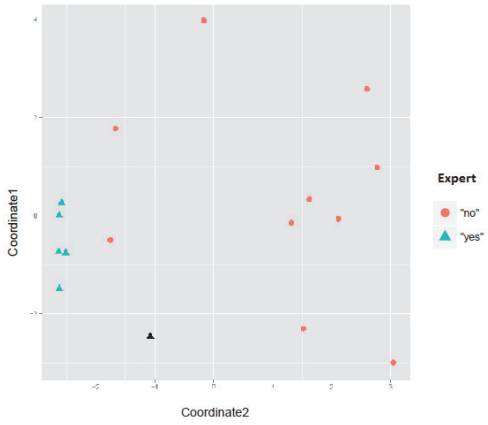

Figure 3: Multidimensional scaling on the survey instrument. The experts are tightly clustered, implying that they shared a common feature: Browning expertise. The rest of the respondents show no clustering, implying that they lack a common unifying feature. Triangles represent Browning experts and circles represent non-experts. The black triangle is one of the experts before data correction.

the class. Participation in the study was offered extra credit. Participants completed the experiment online. They were given the consent form and then were randomly assigned to one of these three instructional methods. They filled out a demographic survey asking about their background and knowledge about the Brownings. Next, they took the survey as a pretest. This was to establish a baseline of their prior knowledge of the Brownings. The participants then completed their instruction, which took about 15 or 20 minutes, and took the same survey again as a post test. The number of questions correct on the pretest and post test were recorded. They then were given a survey measuring any change in interest in the subject matter and the ABL.

In all of the surveys, the questions and choices for the questions were randomized to prevent priming bias and participants had the option to skip any of the questions.

Two central hypotheses, based on the experimented design, were tested:

Hypothesis 1 The participants playing the *Time Historian* video game will show a greater improvement score on the post test compared to the pre test than both the participants reading the library website and the participants reading the self-guided tour packet.

Hypothesis 2 The participants playing the *Time Historian* video game will show a greater interest in the poetry subject material and the Armstrong Browning Library than both the participants reading the library website and the participants reading the self-guided tour packet.

Experimental Evaluation

67 participants were evenly divided among the treatments. 45 people fully completed the study. Of those that fully completed the study, 17 people played the game, 18 read through

the ABL website, and 10 read the self-guided tour packet. The improvement in the post test study over the pretest for each participant was computed by taking the number of questions correct in the post test and subtracting the number of questions correct in the pretest. For example, someone scoring 9 correct in the post test and 6 correct in the pretest had an improvement score of 3. The scores for each of the participants is listed in Figure 4.

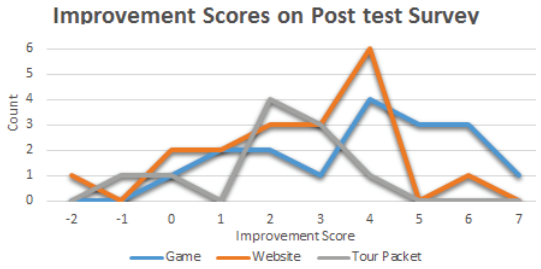

Figure 4: The improvement score counts on the post test survey compared to the pretest survey for the participants of each of the three instructional methods. The improvement in the post test study over the pretest for each participant was computed by taking the number of questions correct in the post test and subtracting the number correct in the pretest.

To evaluate Hypothesis 1, the comparison of improvement scores, the game was compared to each of the other two instructional methods with an unpaired one-tailed t-test. This is because the population was broken up into different study groups and there is no dependence between the groups.

To evaluate Hypothesis 2, the interest level of the participants for the poetry subject matter and the ABL after learning using the instructional tool, the game was compared to each of the other two instructional methods with a pair of one-tailed Mann-Whitney U tests. This is because Mann-Whitney U is used to evaluate ordinal data and the survey given after the post test asked the participants about their interest level using a Likert scale.

Experimental Results and Discussion

The post test improvement for the game was statistically significantly higher than improvement for both the website ($p = 0.03$) and the tour packet ($p=0.01$). The average improvement scores are listed in Figure 5. Participants that played the game improved their score on average almost 4 points on the 9 point test. In general, the participants knew very little about the Brownings before playing the game and showed a large improvement on the survey after playing the game. The website and tour packet showed more modest gains: 2.5 and 2 points, respectively. This verifies Hypothesis 1: participants learned more about the Brownings using the video game as an instructional tool than the other methods.

Participants that played the game also reported higher interest than those that read the website or the self-guided tour packet on a 5 point Likert scale for the survey question: "Based on your learning method about the Brownings that you have just been given, how much more or less interested are you in learning about the 19th century poetry?"

Treatment	Improvement	% Improvement	p Value
Game	3.8	42%	N/A
Website	2.5	28%	0.03
Tour Packet	2	22%	0.01

Figure 5: Average improvement scores for the post test compared to the pre test, the percent improvement that they indicate, and p value for significance compared to the game.

The results of the Mann-Whitney U tests were statistically significant for the game compared to the self-guided tour packet ($p=0.01$), with an improvement of 0.9 on a 5 point Likert scale. They were not significant for the game compared to the website, but a promising difference was observed ($p=0.08$), with an improvement of 0.5. There was not a statistically significant difference between the methods in interest for the ABL. The data partially validates Hypothesis 2: participants were more interested in the poetry subject matter after playing the game compared to the website and the self-guided tour packet but they did not show a statistically significantly higher interest in the ABL itself. However, the game sparked some interest in the subject matter for the participants. This is encouraging from an academic perspective because interest in the subject may lead to students being more willing to spend time learning the subject.

Conclusion

The *Time Historian* game was designed to teach people about the Brownings and create interest in the Armstrong Browning Library. This game was compared against the existing publicity tools: the ABL website and their self-guided tour packet. It was found that participants who played the game showed statistically significantly higher learning gains than those that used one of the other two tools. Also, participants that played the game showed greater interest afterward in learning about 19th century poetry. This demonstrates this game as an effective device for teaching people and creating interest in the subject matter.

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