The Effects of Audio Narration and Feedback used in a Video Game Environment for the Acquisition of Conceptual Knowledge

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Abstract: The purpose of this study was to investigate the effects of audio narration and feedback used in a game environment to measure the acquisition of conceptual knowledge. Forty subjects were randomly assigned to three groups, received their respective instructional presentation, and completed a test. Statistical significance was found between the control group and the treatment groups, as well as the two treatment groups. These results raised concerns about the usefulness of audio narration in a gaming environment when the objective is to complement conceptual knowledge acquisition and the benefit of incorporating feedback in video games to assist with learning.

1. INTRODUCTION

Today in America, there are 215 million people who play video games (ESA, 2023). A large number of them play games for entertainment. However, contemporary video games are built for a purpose other than entertainment. They can incorporate good learning principles (Gee, 2005) and new learning systems and are referred to by scholars as serious games (Pilote & Chiniara, 2019). Corti (2006) defines serious games as computer games capable of captivating and engaging subjects to assist them with gaining knowledge and skills. Michael and Chen (2006, p. 21) define serious games as “games that do not have entertainment, enjoyment, or fun as their primary purpose.” Game-based learning is a concept that has been introduced previously in the field. It has gained more acceptance and popularity among educators lately, which has allowed scholars to consider creating engaging learning environments using video games as a context (Serrano, 2019). Game-based learning has become an important research focus for many scholars in recent years (Russell & Laffey, 2016) partly because of its popularity. Serious games can be designed to measure student learning outcomes (Susi et al., 2007). They can be used as an inquiry tool in various fields, including the military, government, educational, corporate, and healthcare (Susi et al., 2007).

There are a number of research studies conducted using video games and learning. Cameron & Dwyer (2005) and Almeida (2008) have found that serious games, when used in conjunction with feedback as an independent variable, assist subjects with performing well in conceptual knowledge tests among college students. Sitzmann (2011) conducted a meta-analysis study and found that subjects performed better in declarative and procedural knowledge when using simulations. In a study conducted by Munyofu (2008), the researcher investigated the effects of feedback and gaming to complement animated instruction; however, the researcher found that feedback didn’t assist subjects in scoring higher than the control group in four criteria tests. According to Hamari & Tuunanen (2017), gamification might not be an effective learning mode. It depends on several factors, such as the motivations of users. Iten and Petko (2014) stated that games don’t assist subjects in learning. They only make the experience of learning more fun. According to Wang & Lieberoth (2016), subjects learned “something” from playing a game; however, the effectiveness of the audio and or video game wasn’t statistically significant even though there is a body of scholars who have investigated how digital games can promote learning (Cameron, 2004; Gee, 2005; Almeida, 2008; Lynch, R., Mallon & Connolly, 2015). There seems to be a lack of consensus on the effects of computer games as a treatment and an educational environment. This is the reason why the researcher is conducting this research study.

2. FEEDBACK AND LEARNING

There are different kinds of feedback, and each has its definition. Demsey et al. (1993) have defined them as simple verification feedback or what is referred to as knowledge of results (KR). In this type of feedback, subjects are informed about what the correct response is (Demsey et al., 1993). Feedback can also be defined as correct response feedback. When subjects receive this type of feedback, they
are informed about what the correct response should be. Elaborative feedback (Demsey et al., 1993) explains why a subject’s response is correct. It’s more elaborated. Try-feedback (Schwerter et al., 2022) informs the subject what the correct response is and allows the subject to try again. Other types of feedback, including destination feedback (Burgos et al., 2007), can be defined as guidance with complex situations feedback.

Feedback aims to enhance learners’ comprehension, abilities, and additional aspects like study routines, drive, and ability to assess their learning (Nicol and Macfarlane-Dick, 2006; Sadler, 2010). There is a wide body of research indicating that feedback has a positive impact on learning (Hattie and Timperley, 2007), but only if the feedback given is understandable and sufficiently detailed (Ryan et al., 2019). There is also much research indicating that feedback isn’t an effective variable to assist with learning, as well as a few empirical research studies in media and education investigating the impact of feedback in game-based learning environments. This study attempts to answer this question.

In a case study conducted by Burgos et al. (2007), the researchers found that the effect of feedback on declarative knowledge provided insignificant results. In another empirical study conducted by Rogers (2017), the researcher found that feedback produced higher levels of cognitive overload in subjects. Using feedback inside a web-based learning environment resulted in subjects performing higher than subjects in the control group in delayed retention of different learning objectives (Cameron & Dwyer, 2005).

According to El-Nabawi and Shaalan (2018), game-based corrective feedback assisted second-language English learners with reading comprehension scores. In a study conducted by Munyofu (2008), where the researcher investigated the effects of feedback and gaming to complement animated instruction, it was found that feedback didn’t assist subjects to score higher than the control group in four tests. A more recent study conducted by Taguchi et al. (2022) found that feedback conditions assisted subjects with having higher proficiencies of knowledge of request-making, even though receptive knowledge showed no improvement in post-test scores. In a meta-analysis conducted by Serrano (2019), digital game-based learning had a positive impact on student engagement and a significant effect on motivation. Still, feedback was found to have little to no effect on the study’s dependent measures.

One of the encouraging findings from feedback research suggests no notable distinction between immediate and delayed feedback. Moreover, evidence suggests that delayed feedback might be more advantageous for more complex tasks (Fyfe et al., 2021; Hattie, 2009). Research on feedback is inconclusive. Research on the impacts of video games incorporating feedback as an independent variable has been limited and inconclusive. This is why the researcher conducted this research study.

3. Audio and Learning

Using audio to deliver verbal information when that information is designed to support non-verbal information, such as graphics, pictures, and animations, can enhance the effect of using both verbal and visual systems. This is known as the modality effect (Clark et al., 2003). The modality effect states that “People learn more deeply from multimedia lessons when words explaining concurrent animations or graphics are presented as speech rather than as onscreen text” (Clark et al., 2003, p. 93). A number of studies seem to indicate that the modality effect works well at improving students’ verbal recall of factual information (Mayer, 1991, Mousavi et al., 1995, Moreno & Mayer, 1999). When investigating the effects of auditory and visual representations, however, Penney (1989) didn’t find significance relating to the temporal distinctiveness of auditory items.

In a study on the effects of audio-visual and audio-recorded listening tasks, it was found that students in the treatment group outperformed students in the control group significantly in language learning (Pooya & Davatgari, 2016). Other researchers didn’t find significant differences in results using audio as a treatment when used in conjunction with animation. (Lin, Dwyer, and Swain, 2006). Research in audio and learning has been inconclusive. Scholars have conducted a number of studies in audio and learning, but very few have been conducted within a serious game environment. The purpose of this study is to investigate whether video games containing audio and feedback have an impact on learning.
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4. RESEARCH DESIGN

Forty undergraduate students from a southern university majoring in Communication Arts were randomly assigned to the control and treatment groups in this research study. A 2X1 factorial post-test-only control experimental design study was used in this study. There were two independent variables and one dependent variable. The independent variables were narration and feedback. The dependent variable was the achievement of conceptual knowledge. There were 13 subjects in the control group, 14 in the game with narration, and 13 in the games with the feedback treatment group. The researcher used a one-way Analysis of Variance (ANOVA) to calculate the results of this research study and set the alpha level to $p=.05$.

The researcher designed the web game using HTML 5 using the content produced by Dwyer and Lamberski (1979) about the parts and functionalities of the human heart. The subjects had little knowledge about the parts and functionalities of the human heart before participating in this research study. Subjects in the narration treatment group received text and illustrations about the parts and functionalities of the human heart along with a 44.1kHz female voice inside of an online module as a button. Subjects in the feedback treatment group received text and illustrations about the parts and functionalities of the human heart along with a point-based style video game (HTML5, web-based learning environment) where students had to answer random questions relating to the parts and functionalities of the human heart. Subjects in the control group received instruction containing text and illustrations about the parts and functionalities of the human heart only.

The control group read the instructional script about the content and the parts of the human heart and then took the test. The treatment groups read the instructional script about the content and the parts of the human heart, played the game with either narration or feedback, then took the test. There were 20 items in the test. A post-test-only design was used in this research study to reduce potential threats to external validity. The instrument’s coefficient of reliability was KR-20 = 0.76. The instructional script was identical for both the control and treatment groups. A power analysis obtained a high effect of 1.01 to look for a difference between treatments and to determine the number of subjects required for the study. Subjects received three extra points for participating in the research study. Subjects in both treatment groups received monetary rewards for every correct answer they provided. Each question was answered incorrectly, and subjects “lost” money.

The experiment occurred at one of the classroom computer laboratories of a southern university. Students had to log in to the learning management system site, read the study’s instructional script on the computer, and play the game with either narration or feedback elaboration, if the subjects were randomly assigned to the treatment group, followed by taking a 20-question conceptual knowledge quiz. If subjects were randomly assigned to the control group, subjects had to log in to the learning management system site, read the study’s instructional script, and take a 20-question conceptual knowledge quiz. Subjects started the experiment at different times with minimal disruptions and disturbances during the experiment.

There were two null hypotheses in this research study. H01: There will be no significant difference between the control group and the treatment group. H02: There will be no significant difference between the treatment groups. This research study attempted to answer the question: Is there a significant difference between and among the control and the treatment groups?

5. RESULTS

The researcher ran a One-Way Analysis of Variance (ANOVA) to compare the mean scores of the control group and treatment groups. The alpha level was set to 0.5 ($p=.05$). Table 1 presents descriptive statistical results for the control group, treatment group 1: narration, and treatment group 2: feedback. Means and standard deviations are also presented in Table 1. The researcher predicted that both treatment groups would outperform the control group. Only treatment group 2: feedback, had higher scores than the control group. The control group and treatment 1: Narration scores had almost identical means with similar standard deviations. Please refer to Table 1.
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**Descriptives**

<table>
<thead>
<tr>
<th>Conceptual</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval for Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Group</td>
<td>13</td>
<td>9.7154</td>
<td>3.58415</td>
<td>.99497</td>
<td>7.5495 - 11.8813</td>
<td>3.70</td>
<td>17.00</td>
</tr>
<tr>
<td>Narration</td>
<td>14</td>
<td>9.7857</td>
<td>3.94537</td>
<td>1.05414</td>
<td>7.5077 - 12.0637</td>
<td>5.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Feedback</td>
<td>13</td>
<td>13.5923</td>
<td>3.92396</td>
<td>1.08831</td>
<td>11.3211 - 15.8635</td>
<td>6.00</td>
<td>18.00</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>11.0325</td>
<td>4.16815</td>
<td>.65904</td>
<td>9.6995 - 12.3655</td>
<td>3.70</td>
<td>20.00</td>
</tr>
</tbody>
</table>

**Table1.** Descriptive statistics showing the means of conceptual knowledge achievement according to each treatment.

The average mean for all groups was 11.03. Another interesting result from this research study was the percentage of A and B grades received among the control and treatment groups. 30% of students in Treatment Group 2: feedback received either an A or B grade. 83% of students also in Treatment Group 2: feedback received a passing grade. Only 1% in the control and treatment group 1: narration received either an A or B grade. More subjects failed the test in the control group at 63%, followed by Treatment Group 1: narration with 50% and Treatment Group 2: feedback with 17%. A subject in Treatment Group 1: narration, had the highest score.

**Table2.** Means plot results of treatment groups in conceptual knowledge achievement.
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Although the researcher ran a power analysis to determine the required number of subjects per treatment, the researcher ran a test of homogeneity of variances to ensure that the groups had homogeneous variances. Please refer to Table 3.

### Test of Homogeneity of Variances

<table>
<thead>
<tr>
<th>Conceptual</th>
<th>Levene Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Based on Mean</td>
<td>.189</td>
<td>2</td>
<td>37</td>
<td>.829</td>
</tr>
<tr>
<td>Based on Median</td>
<td>.101</td>
<td>2</td>
<td>37</td>
<td>.905</td>
</tr>
<tr>
<td>Based on Median and with adjusted df</td>
<td>.101</td>
<td>2</td>
<td>36.450</td>
<td>.905</td>
</tr>
<tr>
<td>Based on trimmed mean</td>
<td>.159</td>
<td>2</td>
<td>37</td>
<td>.854</td>
</tr>
</tbody>
</table>

**Table3. Results from the Levene test of homogeneity of variances.**

To provide a more robust analysis of the research beyond descriptive statistical data, a one-way Analysis of Variance (ANOVA) was run. The ANOVA test indicated a significant score difference between the control and treatment groups 2: feedback. Please refer to Table 4.

### ANOVA

<table>
<thead>
<tr>
<th>Conceptual</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Groups</td>
<td>136.284</td>
<td>2</td>
<td>68.142</td>
<td>4.658</td>
<td>.016</td>
</tr>
<tr>
<td>Within Groups</td>
<td>541.280</td>
<td>37</td>
<td>14.629</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>677.565</td>
<td>39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table4. Overall effect results from the Analysis of Variance (ANOVA) for conceptual knowledge acquisition.**

The researcher also ran a robust test of equality of means to ensure statistical significance using both the Welch and Brown-Forsythe tests. Both tests showed strong statistical significance. Please refer to Table 5.

### Robust Tests of Equality of Means

<table>
<thead>
<tr>
<th>Conceptual</th>
<th>Statistic</th>
<th>df1</th>
<th>df2</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welch</td>
<td>4.435</td>
<td>2</td>
<td>24.609</td>
<td>.023</td>
</tr>
<tr>
<td>Brown-Forsythe</td>
<td>4.670</td>
<td>2</td>
<td>36.799</td>
<td>.016</td>
</tr>
</tbody>
</table>

**Table5. Robust test of the quality of means using the Welch and Brown-Forsythe statistical tests.**

This research study’s overall results indicate significant differences in scores between the control group and treatment 2: feedback and treatment 1: narration and treatment 2: feedback. A post hoc test using the Scheffe method was used to calculate ratified statistical significance. Please refer to Table 6.
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Table 6. Overall effect results from the posthoc test (Scheffe) for the control and treatment groups.

Hypothesis H01: There will be no significant difference between the control group, and the treatment group was rejected $F(2, 37) = 4.658$, $p<.016$ as well as H02: There will be no significant difference between the treatment groups ($p=.04$). Is there a significant difference between and among the control and the treatment groups? The results of this study indicated that there were significant differences in means between the treatment groups.

6. Conclusion

The researcher found in this research study that there were significant differences between the control group and treatment 2: Feedback to facilitate the achievement of conceptual knowledge ($p= 0.16$). The researcher also found, after running a Scheffe method posthoc test, that there were statistical significances between the treatment groups ($p= 0.40$). This study concurs with Cameron & Dwyer (2005) and Almeida (2008) that feedback in video games assists with the acquisition of conceptual knowledge in college students. It also advances the findings of Molin et al. (2020), indicating that feedback positively affects learning outcomes against a control condition. It advances Mayer’s (2009) claims about the modality principle and the findings from Oberfoell & Correia (2016). It opposes the findings by Burgos et al. (2007), as the researchers found that the effect of feedback on declarative knowledge provided insignificant results and the findings of Pooya & Davatgari (2016).

The results of this study indicated that feedback, when used in video games, does assist subjects to learn content, despite the claims made by Iten & Petko (2016) stating that games are only good for fun. The results of this study advance the findings proposed by a number of other scholars indicating that games can be used for learning (Wang & Lieberoth (2016); Presnky (2007); Gee (2005); Sykes and Reinhardt (2013). Video games, when created with a feedback component, help with learning. Still, empirical data didn’t support audio as a significant treatment in student achievement when used in a video game environment.

7. Limitations/Further Research

Although this study statistically confirmed that subjects who received feedback elaborations within a gaming environment scored statistically higher than subjects in the control group and treatment group narration, there were several reasons to believe that the results of this research study could be inconclusive. The difference in sample size between the control and treatment groups could have impacted the results of this study. Perhaps, if more subjects per treatment participated in the study, the results could have been different. The subjects in this study participated in the experiment and completed a criterion test within an hour. Fatigue could have influenced the results of this study. It is possible that the use of a male voice in the narration for the treatment group could have yielded different results in this study. Further research investigating different types of feedback and different elaborations in audio within a gaming environment to facilitate the achievement of rules and principles knowledge would advance the results of this research study.
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REFERENCES

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