Playing in School or at Home? An Exploration of the Effects of Context on Educational Game Experience

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Abstract: The goal of this study is to gain insight into the effects of context on educational game experience. Using a quasi-experimental setup, it compares the playing and learning experiences of adolescent players of the awareness-raising game PING in a domestic (N=135) and a school (N=121) context. Results indicate that both gaming (identification, enjoyment) and learning experiences are more intense in a home compared to a school context. However, all of the variance in gaming and part of that in learning experience are caused by longer playing times and better computer equipment. Moreover, the overall impact of context on perceived learning is significantly smaller than that of other experiential factors such as identification and enjoyment. Thus context should be considered as a significant yet relatively small determinant of learning experience.

Keywords: context, serious games, game-based learning, situated play, game experience

1   Introduction

The use of digital games for learning has received considerable academic attention in the past decade. Several authors have discussed the opportunities of using games for teaching or training (Michael & Chen, 2006; Prensky, 2003, 2005; Ritterfeld, Cody, & Vorderer, 2009). Others have looked into how the use of game-based learning relates to motivation (Garris, Ahlers, & Driskell, 2002; Miller, Chang, Wang, Beier, & Klisch, 2011; Papastergiou, 2009). Still others have focussed on the design aspect of games and learning and have explored factors that are important when designing game-based learning environments (Gros, 2007; Kiili, 2005). A final strand of research has put forward and assessed potential adoption barriers for using digital games in the classroom (Bourgonjon, Valcke, Soetaert, & Schellens, 2010; Ketelhut & Schifter, 2011; Squire, 2003, 2005). It is clear that educational games cover a broad range of topics featuring different goals and eliciting different types of use. Playing games and learning are, however, context-embedded activities. Hence playing the same game in an educational context tends to be experienced in a different way than in a private setting (Squire, 2005).

Whilst the use of learning games has been studied in educational settings (see e.g. De Grove, Van Looy, Courtois, & De Marez, 2010), little is known about how these games are experienced when being played in other environments and about the experiential differences between differing settings. The aim of this study is to explore whether the playing and learning experiences evoked by an educational game differ between a domestic and an educational context. More particularly, we present a quasi-experimental design in which we compare experience and perceived learning of players of the social awareness raising game Poverty Is Not a Game (PING, GriN Multimedia 2010) who are at home and in school. First, we provide a brief overview of existing literature on the influence of different contexts on game experience. Next, we discuss three experience dimensions related to playing educational awareness-raising games such as PING. Finally, we report on the empirical exploration of how the game is experienced in the different settings.

2   Poverty Is Not a Game (PING)

In order to understand the choice of the theoretical constructs underlying this research, the game used for testing is briefly introduced. Poverty Is Not a Game (PING) is a single-player adventure game that aims to raise awareness concerning poverty and social exclusion in adolescents in a way that relates to their everyday lives (see Appendix A for screenshots of the game). The game takes place in a three-dimensional environment which represents an average Western-European city. Players can choose between a male or a female avatar. Although the decision to play with a certain avatar has an impact on the storyline, the central message the game wishes to convey is the same. It aims to raise

awareness concerning the mechanisms underlying poverty and is specifically aimed at what is sometimes referred to as the fourth world. Each storyline can be finished in approximately forty-five minutes. Previous research into learning and games motivate the inclusion of enjoyment and learning effects in the research design (cf. infra). Moreover, due to the importance of the avatar and its relation with the story, there is also a strong interest in how players identify with their avatar and how this is related to their playing and learning experiences.

3 Background

3.1 Play in context

While digital games mainly take place in a virtual world, they are at the same time being played by individuals in a physical space defined by socio-spatial characteristics. These characteristics, which may include environmental factors, device characteristics, previous occupations, the presence of co-players or even the associations linked with a setting, shape the individual game experience (Mäyrä, 2007). It is therefore surprising that in the literature so little attention has been given to contextual factors in conceptualizations and operationalizations of game experience and in empirically grounded game experience research (De Kort & Ijsselsteijn, 2008). According to Mäyrä (2007), immediate social and personal contexts influence the experience while, on a more abstract level, experiences are influenced by social norms and values, by the contexts of digital game production and by the contexts provided by earlier forms of gaming and play. This model provides us with a first basic understanding of how different types of context influence game experience. At the same time, however, it fails to provide more detailed operationalizations or subcomponents of constructs such as social norms and values. Playing a digital game in a public versus a private place, for example, can be expected to result in a different game experience precisely because the socio-spatial affordances are shaped by the public or private character of those places. To our knowledge no integrated models have been proposed that approach game experience as a contextual phenomenon.

Most research taking into account the role of context focuses on the immediate social relations. De Kort and IJsselsteijn (2008) provide an overview of possible social roles (e.g. spectator, co-player, opponent) and discuss how these roles evoke different experiences. Moreover, a broad range of, mostly survey, studies have explored the importance of the social component as a motivator for playing games (Cole & Griffiths, 2007; Griffiths, Davies, & Chappell, 2003; Van Looy, Courtois, & De Vocht, 2010; Yee, 2006; Yee, 2006). Other, experimental studies manipulate social context and then measure how this change affects game experience. Weibel and colleagues (2008) explored the experiences of people when playing online against a human versus a computer-controlled opponent and found higher instances of presence, flow and enjoyment for people who played against another human. Likewise, the differences in several game experience dimensions between virtual, mediated and co-located play have been studied for adolescents (Gajadhar, de Kort, & IJsselsteijn, 2008; Gajadhar, de Kort, & Ijsselsteijn, 2008) and elderly people (Gajadhar, Nap, de Kort, & IJsselsteijn, 2010).

While the aforementioned studies provide valuable insights into the effects of different social configurations on the game experience, they do not take into account the broader setting in which these games are played. Educational games, for instance, can be designed for use in a school context. This imposes certain limitations regarding the possible social and spatial configurations in which such games are used. Therefore it is argued that these contexts create different social roles and have different spatial and physical characteristics. Research taking the broader context into account in this manner can mainly be found in research on computer-supported collaborative learning in which the effect of group learning in a computer-mediated environment is examined. A key finding in using collaborative learning environments concerns the necessity of social interaction. If group learning is to be efficient, collaborative learning environments should not prevent or inhibit social interaction between students. Therefore, the teacher serves as a facilitator and the design of the learning environment should be as sociable as possible (Kreijns, Kirschner, & Jochems, 2003; Nastasi & Clements, 1993). These studies only focus on variations in social configuration of the educational context however. No empirical research was found that explores how the educational game experience differs between a school and a domestic context.

3.2   Game experience and digital game-based learning

3.2.1   Enjoyment

While digital games can evoke a broad range of different experiences, most studies focus on what makes them enjoyable. Several approaches exist, however, towards its causes and conceptualizations. Vorderer et al. (2004) identify motivations and user and media characteristics as determining factors leading to enjoyment. Motivations are drawn from a uses and gratifications perspective and include escapism, mood management, achievement and competition. Enjoyment is conceptualized as consisting of three components: one cognitive, one physiological and one affective. Tamborini et al. (2010) approach enjoyment from an interpersonal point of view and conceptualize it as the satisfaction of three needs: autonomy, competence, and relatedness. Relatedness refers to the need to feel connected to others while competence refers to the need to feel competent in the action that is performed and is similar to the concept of self-efficacy in social cognitive theory (Bandura, 1977). Autonomy, finally, refers to the desire to behave according to one's own will. In the same vein, Sweetser and Wyeth (2005) define game enjoyment in relation to intrinsic motivations and adapt flow theory (Csikszentmihalyi, 1990) to the specificity of digital games. They propose to extend the traditional flow model with the concept of social interaction.

Despite the differences between these approaches, it is remarkable to note that they all take into account the role played by the social dimension of gaming. Vorderer and colleagues do so by means of the user prerequisites and more specifically by integrating parasocial relationships in their model. In self-determination theory, the importance of the social aspect when playing games is represented by the need for relatedness and in the game flow model of Sweetser and Wyeth, social interaction is added in order to take the social aspect of gaming into account. In addition to these theoretical frameworks, empirical studies have found a significant effect of social context on enjoyment (Gajadhar, de Kort, & IJsselsteijn, 2008; Gajadhar, de Kort, & Ijsselsteijn, 2008). Since private and public environments can be considered as different contexts, it is argued that playing in those contexts will significantly impact enjoyment.

H1: *The enjoyment evoked by playing an educational game will differ significantly between a school and a domestic context.*

3.2.2   Learning effects

Enjoyment is regularly conceptualized as the motivational basis for digital game-based learning (Garris et al., 2002; Michael & Chen, 2006; Squire, 2005). Digital games are perceived as intrinsically motivating because they are enjoyable and it is this trait that is used as a lever to facilitate learning (Chuang, 2007). Authors like Gee (2003, 2005, 2007) and Prensky (2003, 2005) argue that the motivational nature of digital games combined with certain educational content will make learning more effective. Moreover, several models have conceptualized learning as an effect of enjoyment. For instance, Kiili (2005) uses flow and experiential learning theory to construct an experiential gaming model. It is argued that the positive user experiences caused by a flow experience can be brought into service to maximize the impact of educational games. Similarly, Vorderer and colleagues posit that "one the most important of such useful effects of being entertained is comprehension and learning" (Vorderer et al., 2004, p. 403). It is therefore reasonable to assume that the pleasure of playing an awareness-raising game is correlated with its perceived learning effects. The concept of perceived learning aims to explore to what extent participants feel they have learned about the subject matter, in this case about how it is to be poor in a Western country. Employing this construct serves a double purpose. As increased perceived performance capabilities impact motivational outcomes, this construct incorporates an affective outcome (Kraiger, Ford, & Salas, 1993). Yet, by asking to assess their cognitive learning progress, it also serves as a proxy for cognitive learning gains (Pace, 1990).

H2: *Perceived learning effects are positively linked with a stronger feeling of enjoyment*

However, previous research has shown that different social configurations lead to different learning experiences (Kreijns et al., 2003). As with enjoyment, it is argued that the broader context affects the range of socio-spatial possibilities. It is therefore hypothesised that this will in turn result in different learning experiences.

H3: *The learning experiences evoked by playing an educational game will differ significantly between a school and a domestic context.*

3.2.3   Identification

Identification is a concept that has been used to explore the attractiveness of media such as television, film and books. Two central concepts are connected to the process of identification with fictional characters: similarity identification and wishful identification. Similarity identification implies that the observer shares certain salient characteristics with the character and hence feels a stronger affinity with it (Feilitzen & Linné, 1975). Wishful identification, on the other hand, refers to the desire to be more like the media character in general or in a specific regard and is related to the idea of vicarious learning (Konijn, Bijvank, & Bushman, 2007).

Digital games have been claimed to differ from traditional media in that the player is given an active role in the fictional world as opposed to just witnessing on-going events (Herz, 1997; Klimmt, 2003; Van Looy, 2010). Klimmt, Heffner and Vorderer (2009) therefore distinguish between a dyadic audience-character relation as it occurs in most media and a monadic player-avatar relation in digital games, whereby the player alters their self-perception into an amalgamation of their avatar and himself. To account for this specific aspect of digital games Van Looy, Courtois, De Vocht and De Marez (in press) introduce embodied presence alongside similarity and wishful identification to measure avatar identification. Embodied presence thereby refers to the feeling of being present in the virtual environment through the body container of the avatar (see also Ducheneaut, Wen, Yee, & Wadley, 2009). This concept thus combines the idea of presence (Lee, 2004; McMahan, 2003; Schubert, Friedmann, & Regenbrecht, 2001) with the fact that experiences in a virtual environment are observably mediated through the avatar, and hence embodied. Regarding learning effects, the concept of identification is closely related to social learning theory (Konijn et al., 2007). As we are dealing with an awareness-raising game that uses the character and storyline to let players experience aspects of what it means to be poor, it is expected that identification will have an effect on perceived learning.

H4a: *Perceived learning effects are positively linked with stronger identification with the avatar*.

Whereas the effect of (socio-spatial) context on enjoyment and learning experiences has previously been studied, to our knowledge no such research exists for identification with the avatar. Based on the fact that other experience dimensions have been found to be affected by contextual factors, we expect that, apart from the individual situation, the proximity (or absence) of important others influences the feelings of identification. If peers in a classroom make certain remarks regarding the protagonist in PING, for example, these may well affect the feelings of wishful identification of other students. Moreover, the concept of embodied presence entails the idea of 'being there'. As several authors have noted, social interactions can prevent deep engagement in the game (De Kort & Ijsselsteijn, 2008; Mäyrä, 2007).

H4b: *The identification evoked by playing an educational game will differ significantly between a school and a domestic context.*

4   Method

4.1   Design and procedure

Poverty Is Not a Game (PING) was launched online on October 20, 2010 and its free availability was advertised on several specialized websites on educational games as well as in the national, regional and specialized presses. Anyone interested in playing the game could go to the game website and play the game directly in the browser or download it and play on their local system. At the same time schools were encouraged to use the game in their lessons related to the European Year of Combating Poverty and Social Exclusion. For several weeks every visitor of the website was invited to take part in a survey for evaluating the game with the possibility of winning a smartphone as incentive. As relatively few respondents turned out to have played the game in a school setting, the game was tested additionally in five different classes. All participants were asked to fill out a questionnaire before and after playing the game.

A quasi-experimental between-subjects design was used with type of context as a factor with two levels: school and domestic context. In the first analysis, dependent variables are enjoyment, identification and perceived learning. The time spent playing and technical performance are used as control variables. In the second analysis, perceived learning is the dependent variable while enjoyment, identification, the time spent playing and technical performance are the independent variables.

4.2 Subjects

In total, 787 participants filled out the questionnaire. As our interest lay with adolescents, participants born before 1990 were excluded from further analysis. After cleaning the data, 264 respondents were retained of which 125 played the game at school and 139 played the game at home. Analysis revealed that there were no significant differences between both groups regarding the number of male (N_{class}=90; N_{home}=88) and female (N_{class}=35; N_{home}=51) participants (chi^2=2.26; df=1; p=0.15). While the mean age in both groups was statistically different, this difference is considered negligible (M_{class}=17.3 M_{home}=17.8; t=-2.5; p<.05).

4.3 Measures

4.3.1 Enjoyment (Chronbach's α: .90)

To measure enjoyment, a scale based on that by Trepte and Reinecke (2011) was used. Due to the fact that playing during a course is embedded within a certain time frame, it was decided to omit the question "I'm glad the game did not take any longer". Thus the scale consisted of four items rated on a 7-point Likert scale (totally disagree to totally agree). Sample items are "I enjoyed playing PING" and "I found it interesting to play PING".

4.3.2 Perceived learning (Chronbach's α: .90)

A scale to measure self-reported learning effects in PING was developed based on previous research (De Grove, Van Looy, & Courtois, 2010). This scale explores cognitive as well as attitudinal learning effects. It consists of five items rated on a 7-point Likert scale (totally disagree to totally agree). Sample items are "By playing PING I got a better understanding of the problems poor people face" and "If I were a politician I would now be more able to combat poverty".

4.3.3 Identification (Chronbach's α: .89)

Identification with the avatar was measured using a short version of the avatar identification component of the player identification scale developed by Van Looy and colleagues (in press). It consists of the first two items of each of the three first-order constructs (similarity identification, wishful identification, and embodied presence), which together constitute the second order construct avatar identification. All items are rated on a 7-point Likert scale (totally disagree to totally agree) and the words "my character" were replaced with the name of the avatar. Sample items are "Jim as a person, resembles me" and "I would like to be more like Jim".

4.3.4 Time played

As the time that is spent playing the game can influence game and learning experiences, a subjective measure was added asking for how long the participant had played the game (in minutes). A significant difference was found for this variable between both contexts (M_{class}=27min; M_{home}=37min; t=-3.99; p<.001). Playing duration ranged from 10 minutes to 180 minutes.

4.3.5 Technical performance

Previous tests with the game (De Grove et al., 2010) showed that technical problems occasionally occurred during game play due to a slow network connection, limited graphics capabilities or bugs in the software. It was therefore decided to add a subjective measure assessing the technical performance of the game. Participants were asked to rate the technical performance of the game on a scale ranging from 1 (*bad*) to 10 (*excellent*). Technical performance differed between contexts. On average, respondents playing at school scored lower than those playing at home (M_{class}=5.9; M_{home}=7; t=-5.09; p<.001).

5 Results

5.1 Game experience in context

In this first analysis, identification, perceived learning and enjoyment are separately analyzed using ANOVA to check whether there are significant differences between contexts. Similar effects are found for all three variables. As shown in Table 1, enjoyment (M_{class}=4.03, SD=1.22; M_{home}=4.43, SD=1.32), perceived learning (M_{class}= 3.24, SD=1.31; M_{home}=4.26, SD=1.22) and identification (M_{class}=2.51, SD=1.13; M_{home}=3.03; SD=1.21) all score significantly higher in a domestic compared to a school setting. When the same procedure is repeated using time spent playing and technical performance as covariates, however, only perceived learning scores significantly higher in a domestic setting. There are no longer any differences between contexts for enjoyment and identification (Table 1). The effect of both time played and technological performance is significant for all experience dimensions. When the effect of these covariates is omitted, 14% of the overall variance in perceived learning is explained by differing contexts. When taking these factors into account, 5.4% of the total variance in perceived learning is explained by the difference in context.

Table 1: GLM results with and without covariates (*** p<0.01)

		F	df	df error	η^2
Identification	Without covariates	18.01	1	262	.048***
	With covariates	1.36	1	260	.005
Perceived Learning	Without covariates	42.37	1	262	.140***
	With covariates	18.75	1	260	.054***
Enjoyment	Without covariates	6.45	1	262	.024***
	With covariates	.21	1	260	.001

5.2 Context effects of identification and enjoyment on perceived learning

The previous analysis explored the differences in game and learning experiences between contexts. These experiences, however, are not unrelated (cf. supra). Learning effects can be evoked by other experience variables such as enjoyment and identification. Testing this model (ANCOVA) explained 56% of the variance in perceived learning. Results show that the score on perceived learning is different between an educational and a domestic context (*F(1,258)=20.63; p<.001; partial η^2=.074*) when using enjoyment (*F(1, 258)=49.88; p<.001; partial η^2=.16*), identification (*F(1, 258)=30.55, p<.001; partial η^2=.11*), time played (*F(1, 258)=3.81; p=.052; partial η^2=.015*) and technical performance (*F(1, 258)=4.45; p=0.05; partial η^2=.017*) as covariates. This tells us that, in accordance with our first analysis, (adjusted) means show that those playing in school reported lower scores on perceived learning than those playing at home (M_{class}= 3.49, SD=.08; M_{home}=4.03, SD=.08, b=-5.45; t=-4.54, p<.001). Furthermore, perceived learning is positively associated with enjoyment (b=.40; t=7.06, p<.001) and identification (b=.32; t=5.53; p<.001) and to a lesser degree with the time played (b=.005; t=.003; p=.052) and technical performance (b=.077; t=2.11; p<0.05).

6 Conclusion / discussion

The results of this explorative study suggest that context has an effect on game and learning experiences. Although the effect of context was small to moderate, people playing at home reported significantly higher scores on enjoyment, perceived learning and identification. It is interesting to see that the technical performance of the game and the time played account for these differences regarding enjoyment and identification. This means that if these two covariates were kept constant, there would be no difference in the feelings of enjoyment or identification evoked by playing PING. It should be noted, however, that technical performance and the time that can be spent playing a game are part of the broader context in which an educational game is played. Education in schools is typically embedded within a certain time frame and IT infrastructure which is not always up to date (Squire, 2005). Findings thus suggest that not only socio-spatial characteristics play a significant role in influencing the game experience.

Regarding our hypotheses, our first analysis shows that context has an effect on all three experience dimensions (**H1, H3, H4b**). While it could be expected that a different setting in itself, disregarding playing time and technological performance, would result in differences for enjoyment and

identification, this is not confirmed by our data. Moreover, with the available data it is not possible to say what caused the feelings of enjoyment and identification. Acquiring the same score on enjoyment does not guarantee that the cause of enjoyment is the same for both groups. A part of the score on enjoyment in a school context could stem from lower expectations or the social dynamics while the same score on enjoyment in a domestic setting could be caused by in-game characteristics. The same holds true for identification. While the score on identification is the same in both contexts (when controlled for time played and infrastructure), the processes underlying identification may be different.

For perceived learning, differences remain when accounting for (significant effects of) time played and technical performance. It is remarkable to see that higher learning is reported by people playing in a domestic context which indicates that a domestic setting produces stronger perceived learning effects than an educational one. A possible explanation could be that people playing at home have different expectations than those playing in class. Due to the school context, students may have had higher learning expectations compared to people playing the game at home. Or people playing the game voluntarily at home may have been more interested in the subject matter than those playing it compulsorily in class. Such assumptions, however, cannot be confirmed by the present study.

As learning in the broadest sense of the word is seen as the primary goal of playing or designing an educational game, the second part of our analysis focused on the learning experience and its relation to enjoyment and identification. A model was constructed that explained 56% of the variance in perceived learning. There is a relatively strong association between enjoyment and learning (**H2**). This is in line with most research on the topic (De Grove et al., 2010; Kiili, 2005). The same goes for identification (**H4a**). A higher degree of identification is related to higher learning effects. Even when controlling for enjoyment, identification, time played and technical performance, a significant effect of context remains (5,4% of total variance in perceived learning).

7   Limitations and future research

Exploring context effects raised several important questions. While, initially, enjoyment and identification differed between contexts, these differences disappeared when time played and technological performance were used as covariates. This points to little or no direct influence of for example social context on these playing experience variables. The question remains, however, as to the antecedents of enjoyment and identification. Future research could explore what causes these experiences and whether these causes differ between contexts. Furthermore, it should be noted that participants playing the game at school did so in a compulsory framework while those playing at home did not. It could be useful to explore how learning is experienced by students playing compulsorily at home as well (e.g., as homework).

Moreover, this study is limited by the consequences of the design. Using a quasi-experimental design allows to test in a naturalistic setting but the flip side of the coin is that there is little control over such a setting or over the participants, which endangers the internal validity. Due to the fact that we had no control over who was allocated to which experimental condition, it is possible that both groups differed in important respects. Although no relevant differences were found between groups on account of gender and age, future research should take into account additional control variables such as participants' interest in or relatedness to the subject matter and expectations in terms of learning and enjoyment. Another option could be to complement quantitative research with qualitative research such as observations and interviews. In this way, it would have been possible to explore why little or no differences were found between contexts for enjoyment or identification.

Furthermore, there was no control over the setting in which the game was played. Different school settings may have had different social configurations while the same holds true for the domestic settings. Again, observations and interviews could have been valuable complementary techniques to gain additional insight into these questions. Nonetheless, we believe that our findings provide a valuable starting point for further research. As digital games are played within a variety of contexts and not within one contextual layer, it would be interesting for future research to take these broader contexts into account on a theoretical as well as on an empirical level. More specifically, this is supported by the finding that other contextual aspects besides socio-spatial characteristics influence the game experience.

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Appendix A – Screenshots of PING

Jim in Wooters

Sophia talking to her sister