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Could the player's engagement in a video game increase his/her interest in science?

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Abstract: Our work is to analyze how the practice of chosen video games may influence the player's interest. A set of video games was selected by a group of experts according to their qualities as games and their relations with scientific knowledge. A focus test experiment has been set up to evaluate the correlation between teenagers engagement and their interest in scientific domains. The analysis of the results shows that the desire to pursue the game and the sentiment of responsibility has, respectively, a direct and an indirect influence on the player's scientific interest. Considering that interest is known to be an important motivational factor in learning, these results have important implications for the serious games design.

Keywords: Video games, scientific knowledge, player's engagement, serious game, focus test

1 Introduction

The present study is a part of the project, Recensement /INMEDIATS¹, which main goals are to understand the relationship between digital entertainment and the interest in scientific knowledge. Our work is to analyze how the practice of chosen video games may influence the player's interest.

Interest is defined to be an emotional and motivational variable [1]. Furthermore, it has been established that the student's personal, situational and topic interest influence positively his/her learning outcomes [2,3]. Finally, in cognitive science, interest is considered to be very closely associated to a person's engagement in a given cognitive activity [4].

Engagement is associated with sensations such as immersion or, even more so, presence: Essentially, the sensation to "be there" [5,6,7]. In particular, Brockmyer & al. establish the relation between engagement and emotions, as fear, in their game engagement questionnaire. Furthermore, some theoretical video game studies observed that emotion can be considered as a component of engagement [8,9]. On the

¹ Recensement/INMEDIATS is partly funded by the Government agency ANRU with Universcience, CNAM, the University of Paris 8 as partners.

other hand, Natkin [10] defined engagement in video games as a feeling of responsibility and Shoenu-fog [11] came to the conclusion that engagement can be conceived as a desire to pursue the game. Engaging the user in his/her experience of the product should be, among others, facilitative of cognitive efforts associated with serious aspects which might be presented in the product [12].

However, the manner in which a fun and engaging nature of an application, notably a video game, influences cognitive processes of the user has not yet been established. One way to think of such a relationship is to conceive it as being mediated by some other variable, for example the player's interest. Considering All these points of view, the present study attempts to explore the relationship between the player's engagement in a videogame and his interest in the scientific domain presented in the game.

2 Method

2.1 Video games selection

A set of video games has been selected by a group of experts. That was divided in two steps: first, from a dedicate data base, games were chosen according to their scientific aspects and gameplay qualities; Then, these shortlisted games were played by a group of scientific popularization experts and a pedagogical expert². The final games chosen are: The Bridge (Ty Taylor and Mario Castaneda, 2013), World of Goo (2D Boy, 2008), Angry Birds Space HD (Rovio, 2012), Puddle (ENJMIN, Neko/Konami 2012) and Sim City 4 (Maxis, 2003).

2.2 Participants

One hundred and thirty three teenagers participated in the study, 23 girls and 110 boys. They were ranging in age from 14 to 18 years old ($M = 15.360$; $SD = 1.292$), were all native speakers of French and had the habit to play video games at least three hours per week.

2.3 Questionnaires

For this study we designed a pre- and a post-questionnaire. The pre-questionnaire was designed to assess video games habits and school interests. It consisted of multiple-choice questions. The post-questionnaire was designed to assess the level of engagement that the video game incited in the participants, as well as participants' interest in the scientific domain that was suggest by the video game a given participant has played. The participant's engagement in the video game was assessed on three separate dimensions; the player's presence during the game, the desire to pursue playing the video game and the feeling of responsibility.

² More details on <http://www.cite-sciences.fr/inmediats/seriousgame/projet.php>

Each section of the post-questionnaire contained several questions to which participants were asked to answer by choosing one modality on a scale going from 1 to 10 : 1 being either a highly negative answer or an answer with the lowest degree of agreement. The questions corresponding to the different sections of the post-questionnaire were conceived based on theoretical and methodological elements from previous studies [1,2,10,11].

2.4 Procedure

The study consisted of 3 stages. In the first stage, the participant was asked to answer the pre-questionnaire. In the second stage, the participant was assigned to a video game related to a scientific domain different than his/her favorite school subject. He/she was asked to play the game autonomously for 30 minutes. In the third and final stage the participant was invited to answer, right after they played the game, at the post-questionnaire.

2.5 Results

The post-questionnaire internal stability was tested with the use of Cronbach's alpha statistics³. For further analysis, only the data from sections with high reliability (Cronbach's alpha was superior to .650) were retained (*Desire to pursue the game*, *Feeling of responsibility* and *Interest in scientific domain*), while those from section *Presence* were excluded (Cronbach's alpha was inferior to .500).

In order to assess the influence of the two compound variables of player's engagement on his/her interest in the scientific domain presented in the video game he/she has played, a multiple regression analysis using a step-wise method was conducted with the *Desire to pursue the game* and the *Feeling of Responsibility* as predictor variables, and the *Interest in the scientific domain* as a predicted variable.

The multiple regression⁴ analysis results revealed a moderate to middle positive correlation among the variables ($r=.483$ for the correlation between *Desire* and *Interest*; $r=.357$ for the correlation between *Responsibility* and *Interest*; $r=.504$ for the correlation between *Desire* and *Responsibility*)⁵. Furthermore, *Desire*, but not *Responsibility*, was found to have a significant contribution to predicting Interest. ($F(1,131)= 39.861$; $p<.001$) and to account for approximately 23 per cent of the variance of the predicted variable ($R^2 =.233$; $\text{delta } R^2 =.227$)⁶.

³ Coefficient providing a measure of the internal stability of a given questionnaire..

⁴ *F*-test (*F* and *p* values): In multiple regression, it explore whether the variables thought of as predictors have a significant effect on the predicted variable.

⁵ *r*: Pearson product-moment correlation coefficient which is a measure of dependence between two variables. Its values vary between +1 -1; the higher the absolute value of *r*, the stronger the dependence/correlation.

⁶ *R*²: Coefficient of determination which provides a measure of how well observed outcomes are replicated by the model.

2.6 Discussion and conclusion

Roughly speaking, these results show that the *Desire to pursue the game* has a direct impact on the *Interest in the scientific domain*, while the *Feeling of responsibility* influences this same variable through its relation to *Desire to pursue the game*. *Desire* directly affects *Interest* with a very likely causal link. Similarly, *Responsibility* indirectly affects *Interest*, through *Desire* but this link might not be causal.

As theorized by Natkin [10], it might be linked to the *Feeling of responsibility* thus seems to be a component of the player's engagement. Following this research, it is necessary to validate the game questionnaire engagement on presence and to include it in our study [5]. It may help to understand better the potential relationships between the quality of a game in term of engagement and its implicit contents and messages (in our case, the scientific content) included in the same game. Finally, further research is needed in order to identify other factors influencing the player's interest for serious contents of a video game.

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