

Comparing the Structural Elements of Best and Worst Educational Computer Games

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Abstract

Empirical examination of the characteristics of games that create the most enjoyment and engagement has been limited. The goal in this paper was to determine whether or not there are any specific game design elements that make an educational game particularly engaging and enjoyable. Challenging, embodiment, and manipulable are the game elements that were most closely associated with best educational games. Additional findings, limitations, and future directions for research are discussed in this paper.

Introduction

Americans who play at least three hours of video games weekly make up a surprising 42% of the population with 26% percent of players under the age of 18 years (Entertainment Software Association, 2015). Numerous studies have investigated the effects of video games on learning. However, empirical examination of the characteristics of games that create the most enjoyment and engagement has been limited (Quick, Atkinson, & Lin, 2012)

Several taxonomies have been created to describe the design of video games. Wood, Griffiths, Chappell, and Davies (2004) surveyed gamers to identify game design elements that attract players to certain games. Their framework consists of 13 game design features that are ranked from most important to least important based on the enjoyment of video games. The most highly rated features were realistic graphics and sounds, character development, rate of play, and game dynamics (exploring and elements of surprise).

The goal in this paper was to determine whether or not there are any specific game design elements that make educational games particularly engaging and enjoyable. Instead of relying on gamers' perceptions of specific games as in the study by Wood et.al, (2004), this study examined the game design elements found in the best and worst educational games based on the ratings of internet users. This study also used a more comprehensive list of 18 game elements proposed by Mathew Ventura (2011) from Educational Testing Services: creating and sharing, social interaction, humorous, ease of control, manipulable, interactive, AI simulator, feedback, freedom, fantasy, realistic, complexity of rules, challenging, re-playable, characters, storyline, embodiment, and aesthetic.

The purpose of this study was to address the following question: What game elements are most associated with high vs. low ranked educational games rated by users at gamerankings.com?

Method

Thirty-eight graduate students enrolled in an online course on e-learning in a major southeastern American university examined 76 educational games rated and ranked on Gamerankings.com. Each student was assigned to choose one game that received all-time worst rating and one game that received an all-time best rated game on Gamerankings.com. Students then identified which of the eighteen game elements (Ventura, 2011) were present in each game based on the given game descriptions and user comments. The data was collected by students across three different semesters (2011, 2013, and 2015). This data was aggregated and duplicate games were removed in order to determine which game elements are most associated with high vs. low ranked educational games.

Results

Frequencies of each game element observed within the best and worst games were computed. Latent Semantic Analysis was then applied to visualize the game elements that were most closely associated with high ranked and low ranked games. Figure 1 shows the analysis results of all compiled data from 2011, 2013, and 2015. It can be seen that challenging, embodiment, and manipulable are the game elements that were the three most closely associated with all-time best educational games. Social interaction, ease of use, and interactive are the game elements found to be most associated with the worst rated games. The differences in distance between the worst and best games throughout all the elements was used to rank order all eighteen elements based on the level of association with the best ranked games. Table 1 shows the resulting ranking of the eighteen game elements. The table shows that challenging, embodiment, and manipulable received the highest rankings respectively. Interactive, ease of use, and social interaction received the lowest rankings.

Discussion

The purpose of the study was to determine what are the game elements most associated with high vs. low ranked educational games rated by users at gamerankings.com. Challenging, embodiment, and manipulable are the game elements that were most closely associated with best educational games. A comparison of the findings with the findings of Wood, Griffiths, Chappell, and Davies (2004) reveal some similarities. The “challenging” element was not directly examined in the Wood et al. study, however, game dynamics such as “skill development” and “sophisticated interactions” were highly ranked by participants in their study. Both the “embodiment” element examined in this study (representing objects in tangible form such as personification or using avatars) and the element of “realistic high-quality graphics” examined in the Wood et al. study both received high ranks. Also, the “manipulable” element and the element “control options” (when the player is able to customize the settings) were both found to be highly ranked in this and Wood et al.’s study.

In contrast, Wood et al. found “character development” and “game dynamics” to be highly ranked, where as in this study, “characters” and “interactive” were some of the lesser ranked game elements. The elements that found in this study to be most associated with the worst rated games: social interaction, ease of use and interactive were not tested in their study. The lowest ranking elements in their study are celebrity endorsement, short duration, and linear game format.

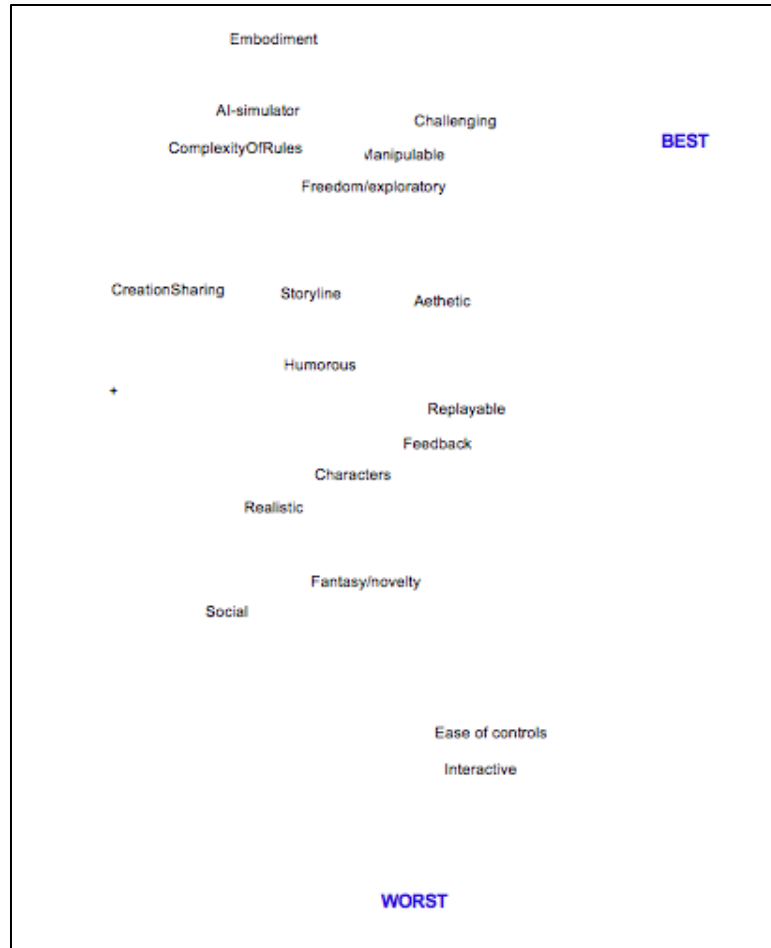


Figure 1. Graph visualizing the association between game elements and game ranking

Table 1. Ranking of all educational game elements

Element	Best	Worst	Difference
Challenging	0.60	1.20	.60
Embodiment	0.76	1.32	.56
Manipulable	0.66	1.17	.51
AI-simulator	0.79	1.25	.46
Complexity of Rules	0.77	1.20	.43
Freedom/exploring	0.73	1.15	.42
Aesthetic	0.68	1.00	.33
Storyline	0.79	1.04	.24
Creation & Sharing	0.84	1.06	.21
Replayable	0.73	0.88	.15
Humorous	0.83	0.96	.13
Feedback	0.78	0.85	.07
Characters	0.87	0.84	-.03
Realistic	0.94	0.82	-.12
Fantasy/novelty	0.95	0.72	-.22
Social interaction	1.04	0.73	-.31
Ease of controls	0.99	0.53	-.46
Interactive	1.02	0.49	-.53

Rankings in this study were based on player rating and perceptions, not on measures of learning. Reliability in data could be improved by playing the game when identifying the presence and absence of each game element. This study does not take into account how well a particular game element was implemented within each game. These noted limitations point to directions for further research into identifying the most critical elements of educational games.

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