International Journal of Media, Journalism and Mass Communications (IJMJMC)
Volume 9, Issue 2, 2023, PP 16-23
ISSN 2454-9479
https://doi.org/10.20431/2454-9479.0902002
www.arcjournals.org

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

Luis Camillo Almeida

Claflin University

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.

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.

Descriptives

Conceptual

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Control Group	13	9.7154	3.58415	.99407	7.5495	11.8813	3.70	17.00
Narration	14	9.7857	3.94537	1.05444	7.5077	12.0637	5.00	20.00
Feedback	13	13.6923	3.92396	1.08831	11.3211	16.0635	6.00	18.00
Total	40	11.0325	4.16815	.65904	9.6995	12.3655	3.70	20.00

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.

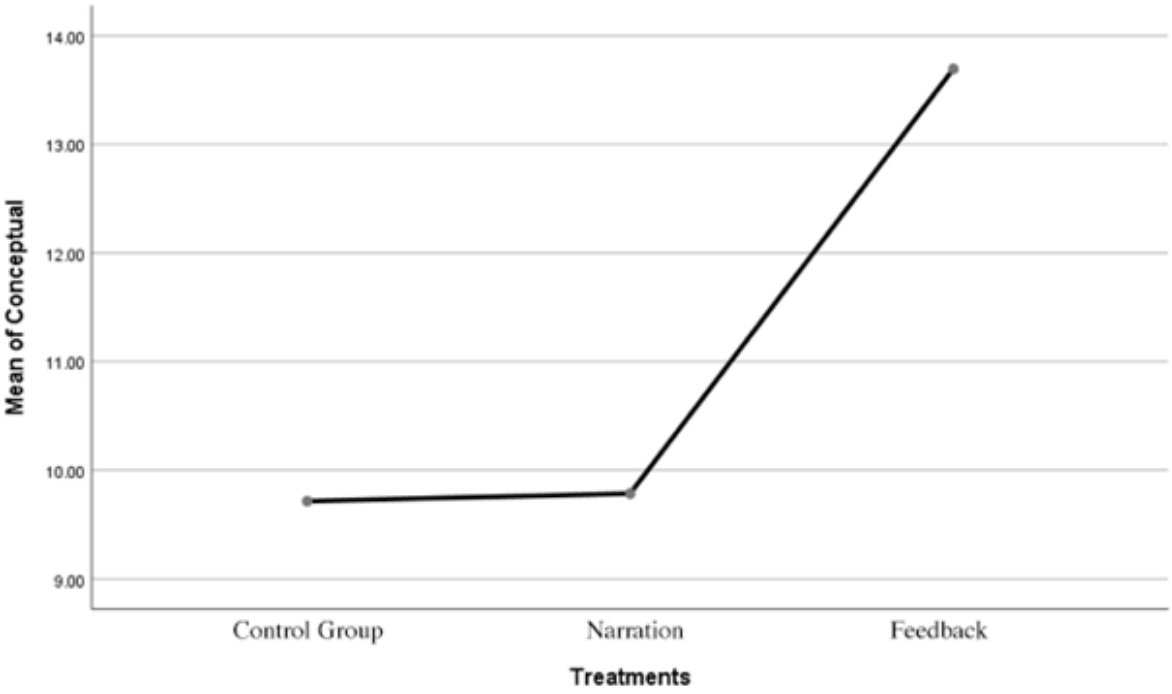
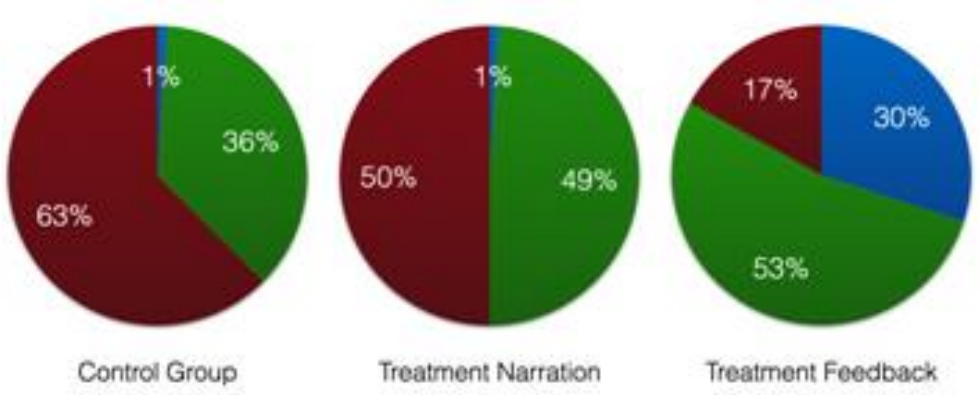


Table2. *Means plot results of treatment groups in conceptual knowledge achievement.*



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

		Levene Statistic	df1	df2	Sig.
Conceptual	Based on Mean	.189	2	37	.829
	Based on Median	.101	2	37	.905
	Based on Median and with adjusted df	.101	2	36.450	.905
	Based on trimmed mean	.159	2	37	.854

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

Conceptual

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	136.284	2	68.142	4.658	.016
Within Groups	541.280	37	14.629		
Total	677.565	39			

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

Conceptual

	Statistic[a]	df1	df2	Sig.
Welch	4.435	2	24.609	.023
Brown-Forsythe	4.670	2	36.799	.016

a. Asymptotically F distributed.

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.

Multiple Comparisons

Dependent Variable: Conceptual

Scheffe

(I) Treatments	(J) Treatments	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Control Group	Narration	-.07033	1.47318	.999	-3.8273	3.6867
	Feedback	-3.97692*	1.50022	.040	-7.8029	-.1510
Narration	Control Group	.07033	1.47318	.999	-3.6867	3.8273
	Feedback	-3.90659*	1.47318	.040	-7.6636	-.1496
Feedback	Control Group	3.97692*	1.50022	.040	.1510	7.8029
	Narration	3.90659*	1.47318	.040	.1496	7.6636

*. The mean difference is significant at the 0.05 level.

Table6. *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.

REFERENCES

[1] Almeida, L. (2008). The effects of different learning strategies to facilitate the achievement of different educational objectives. Tech Trends (52), 3, 32-36.

[2] Burgos et al. (2007). Game-based learning and the role of feedback. A case study. https://core.ac.uk/download/pdf/55533955.pdf

[3] Cameron, B. (2004). The Effect of Online Gaming, Cognition and Feedback Type in Facilitating Delayed Achievement of Different Learning Objectives. *Unpublished doctoral dissertation*, Penn State University.

[4] Cameron, B. & Dwyer, F. (2005). The Effect of Online Gaming, Cognition and Feedback Type in Facilitating Delayed Achievement of Different Learning Objectives. *Journal of Interactive Learning Research*, *16*(3), 243-258.

[5] Clark, R., Mayer, R., & Thalheimer, W. (2003). E-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning. Performance Improvement. 42. 41-43.

[6] Corti, K. (2006) Games-based Learning; a serious business application. PIXELearning Limited. www.pixelearning.com/docs/games_basedlearning_pixelearning.pdf

[7] Dempsey, J.V., Driscoll, M.P., & Swindell, L.K. (1993). Text-based feedback. In J. V. Dempsey & G. C. Sales (Eds.), Interactive instruction and feedback (pp. 21-54). Englewood Cliffs, N.J.: Educational Technology Publications.

[8] El-Nabawi, I., & Shaalan, A. (2018). The Effect of Game-based Feedback on Improving EFL Learners' Reading Comprehension and Raising Autonomy. https://mfes.journals.ekb.eg/article_105056.html

[9] Entertainment Software Association (2023). Essential facts about the computer and video game industry. https://www.theesa.com/

[10] Fyfe et al. (2021). Assessing the Generalizable Effect of Immediate Feedback Versus Delayed Feedback Across Many College Classes. *Advances in Methods and Practices in Psychological Science* 4(3).

[11] Gee, P. (2003). What video games have to teach us about learning and literacy. New York. Palgrave MacMillan.

[12] Gee, J. (2005). Learning by Design: good video games as learning machines.' E–Learning and Digital Media, Volume 2, Number 1, 5-16.

[13] Gee, J. (2005). Good video games and good learning. Phi Kappa Phi Forum, 85(2), 33-37.

[14] Hamari, J., & Tuunanen, J. (2017). Player Types: A Meta-synthesis. Transactions of the Digital Games Research Association 1(2), 29-53.

[15] Hattie, J., and Timperley, H. (2007). The power of feedback. *Rev. Educ. Res.* 77, 81–112.

[16] Hattie, J. (2009). Visible learning: A synthesis of over 800 meta-analyses related to achievement. London: Routledge.

[17] Imlig-Iten, N.,& Petko, D. (2016). Learning with serious games: Is fun playing the game a predictor of learning success? British Journal of Educational Technology. 47, 151-163.

[18] Lin et al. (2006). The Effect of Varied Cognitive Strategies Used to Complement Animated Instruction in Facilitating Achievement of Higher Order Learning Objectives. International Journal of Teaching and Learning in Higher Education, 18, 155-167.

[19] Lynch, R., Mallon, B. and Connolly, C. (2015). The pedagogical application of alternate reality games: Using game-based learning to revisit history. International Journal of Game-Based Learning, 5, 18–38.

[20] Mayer, R. (2001). Multimedia learning. Cambridge: Cambridge University Press.

[21] Mayer, R. (2009). *Multimedia learning* (2nd ed.). Cambridge, England: Cambridge University Press.

[22] Moreno, R., & Mayer, R. (1999). Cognitive principles of multimedia learning: The role of modality and contiguity. *Journal of Educational Psychology*, *91*(2), 358–368.

[23] Michael, D. & Chen, S. (2006) Serious games: Games that educate, train, and inform. Thomson Course Technology. Boston, MA.

[24] Munyofu, M. (2008). Effects of Varied Enhancement Strategies (Chunking, Feedback, Gaming) in Complementing Animated Instruction in Facilitating Higher Order Learning Objectives. The Pennsylvania State University.

[25] Molin, F., Haelermans, C., Cabus, S., & Groot, W. (2020). The effect of feedback on metacognition - A randomized experiment using polling technology. *Computers & Education*, *152*. https://doi.org/10.1016/j.compedu.2020.103885

[26] Mousavi, S. Y., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of Educational Psychology*, *87*(2), 319–334.

[27] Nicol, D., &Macfarlane, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education* 31(2): 199–218.

[28] Oberfoell, A.,& Correia, A. (2016). Understanding the role of the modality principle in multimedia learning environments. Journal of Computer Assisted Learning. 32, p. 607-617.

[29] Penney, C. (1989). Modality Effects in Delayed Free Recall and Recognition: Visual is Better than Auditory. Quarterly Journal of Experimental Psychology 41, p. 10-14.

[30] Pilote, B.,& Chiniara, G. (2019). The Many Faces of Simulation. In Gilles Chiniara (Ed.), Clinical Simulation: Education, Operations and Engineering (2nd Edition) (pp. 17-32). London: Academic Press.

[31] Pooya, D., & Davatgari, A. (2016). The Effects of Audiovisual Recorded and Audio Recorded Listening Tasks on the Accuracy of Iranian EFL Learners' Oral Production. English language teaching, 9, 110-115.

[32] Prenky (2007). Digital Game-Based Learning. Paragon House. New York, NY.

[33] Ryan, T., Henderson, M., & Phillips. M. (2019). Feedback modes matter: Comparing student perceptions of digital and non-digital feedback modes in higher education. *British Journal of Educational Technology* 50(3), 1507-1523.

[34] Rogers, R. (2017). "The motivational pull of video game feedback, rules, and social interaction: Another self-determination theory approach."Scholarship and Professional Work - Communication. 446-450.

[35] Russell, D., & Laffey, J. M. (2016). Handbook of Research on Gaming Trends in P-12 Education. *Advances in Game-Based Learning Book Series*. https://doi.org/

[36] Sadler, D. (2010). Beyond feedback: Developing student capability in complex appraisal. *Assessment & Evaluation in Higher Education* 35(5), 535–550.

[37] Serrano, K. (2019). The effect of digital game-based learning on student learning: A literature review. Graduate Research Papers. https://scholarworks.uni.edu/grp/943/

[38] Sitzmann, T. (2011). A meta-analytic examination of the instructional effectiveness of computer-based simulation games. Personnel Psychology, 64(2), 489–528.

[39] Schwerter, J., Wortha, F. & Gerjets, P (2002). E-learning with multiple-try-feedback: Can hints foster students' achievement during the semester? *Education Tech Research Development* 70, 713–736.

[40] Sykes, J., and Reinhardt. (2013). Language at play: digital games in second and foreign language teaching and learning. Pearson. Boston, MA.

[41] Squire, K. (2006). From Content to Context: Videogames as Designed Experience". In: Educational Researcher, 35(8), 19-29.

[42] Susi, T., Johannesson, M., & Backlund, P. (2007). Serious Games: An Overview. https://www.semanticscholar.org/paper/Serious-Games-%3A-An-Overview-Susi-Johannesson/35627442d7073968b06868821722e5db8c21062d

[43] Taguchi, N., Dixon, D., Qin, Y., & Cheng, Y. (2022). Pedagogic tasks in digital games: Effects of feedback conditions and individual characteristics on learning request-making. *Language Teaching Research.* https://doi.org/10.1177/13621688221110871

[44] Wang, A., & Lieberoth, A (2016). The effect of points and audio on concentration, engagement, enjoyment, learning, motivation, and classroom dynamics using Kahoot!. In *Proceedings from the 10th European Conference on Games Based Learning*, (p. 738). Reading, UK: Academic Conferences International Limited.

Citation: *Luis Camillo Almeida. "The Effects of Audio Narration and Feedback used in a Video Game Environment for the Acquisition of Conceptual Knowledge" International Journal of Media, Journalism and Mass Communications (IJMJMC), vol 9, no. 2, 2023, pp. 16-23. DOI: https://doi.org/10.20431/2454-9479.0902002*