

Present or Play, Some First Evidence on the Effect on Behaviour of Serious Gaming

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Abstract

Serious gaming is one of the newest developments in the world of learning and is recently gaining increasing attention and interest in the business environment. Many people claim that serious gaming has more influence on the behaviour of trainees than a normal presentation, but very little evidence is available in literature. Therefore in this paper the following research question will be answered: *“Is people’s demonstrated behaviour after playing a serious game, which is highlighting the need for a specific set of behaviours, different from their demonstrated behaviour after attending a presentation with the same content, and why?”*

To answer this research question, an experiment lasting four months was conducted within a consulting company. A presentation was given twice and a serious game was played twice, both addressing the same content. In total 82 participants played a serious game and 72 participants attended a presentation. Consequently, participants’ behaviour was measured in a business simulation environment.

This experiment shows that a serious game is more effective than a presentation when it comes to making people demonstrate a specific set of behaviours. Experiencing failure is an important element of learning in a serious game and most learning occurs during a debriefing when participants reflect on their in-game experiences. The importance of learning elements like goal setting, feedback and challenge is shown as well. Finally and not surprisingly, results indicate that a serious game is more engaging than a presentation.

Although it is difficult to generalize about the effectiveness of serious games over presentations, as it also depends upon the learning elements included, this study is one of the first to show evidence on the effect on behaviour of serious gaming.

Introduction

“While most games appear to be effective in terms of creating an environment where students stay on task longer while engaged in the process of playing, little empirical evidence exists that demonstrates games providing any more positive, systematic outcomes for content learning than traditional teaching methods” (Gunter, Kenny, & Vick, 2007).

The focus of this research is on serious games, generally described as games that are used for the purposes of learning and training, regardless of whether they are making use of computer technology and video graphics or not (Crookall, 2011). During the last couple of years serious gaming gained an increasing amount of attention which could be explained by two developments. Firstly, there are large developments in Information Technology stimulating the thought of practitioners that “new form of training, as close as possible to business situations (...), needs to be organised in order to keep up with the speed of changes” (Pannese & Carlesi, 2007). Secondly, there is an increasing belief that learners need to be engaged more extensively, and that learners must be put more in the centre of the learning experience.

In this paper we concentrate on the second development and present an experiment that partly proves that a serious game is more effective than a presentation. In the pages to follow we first provide some background on serious gaming and learning and their impact on behaviour. We then report on the experiment, its results and the analysis conducted with six experts. Finally, we conclude and discuss some possible limitations of the approach.

Background

To establish the theoretical foundation for this research, first the relevant and available serious gaming literature was identified. A systematic literature review was conducted according to the method of Wolfswinkel, Furtmueller, and Wilderom (2011), using the 'Social Sciences & Humanities' database of Scopus. Search terms used were games or gaming or serious games or serious gaming. Additional search was done on learning or behaviour or knowledge or training.

In total 433 articles were found. After filtering out doubles, reading abstracts and the full text articles, and applying forward and backward citation, 12 articles remained in total. The analysis of these 12 articles has been used as the core of this chapter.

To gain a better understanding on how a learning effect can be created by serious gaming, the learning elements that can be included in a serious game have been examined. These elements are distilled from the articles found. An overview of these elements is shown in table 1.

Table 1: Learning elements of serious gaming

Learning elements serious game	Author(s)
Adaptation: Level of difficulty adjusts itself to the skill level of the player by matching challenges and possible solutions.	(Wilson et al., 2008); (Greitzer, Kuchar, & Huston, 2007); (Garris, Ahlers, & Driskell, 2002) (Thompson et al., 2010);
Competition/challenge: Challenge adds fun and competition by creating barriers between current state and goal state.	(Wilson et al., 2008); (Ricci, Salas, & Cannon-Bowers, 1996); (Garris et al., 2002); (Thompson et al., 2010)
Control/Choice: The player's capacity for power or influence over elements of the serious game.	(Wilson et al., 2008); (Garris et al., 2002); (Thompson et al., 2010)
Fantasy: It involves the user in imagined unusual locations, often analogies for real-world processes.	(Wilson et al., 2008); (Garris et al., 2002); (Thompson et al., 2010)
Feedback/Assessment: Feedback provides a tool for users to learn from previous actions and adjust accordingly.	(Wilson et al., 2008); (Ricci et al., 1996); (Garris et al., 2002) (Thompson et al., 2010)
Goal Setting: Goal directedness can motivate players to achieve something, enhancing challenge and involvement.	(Wilson et al., 2008); (Ricci et al., 1996); (Greitzer et al., 2007); (Thompson et al., 2010)
Interaction: Provides an opportunity for achievements and acknowledgement by others.	(Wilson et al., 2008); (Ricci et al., 1996); (Greitzer et al., 2007)
Mystery: Gap between existing and unknown information.	(Wilson et al., 2008); (Garris et al., 2002)
Practice: Repeating for harder task and better knowledge retention.	(Thompson et al., 2010); (Yusoff, Crowder, & Gilbert, 2010)
Progress/Levelling: Progress and surprise is how the player progresses toward goals of the serious game.	(Wilson et al., 2008); (Greitzer et al., 2007);
Rules: Specific, rules and guidelines are a necessary component for an effective educational serious game.	(Wilson et al., 2008); (Garris et al., 2002)
Sensory stimuli: Visual or auditory stimulations, which distort perception and imply temporary acceptance of an alternate reality.	(Wilson et al., 2008); (Garris et al., 2002)

Furthermore, to gain a better understanding on what is already known about the impact of serious gaming, the literature was also reviewed on evidence related to learning and serious gaming. Regarding the effects of serious games on attitude, knowledge, skills and behaviour, Connolly, Boyle, MacArthur, Hainey, and Boyle (2012) conducted a valuable literature review. A representation of the found evidence is presented below:

- Attitude: Wijers, Jonker, and Kerstens (2008) reported that students found a game motivating for learning math. In contrast to that, Huizengal, Admiraall, Dam, and Akkerman (2008) found that students did not find a mobile game motivating for learning history.
- Knowledge: Contradicting results were found, where Papastergiou (2009) and Beale, Kato, Marin-Bowling, Guthrie, and Cole (2007) showed improvements in memory and knowledge retention, while Sward, Richardson, Kendrick, and Maloney (2008) did not find any significant differences between their experimental and control-group.
- Skills: All papers found in this category were quasi-experiments; again contradicting results were found. Hogle, Widmann, Ude, Hardy, and Fowler (2008) found results in favour of gaming when looking at the improvement in performance on depth perception and operative performance, but found no difference on four other measures. Furthermore, while Stefanidis, Scerbo, Sechrist, Mostafavi, and Heniford (2008) found improvements in students' performance using a game; Orvis, Horn, and Belanich (2008) found that inexperienced players did not benefit as much from a similar serious game.
- Behaviour: An experiment conducted by Lavender (2008) focussing on behaviour change showed that participants demonstrated more sympathy towards homeless people after playing a serious game. Jouriles et al. (2009) conducted a randomized experiment to test a role-playing game designed to train young women to develop behavioural strategies for resisting untoward sexual advances. Although they concluded that the game could be useful, the researchers did not focus on the specific behavioural impact of the games.

The literature review of Connolly et al. (2012) shows that the available literature indicates a positive impact of serious gaming on e.g. motivation, knowledge improvement, knowledge retention and skill performance. However almost all evidence found could be weakened by similar research that shows opposing results. Furthermore, no article really focusses on the impact of serious gaming on demonstrated behaviour which is the scope of this research.

In order to gain a better understanding on how a learning method can enhance learning, an additional literature search was conducted to identify relevant learning theories. Since the number of learning theories is almost infinite, the most important ones were classified into four types of learning paradigms: Behaviourism, Constructivism, Cognitivism and Humanism (see figure 1).

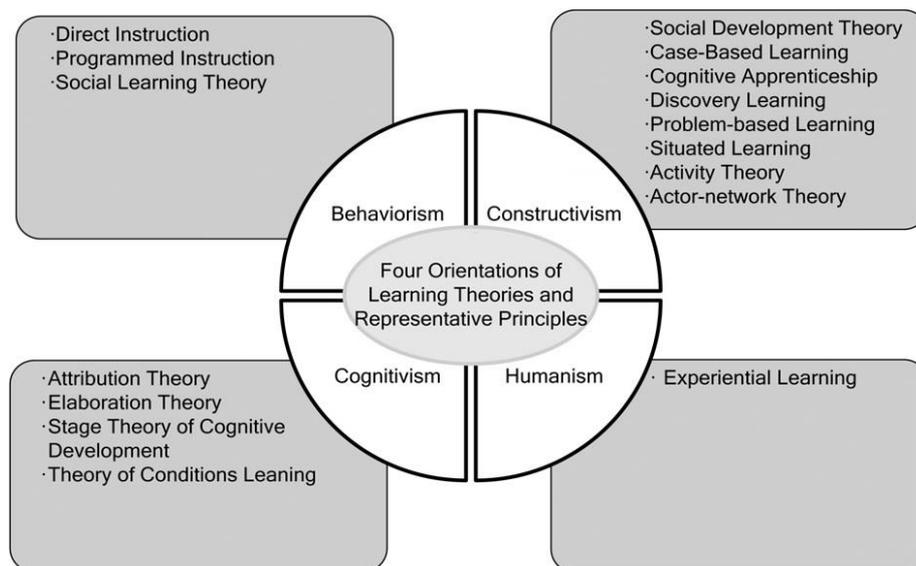


Figure 1: Overview of learning theories (Wu, Chiou, Kao, Alex Hu, & Huang, 2012)

Based on these learning paradigms and their underlying learning theories, essential learning elements were derived. A comparison between serious games and presentations is presented along these

elements in table 2. On the left side there are learning elements derived from literature, while on the right side a possible representation of these elements within serious games and presentations.

Table 2: Mapping serious games and presentations on learning elements

Learning Elements	Serious games	Presentations
Reflection	(1) In-game feedback on decisions made– (2) debriefing	Presenter-audience interaction
Challenge	(1) In-game goal setting – (2) competition	(1) Question the audience – (2) provide a case
Control	(1) Players can make their own choices (control) – (2) game adapts to the player	Address content based on audience preferences
Goal Setting	(1) Present learning goals at the start – (2) in-game goals	Present learning goals at the start
Failure	In-game experience of problems	(1) Present a problem – (2) ask questions to the audience
Practice	Practice while playing	Stimulate active thinking by showing examples
Interaction	(1) In-game interaction – (2) interaction among players	Involve the audience
Recall prior knowledge	Include elements which require recall of prior knowledge	Address previously acquired knowledge
Guidance	(1) In-game help – (2) game can be adjusted to the level of a player	Address problems of the group

In general both a serious game and a presentation contain corresponding learning elements, although the format in which the learning elements are included in both learning methods is different. The format of a serious game is more related to the humanistic learning theory of Kolb (1984), taking a more learner centred approach and integrating the learning elements in the flow of the serious game. The format of a presentation is more related to the cognitivist theory of Gagné (1965), looking at humans as ‘processors of information’, including the learning elements in a more stepwise manner.

Method

To answer the research question, a quasi-experiment has been conducted within a consulting company. The experiment took place during the ‘new hire days’; an introduction program for all new employees, taking place each month during the first two days of their new job. During these days new employees are expected, among other things, to gain an understanding of the company’s Core Values. These Core Values are presented during the first morning of the program, definition of which can be found below:

- (1) One Global Network: Cross-team collaboration to deliver exceptional service to the client
- (2) Client Value Creation: Approach the clients and validate their needs
- (3) Stewardship: Help each other, and stimulate others to engage
- (4) Respect for the individual: Treat each other with respect
- (5) Best People: Use people potential and allocate roles based on capabilities
- (6) Integrity: Be honest and take responsibility

For the purpose of this research this content was introduced using two different formats. During two ‘new hire days’ a serious game was played and during two ‘new hire days’ a presentation was given. Consequently, participants’ behaviour was observed three hours later, during a business simulation in which participants run a number of competing virtual companies. This business simulation lasts for two hours and provides an environment in which all behaviours related to Core Values could be observed. Therefore, during this simulation, the impact could be observed of both the presentation and the serious game on participants’ demonstrated behaviour. A graphical representation of the experimental research design is shown in figure 2.

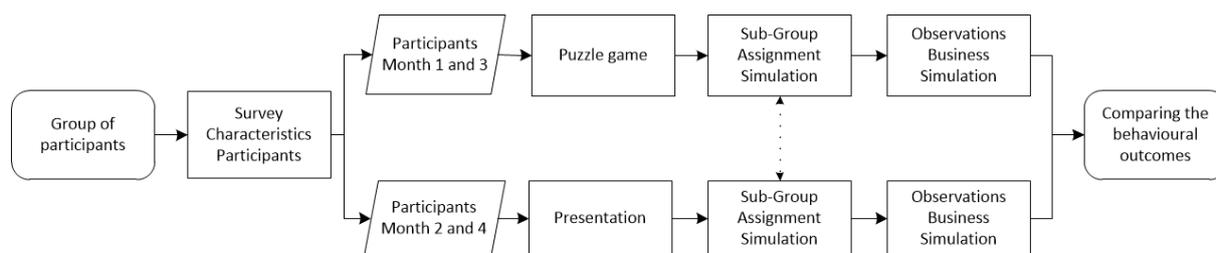


Figure 2: Research design experiment

In total 154 people took part in the experiment; in total 82 participants played a serious game and 72 attended a presentation. To create equality among both the experiment and the control group, comparable sub-groups were created based on participants' social demographics, personality traits and social styles. In total 14 groups played the serious game and 12 groups attended the presentation. Control for possible third-variables that could influence participants' behaviour was based on the model of Fishbein and Ajzen (2011).

The serious game used (the Core Value Puzzle Game) is an analogue multi-player social interaction game at a higher level of abstraction of real-life business processes. The players are divided into small teams, each receiving a set of 9 puzzle pieces and one short and vague assignment from the client. During the play participants need to create the 'complete picture' for the client. This apparently simple assignment takes a long time because participants base their actions on unconfirmed assumptions and do not work in the most efficient and effective way. At the end of the game, during the debriefing, facilitator reflects on the playing process and participants realize that they had no idea of what the client wanted, did not work together, did not stimulate each other to engage, did not use the strengths of their team and their actions were primarily internally focused. Consequently participants realize that the behaviours lacking in the game are essential aspect of their future consulting work.

The same content was also introduced using a presentation. In order to gain a more objective view on how the Core Value Puzzle Game and the Core Value Presentation differ, both of these methods are mapped on the learning elements as identified previously (see table 3).

Table 3: Learning Elements included in the Core Value Puzzle Game and Core Value Presentation

Elements	Core Value Puzzle Game	Core Value Presentation
Reflection	Participants gain feedback during the game and afterwards during the debriefing	Participants get feedback when asking questions
Challenge	Creating the idea that different teams are in fact competing	Participants are encouraged to think actively
Control	Participants have the freedom to make their own choices	The content is presented; teacher centred
Goal Setting	Participants are encouraged to work towards the goal of delivering a complete picture	At the start of the presentation the learning goals are stated
Failure	Participants experience failure by acting on unconfirmed assumptions	Questions are asked regarding their knowledge on Core Values
Practice	While playing, participants actively experience the 'Core Value behaviours'	Participants are encouraged to think actively about why the 'Core Value behaviours' are important
Interaction	Participants have interaction with the facilitators and can share knowledge with each other	Presenter-audience interaction is stimulated
Recall prior knowledge	Previous knowledge and skills are used while playing	Participants are encouraged to think actively about their own experiences
Guidance	Afterwards a facilitator reflects on participants' behaviour	Questions are answered

In general both the Core Value Puzzle Game and the Core Value Presentation possess similar

learning elements as identified in the theory section. The main difference between the Core Value Puzzle Game and the Core Value Presentation is that during the Core Value Puzzle Game participants actively play, while during the Core Value Presentation participants mainly listen. Therefore, it is interesting to observe whether they demonstrate different behaviours after experiencing both learning methods.

The data was gathered by observations and by making participants reflect on their own behaviours. The data was analysed using an Independent Samples T-test or Wilcoxon Rank Sum Test. When normality of the data was assumed, the Independent Samples T-Test has been conducted. When Normality was not assumed the Wilcoxon Rank Sum Test has been conducted. Afterwards, the results have also been discussed based on 6 interviews with serious gaming experts.

Results

Firstly the results of the experiment are presented. An overview of the data is given in table 4.

Table 4: Results observations

Measures	Measurement	Statistical Test	Significance
<u>One Global Network</u>			
Cooperation Among Teams	Observation	Rank Sum Test	,001*
Cooperation Among Teams	Reflection	Samples T-Test	,001*
Knowledge Exchange	Reflection	Samples T-Test	,26
<u>Client Value Creation</u>			
Market Approaches	Observation	Samples T-Test	,514
Shareholder Approaches	Observation	Rank Sum Test	,94
Idea Market Need	Reflection	Samples T-Test	,500
Involved Shareholder	Reflection	Samples T-Test	,801
<u>Stewardship</u>			
Help Team Members	Observation	Rank Sum Test	,861
Pro-Actively Sharing Ideas	Reflection	Samples T-Test	,442
Help Team Members	Reflection	Rank Sum Test	,498
<u>Respect For The Individual</u>			
Feel Free To State Opinion	Reflection	Samples T-Test	,089*
Feel Trusted in Role	Reflection	Samples T-Test	,226
<u>Best People</u>			
Have The Role That Fit Best	Reflection	Samples T-Test	,984
Team Listens To Me	Reflection	Samples T-Test	,009*
<u>Integrity</u>			
Honesty and Openness	Reflection	Rank-Sum Test	,208
Everyone took their responsibility	Reflection	Samples T-Test	,076*

* $p < .10$

One Global Network: It was observed that the two times that the Core Value Puzzle Game was played a lot of dynamic interaction occurred among the sub-groups, while the two times a presentation was given all teams were really internally focused. When looking at the measured cooperation, (0,001 (p) < 0,10 (α)), the null hypothesis is rejected. Participants that played the serious game cooperated more than the ones attending the presentation. Because 0,26 (p) > 0,10 (α), the null-hypothesis is not rejected for the knowledge exchange. Thus in general the participants showed more cooperating

behaviour after playing the Core Value Puzzle Game then after a Core Value Presentation, mainly by exchanging resources.

Client Value Creation: The general impression during the observations was that participants were really client oriented during all four business simulation runs. Therefore, when looking at the observed market approaches, 0,514 ($p > 0,10$ (a)), the null-hypothesis is not rejected. The reflected data shows a similar pattern because 0,5 ($p > 0,10$ (a)) and 0,801 ($p > 0,10$ (a)). No significant differences are found regarding market understanding and the involvement of the shareholder (a played role in the simulation). The score of the shareholder approaches, 0,094 ($p > 0,10$ (a)), indicates that significant differences exist between the observed experimental and control group. Although this is not a convincing score, the conclusion can be drawn that no difference exists between experimental and control groups regarding client orientation.

Stewardship: In general it was observed that during all four runs participants were really willing to provide help when it was asked. When looking at the observed helping behaviour towards teammates, 0,861 $> 0,10$, the null-hypothesis is not rejected. All of those that played a serious game and attended a presentation showed a lot of helping behaviour in the observational setting. The reflective data shows a similar pattern. Due to the fact that 0,442 ($p > 0,10$ (a)) and 0,498 ($p > 0,10$ (a)), no significant differences are found between the experimental and control groups regarding pro-activity in sharing ideas or helping teammates.

Respect for the Individual: It was observed that some participants wanted to make all the decisions, and sometimes forgot to involve other team members. No disrespectful behaviour was observed during all four runs. Therefore the null-hypothesis is not rejected for the degree 'people feel trusted in their role' (0,226 ($p > 0,10$ (a))). Regarding the degree 'people feel free to state their opinion', the null hypothesis is rejected (0,089 ($p < 0,10$ (a))). The reflection of the participants indicates that participants who played a serious game felt a higher degree of freedom to state their opinion than the ones attending a presentation.

Best People: The general impression during these four months was that participants really tried to operate their teams in the best way possible, respecting each role. This is shown in the measure whether they feel that they have the role that fit them best (0,894 ($p > 0,10$ (a))). However, it was observed that some of those in the control group forgot the importance of involving the team. Therefore for the measure whether 'people felt listened to', the null hypothesis is rejected (0,009 ($p < 0,10$ (a))). The reflection of the participants indicates that participants who played a serious game felt more listened to than the ones that attended a presentation.

Integrity: There was a high degree of integrity. Therefore the null-hypothesis is not rejected regarding participants' honesty and openness (0,208 ($p > 0,10$ (a))). Regarding the degree indicating whether they took their responsibility or not, the null hypothesis is rejected (0,076 ($p < 0,10$ (a))). So, significant difference exists between the experimental and the control group. The reflection of participants indicates that those that played a serious game took more responsibility than those who attended a presentation.

Analysis

In general, the results of the conducted experiment indicate that participants showed different behaviours after playing a serious game or attending a presentation. Participants that played a serious game showed more cooperating behaviour, felt significantly freer to state their opinion, felt more listened to, and had the idea that all members took their responsibility; all of it related to essential elements of the Core Value Puzzle Game. Results of this experiment will be discussed below, based on the outcomes of 6 expert interviews.

The results indicate that a serious game is a more effective learning method than a presentation when it comes to helping people acquire certain behaviour. During a serious game people learn actively, gaining a practical understanding of the expected behaviour, while during a presentation people learn passively, only gaining a theoretical understanding of the content. During a serious game, as indicated by Wilson et al. (2008), Garris et al. (2002) and Thompson et al. (2010), people are self in control and can regulate their own actions and learning process. This is in line with the humanistic approach and the theory of Kolb (1984). During a presentation the learning experience is directed by the presenter, which is more in line with the stepwise cognitivist approach of Gagné (1965).

Failure plays an important factor in the learning effect of a serious game. During a serious game the participants really experience the consequences of their own choices. The results show that the more they experience failure during the serious game, the larger the difference becomes in observed behaviour compared to those participants that attended a presentation. During the Core Value Puzzle Game participants failed to cooperate, failed to work as a team, and acted primarily as individuals. In the observational setting though (business simulation), the same participants showed more cooperating behaviour, felt significantly more free to state their opinion, felt more listened to, and acted more on their responsibilities, than the participants attending the Core Value Presentation. Most of the learning actually occurs during the debriefing, when participants reflect on their in-game behaviour. This also demonstrates the importance of elements like competition, goal setting and feedback. These elements, as derived from e.g. (Wilson et al., 2008), are factors that enhance the feeling of failure, and provide reflection. People mainly experience failure when they're engaged and challenged to reach certain goals, where challenge adds fun and competition by creating barriers between the current state and the goal state (Wilson et al., 2008). Feedback provides a tool for participants to learn from their previous actions and adjust them accordingly (Wilson et al., 2008).

The results indicate that a serious game is more engaging than a presentation. Both the Core Value Puzzle Game and Core Value Presentation included similar learning elements, but only during a serious game the learning elements are embedded in playing experience, enhancing both mental and emotional involvement (Gunter et al., 2007). During a serious game participants experience the content with several senses (touch, smell, listening), while during a presentation engagement must be stimulated mainly by the presenter. During a serious game the participants create their own story, while during a presentation they are spectators of someone else's story. However, since people are social animals, elements like fun, interaction, and a shared responsibility, enhance the level of engagement.

Conclusion and discussion

This research shows that a serious game is more effective than a presentation to make people demonstrate a specific set of behaviours in this training setting. In the conducted experiment, a learning method, similar to the humanistic approach is compared with a learning method similar to the more cognitive approach. Furthermore, a framework is constructed that can be used to compare both a serious game and a presentation along similar learning elements, especially on the elements goal setting, feedback and challenge.

It is difficult to make generalizations about all serious games and presentations, since the effectiveness of each learning method depends upon the included learning elements. However, since a serious game and presentation were compared which both include similar learning elements; this research is a good indication of the extent to which the impact of both learning methods differs.

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