Reviewing the need for gaming in education to accommodate the net generation

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**Abstract**

There is a growing interest in the use of simulations and games in Dutch higher education. This development is based on the perception that students belong to the ‘gamer generation’ or ‘net generation’, a generation that has grown up with computer games and other technology affecting their preferred learning styles, social interaction patterns and technology use generally. It is often argued that in education this generation prefers active, collaborative and technology-rich learning, i.e. learning methods that involve extensive computer use and collaboration among students. Gaming is then proposed as a new teaching method which addresses these requirements. This article presents the results of a survey which studied whether this discourse is also applicable to higher education students from the Netherlands and whether games, considered as active, collaborative and technology-rich learning experiences, are of greater importance in the formal education of today’s students. Of 1432 respondents from eight Dutch institutes of higher education surveyed between 2005 and 2009, about 25% fit the criteria of being a clear representative of the net generation. Furthermore, our analysis shows that there is little difference, and no statistically significant difference, in active, collaborative and technology-rich learning preferences between the representatives and non-representatives of the net generation. Furthermore, no large or statistically significant differences were found between representatives and non-representatives of the net generation with respect to the value they accorded to gaming technology. Therefore, regardless of whether they represented the net generation or not, in general our respondents preferred collaborative and technology-rich learning and deemed games a valuable teaching method.

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1. Introduction

Dutch higher education has undergone considerable change over the past years. Throughout numerous institutes of Dutch higher education, we have observed increased interest in and use of simulations and games (including their combined use). The increased interest is evident first and foremost from the initiation and outcomes of numerous governmentally funded and educationally focused game research and development projects (GATE, 2011; Mayer, Bekebrede, Stegers-Jager, 2007; Programmabureau Maatschappelijke Sectoren & ICT, 2011; Warmelink & Mayer, 2009). This interest is not only visible in Dutch higher education but can also be observed in other Western countries such as the USA, the UK and Canada. One way to explain the increase in the use of computer simulations and games in higher education is the popularity of computer gaming as entertainment in the Netherlands and the world in general. The fact that gaming requires and elicits learning, fuels a perception that educational institutes can and need to adopt gaming technology and the accompanying principles of use to ensure the appeal and thus the learning effect of the educational programmes offered.

Educators and educational policymakers have many influential publications to which they can refer in support of such perceptions. These publications adopt discourses that stress the uniqueness of those who extensively adopt technology and play computer games in their daily lives. They are the ‘gamer generation’ (Beck & Wade, 2004, 2006), ‘digital natives’ (Prensky, 2001a) or the ‘net generation’ (Tapscott, 1998). According to Prensky, these ‘digital natives’ have undergone ‘mind alterations’ and ‘cognitive change’ (2001a, p. 39) while growing up with computer games and other technology. Beck and Wade argue similarly that the ‘gamer generation’ has ‘systematically different ways of working’ resulting from ‘one central factor: growing up with video games’ (Beck & Wade, 2004, 2006, p. 2). Tapscott uses perhaps the most

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popular term to date - the 'net generation' - stating that people of this generation 'are learning, playing, communicating, working and creating communities very different than their parents' (Tapscott, 1998, p. 2, quoted in Prensky, 2001a, p. 39). Due to the intense use of computer games and other new media, these authors argue that this generation has a different way of interacting and learning in general.

According to the discourse, this alternative way of learning requires alternative ways of teaching. Gaming is expected to be one new method that is appropriate to the net generation, as it is based on active, collaborative and technology-rich learning, i.e. learning methods that involve extensive computer use and collaboration among students. The main question we ask in this article is whether this discourse is applicable to higher education students in the Netherlands. Do these students exhibit the characteristics of the net generation? Secondly, we ask whether games, considered as active, collaborative and technology-rich learning experiences, are of greater importance to these students in their formal education. Finally, we ask whether the greater importance of gaming in higher education deemed by these students is due to changed learning preferences.

In this article we firstly review recent research into the topic of the net generation and identify new topics for further research. We argue that our empirical study of higher education students in the Netherlands is able to offer relevant insights into the existence of a ‘net generation’ and its subsequent effects on higher education methods. We thus turn to investigate the existence of a net generation in our dataset. This is followed by an analysis of the data to determine whether the net generation prefers active, collaborative and technology-rich learning experiences, including the use of games, in their higher education. The article ends with a discussion of the consequences of our research for the use of games in higher education.

2. The gamer discourse

At the turn of the millennium, a number of authors of high-profile books instigated what we term ‘the gamer discourse’. Prensky, an educational theorist and practitioner, popularised the discourse in his seminal book Digital Game-based Learning (2001a), referring to and building upon Tapscott’s equally influential work Growing Up Digital (1998), in which the term ‘net generation’ was coined. We consider both Prensky and Tapscott to be the protagonists of the gamer discourse. The discourse describes specific characteristics of those who have grown up as avid users of technology – computer games in particular – and distinguishes them from those who have not. In other words, the former group is considered to be distinct from the latter and to form a distinct generation, not only in terms of birth date but also in terms of behaviour, and specifically with respect to preferred learning styles, social interaction patterns and technology use, which also encompasses formal education. Thus, advocates of the discourse conclude that tech-savvy and game-playing students wish to adopt and also expect an active, collaborative and technology-rich learning experience in their formal education (Prensky, 2001a, p. 52).

Prensky further popularised gamer discourse through several journal publications (e.g. Prensky, 2001b, 2001c), another book (Prensky, 2006) and various keynote lectures. The discourse was adopted by other authors in the Western world, for example by Oblinger from the EDUCAUSE institute, who subsequently initiated many extensive studies on the topic in the USA (Oblinger, 2004; Oblinger & Oblinger, 2005), and the educational specialists Veen and Vrakking (2006). Moreover, the discourse was adopted by Beck and Wade in the context of a discussion of changes that the ‘gamer generation’ would bring to business organisations (2004, 2006).

Gamer discourse has since become a popular research topic, with the funding of many extensive research projects over the years which have been able to further gather large amounts of rich empirical data in order to study and evaluate this discourse. The following research projects into the media and technology use of students are notable:

- Over 28,000 higher education students from 96 institutes were surveyed in the USA between 2004 and 2006 (Salaway, Katz, & Caruso, 2006).
- Over 5000 primary and secondary education students from 43 institutes were surveyed in Canada in 2005 (Media Awareness Network, 2005).
- Over 2300 secondary education students throughout the UK were surveyed in 2006 (Sandford, Ullesca, Facer, & Rudd, 2006).
- Over 2500 higher education students from 3 institutes were surveyed in Australia in 2006 (Kennedy et al., 2009).
- In 2008 a commercial research organisation collated data from different research projects to gain a general insight into the media and technology use of an unknown number of ‘teens’ across 50 countries (The Nielsen Company, 2009).

These studies were often representative of at least a substantial section of the population in a specific country and were focused on students who were assumed to be part of the net generation. However, the researchers found that the dichotomous thinking underlying the gamer discourse was not supported by their datasets and they therefore developed a much more nuanced view of students, their technology use and their preferred use of technology in formal education. Not all youngsters were avid technology users or gamers, nor did they all prefer gaming within their education.

Two recent review articles have examined the evidence provided by the studies mentioned above as well as other studies that criticise or even reject the discourse (Bennett, Maton, & Kervin, 2008; Schulmeister, 2009). Following a review of over 50 empirical studies into media use, Schulmeister criticised the notion of a generational shift implied by the term ‘net generation’. According to him, the extensive use of many different types of media and technology does not warrant the signifying of a generational shift. Focusing on the context and motives behind media and technology use, Schulmeister, as well as Bennett, Maton and Kervin, suggest that there has been no fundamental change in learning style preferences in higher education. Put simply, they argue that media and technology have replaced other means or places of socialisation, such as the playground, that adolescents are attracted to as part of growing up.

Thus, the deterministic undercurrent of the gamer discourse has to some extent been disproved by empirical research and replaced by new theories that are informed by that evidence. What we are left with is a discourse that emphasises the context and motives behind media and technology use, and discounts the general social-psychological effects of media and technology use since empirical evidence suggests that the same, familiar and ‘completely normal process of socialization’ (Schulmeister, 2009) is taking place when students and youngsters use them. This helps explain why in certain learning contexts games as forms of active, collaborative and technology-rich learning might not be as attractive as other forms. Moreover, it also helps explain why in certain learning contexts, non-gamers might be just as interested
in using games as forms of active, collaborative and technology-rich learning as gamers. It simply depends on the lifetime experiences, context and motives of the learner.

Interestingly, Prensky recently introduced some amendments to his original theory of digital natives and immigrants (2009), suggesting that the distinction between the two was losing ground. As technology in general and computer games in particular become more ubiquitous and saturate our daily lives, there is a growth in the number of tech-savvy people regardless of date of birth. Moreover, since the people previously attributed to the digital natives category have a birth date of roughly 1982 onwards, they are now up to or even over 28 years old and have thus left the formal education system to perhaps become teachers themselves. Prensky maintains that the more ubiquitous use of media and technology today favours a learning style that entails active involvement, collaboration and the high use of technology which also extends to formal education. Furthermore, having done extensive empirical research and developed extensive knowledge into the topic, both Prensky (2010) and Tapscott (2008) more recently reaffirmed the gamer discourse in new books.

Thus, the debate about the validity of the gamer discourse is not over and the discourse itself continues to be attractive. Moreover, given the wide net that the discourse casts over society, the amount of empirical research is as yet insufficient to confirm, criticised or denounced it. The empirical evidence and recent theoretical amendments by those opposed and attracted to the gamer discourse suggest that a subsection of students who have used technology avidly, socially and throughout their entire lives prefer a formal education system based on active, collaborative and technology-rich learning. Taking Prensky’s recent theoretical amendment into account, one would assume this subsection to have grown in size over the years.

The question remains whether current and future generations of students are and will be different from their predecessors in terms of their technology use and preferred learning styles, and what the consequences are for using games within formal education. Our empirical research provides insight into these issues within the context of Dutch higher education, fulfilling two current scientific needs. Firstly, large-scale quantitative social scientific research on this topic has – to our knowledge – not been conducted in the Netherlands. It is reasonable to assume that such research would lead to results that are just as interesting as those in other Western countries. With our data we will be able to extensively test whether the recent criticisms of the gamer discourse as expressed by Schulmeister and Bennett, Maton and Kervin apply to Dutch students. Secondly, our surveys of Dutch students of higher education have been carried out since 2005, making our study longitudinal in design. Since we have obtained empirical data over a five-year period (2005–2009), we are able to test Prensky’s more recent theory about the growth of the subsection of students looking for active, collaborative and technology-rich learning experiences in formal higher education, regardless of their birth year or upbringing.

Our study poses and answers the following three questions:

1. Do higher education students in the Netherlands exhibit the characteristics of the net generation in the period 2005–2009, i.e. are they avid computer users and computer-game players?
2. Is there a difference between net generation representatives and non-representatives concerning a preference for active, collaborative and technology-rich learning?
3. Is there a difference between net generation representatives and non-representatives concerning a preference for gaming as a teaching method?

3. Method

3.1. General research design

Our research revolved around the application of 23 games within several Dutch institutes of higher education. These games differ in topic (from port planning to social work), duration (one day or several weeks), computer use (computer supported or completely virtual environment) and learning objectives. At the start of each game we asked the students who were about to take part to fill in our questionnaire. In this first survey we determined the gender, age, amount of game-play (both for entertainment and educational purposes), attitude towards gaming in education, preferred learning styles and learning expectations for the upcoming game. After each game had finished, we asked the same students to fill out another questionnaire. In this second survey we determined their opinions about the design of the game, the play process and the learning outcomes. The surveys’ designs were based on Kriz and Hense’s groundwork for game evaluation (2006), adapted for computer and online games (Mayer et al., 2007).

To answer the questions posed in Section 2 above, we focused our analyses on the data about the players of these games, provided by the pre-game survey. We examined whether these students liked trying new uses and applications of computers and whether they played computer games privately. These data allowed us to determine to what extent we had representatives of the net generation in our sample. Furthermore, we analysed the data to determine the learning style preferences of these students (both those representative and non-representative of the net generation) and to what extent they deemed gaming of value or added value in their education.

3.2. Sample

Since starting this research in 2005, we have obtained data from 1607 respondents. These respondents took part in one of 23 games across 12 educational institutes. All of these games were specifically designed by teachers and simulation/gaming experts for use in higher education. Each institute used their games in different courses at different levels, BSc and MSc, and in different years of their curricula. This gives our sample an enormous variety.

1 The development and use of these games in education were part of different research projects over the period 2005–2009 in which we were involved, as mentioned in the acknowledgements.
Most respondents (68%) were students studying at Delft University of Technology (DUT), the university with which we are affiliated. The other participants studied at other institutes of higher education (universities, universities of applied sciences and colleges), of which 8 were located in the Netherlands. For this article we selected Dutch students from 2005 to 2009 as our unit of analysis to specifically address the Dutch situation. Consequently, this led to the exclusion of some respondents from our dataset. The final sample consisted of 1432 respondents, all students of higher education in The Netherlands. In addition to DUT, the Dutch institutes are (in order of the number of respondents they provided): HU University of Applied Sciences Utrecht, Erasmus University Rotterdam, Rotterdam University of Applied Sciences, the Open University of the Netherlands, The Hague University of Applied Sciences, Inholland University of Applied Sciences, Leiden University and Leiden University of Applied Sciences.

3.3. Participants

The average age of the participants in the sample was 22 years (±3.4) at the time they filled in the questionnaire. Many were students at Delft University of Technology, who thus largely influence the general outcomes of the analyses. Table 1 shows the makeup of the sample in each year. As can be seen, the number of respondents in 2005 was relatively low. Moreover, in that year the sample only consisted of DUT students. The reason is that this entire research endeavour started in September of that year, the beginning of the new academic year. The table also shows that our sample is biased towards male students and has some omissions in gender information. The bias is a result of the large percentage of male students at DUT, while the omissions are a result of making the question about gender optional. Both the bias and omissions limit our ability to make distinctions between male and female students in our analyses.

Between 2006 and 2009 the number of participants was continuously above 200, up to 364 respondents in 2007. Given these high numbers, as well as similar mean ages and gender distributions per year, we deemed the years comparable. The large number of participants, the general variety in the participants and the comparability of the participants per year render the conclusions we draw generalisable, although they cannot be considered to concern the entire population of higher education students in the Netherlands.

3.4. Statistical analyses

We used SPSS version 17.0 to analyse the results. We gathered descriptive statistics for our respondents, compared means between representatives and non-representatives of the net generation within the sample and carried out six Independent-samples t-Tests to ascertain the statistical significance of the results.2 We also performed one bivariate correlation analysis to ascertain the rigour of our conclusions. The following three sections present the results of our analyses with respect to each of our three research questions.

4. The net generation

Our first question was whether the surveyed students in the Netherlands exhibit characteristics of the net generation, i.e. are avid computer and computer game users. Based on the gaming discourse we expected that most of the students would have these characteristics.

We used data provided by two items (one question and one statement) in the pre-game survey to answer this question. We asked each respondent how often he/she generally played computer games and provided a four-point response scale, between ‘never’, ‘a few times a year’, ‘monthly’, ‘weekly’ and ‘daily’. The second item was a statement concerning the respondent’s attitude towards computer use, which required a response on a five-point Likert scale. Together these data provided an indication of whether the respondent displayed the characteristics of the net generation, that is, people to whom the gamer discourse would be applicable. We deemed respondents who indicated that they played computer games weekly or daily and enjoyed trying out new uses and applications for computers as clear representatives of the net generation. We deemed all other respondents not to be representatives of the net generation. Specifically, these latter respondents indicated that:

- They played computer games monthly, a couple of times a year or never at all, and/or
- They were neutral or negative towards trying out new uses and applications for computers.

The results of the survey show that 32% of the students play computer games daily or once a week, while 16% indicated that they do not play computer games at all. In an open question about why the respondents like to play computer games, a large percentage answered that

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2 The assumption behind using the t-Test is that the data of the analysed variables have a normal distribution. For a variable with a Likert scale this is hardly possible. This means that a non-parametric test like a Mann–Whitney or Wilcoxon test is more suitable for variables with Likert scales. The t-Test will more quickly reject the hypothesis that the outcome between the groups can be assumed equal, and can thus be considered the most rigorous of all three mentioned tests. As such the t-Test was more useful for our analyses. Therefore in this article we used the t-Test only.
they did not like playing computer games or only played simple games such as solitaire or minesweeper to ward off boredom. About 17% disagreed with the statement that they enjoy trying out new uses and applications for computers, while 63% agreed with it. This means that the general assumption of the net generation theory that all students play computer games is not confirmed. However, most students do enjoy trying new uses and applications for computers. The question then remains whether the respondents who do play games also enjoy trying new computer uses and applications.

Table 2 shows that only 25% of the students fit our criteria of being a clear representative of the net generation, which means they play computer games regularly and enjoy trying out new computer uses and applications. Somewhat surprisingly, 28% of the respondents are most clearly not representative of the net generation. The largest group (38%) likes to try out new computer uses and applications, but does not frequently play computer games. The other 9% play computer games but do not enjoy using new computer applications. We considered these last two groups to also not be clearly representative of the net generation. Based on these criteria, we conclude that 25% of the students in our sample are clear representatives of the net generation while 75% are not.

To determine whether the number of net generation representatives had changed much over the past years, we divided our dataset into five periods, from 2005 to 2009. As Fig. 1 shows, the percentages of respondents who are clear representatives of the net generation remains almost the same over the five-year period, around 25%. Thus, a constant minority of respondents were avid technology users and computer game players over the period 2005–2009.

Based on these results, we conclude that in the Netherlands, as elsewhere, the net generation, characterised as frequent game players and avid users of technology, does not exist. Only 25% of the sample fulfils both criteria. Similarly to the results from several other countries, we cannot confirm the theory that all people born after 1982 play computer games frequently.

5. Learning style preferences

Although the group of clear representatives of the net generation forms only 25% of our dataset, the question of whether there are differences in preferred learning styles when compared to the non-representatives still remains.

We used data provided by four items in the pre-game survey to answer this second research question. Specifically, we used four statements designed to ascertain the respondents’ preferred learning styles, which the respondents answered on a five-point Likert scale. The four statements were:

- ‘My learning improves when I work in a group with other students’.
- ‘I enjoy working in a group with other students’.
- ‘I would rather have formal lectures than do a project’.
- ‘The use of digital learning environments in education is valuable’.

With this data we were able to determine whether the respondents, both representatives and non-representatives of the net generation, preferred active, collaborative and technology-rich learning. The first two statements were used to determine whether the respondents preferred collaborative learning. We inverted the data provided by the third statement to determine whether the respondents preferred active learning. The fourth statement was used to determine whether the respondents preferred technology-rich learning. Figs. 2–5 show the results for those representative and not representative of the net generation over the five-year period.
Figs. 2 and 3 show that in general students prefer to work together, whether they are representatives of the net generation or not. In 2005, when we only had respondents from Delft University of Technology, there was a clearer difference between the means of those representative and not representative of the net generation than in the subsequent four years. A difference can also be observed in 2006. An Independent-samples \( t \)-Test confirmed that the differences between the two groups of respondents with respect to effectiveness was only statistically significant in 2006 (\( t = 3.26 \)) and with respect to enjoyment only in 2005 (\( t = 3.13 \)) and 2006 (\( t = 3.19 \)). However, since both groups scored high means, the statistically significant differences between the means does not signify a significant difference of opinion.

As Fig. 4 shows, in general students only slightly prefer to use active over passive learning styles. Again, in 2005, when we only had respondents from Delft University of Technology, there was a clear and significant difference between the students representative and not representative of the net generation (\( t = 2.60 \)). No further differences could be observed between the two groups.

As Fig. 5 shows, the acceptance of technology-rich learning was generally quite high over the entire period, though it decreased in 2008 and 2009. In those two years the differences between those representative and not representative of the net generation also decreased. The Independent-samples \( t \)-Test confirmed that the differences per year were not statistically significant.
The results of the survey show that students prefer to work together and use technology-rich educational methods, and they slightly prefer active learning methods. The hypothesis that students prefer more active teaching methods rather than lectures cannot be confirmed on the basis of our analyses. Although students are on average positive about working together and using technology in their education, not all agree. It would be thus overly simplistic to conclude that all students prefer active, collaborative and technology-rich learning.

We conclude that there are no clear differences between representatives and non-representatives of the net generation. If there is a change in learning attitudes compared with 10 or 20 years ago, this cannot be explained by the existence of a net generation, because there are very small differences between the means of those considered to be representatives and non-representatives of such a generation concerning learning style preferences.

6. Games in education

The third research question focuses on the use of gaming in education. It is expected that the representatives of the net generation would enjoy gaming activities in their education. Furthermore, given the conclusion that most of our respondents prefer to work together, use technology-rich learning and slightly prefer active learning, we analyse whether the value accorded to the use of games in education differs depending on preferred learning styles.

We used data provided by two items in the pre-game survey to answer the third research question. Specifically, we used two statements designed to ascertain the respondents’ acceptance of gaming as a teaching method in their own education. The first statement ascertained whether the respondent deemed gaming of general value to their education. This statement focuses on the opinion of the respondent about the value of using gaming as a teaching method regardless of other teaching methods. The second statement ascertained whether the respondent deemed gaming of added value to their education, that is, whether it added something to existing teaching methods used in their education like lectures, working classes or projects. The respondents answered using a five-point Likert scale. Figs. 6 and 7 show the results for those representative and not representative of the net generation over the five-year period.

Both figures show that in general our respondents deemed gaming to be both of value and added value in their own education. Overall the respondents deemed gaming to be more of an added rather than a general value. Apart from 2007, there were differences in means between those representative and not representative of the net generation. However, the Independent-samples t-Test confirmed that these differences were not statistically significant, except for the general value in 2006 (t = 3.43). Again, we can conclude that the use of gaming could be valuable in education, but not because of the existence of the net generation.

This does not answer the question of whether the deemed value or added value of gaming is related to a preference for certain learning styles. To study the relationship between learning preferences and the value of gaming, a bivariate correlation analysis was performed. This analysis showed that learning preferences are significantly positively correlated with the value or added value of gaming in education. However, these numbers are low; for example, the correlation between enjoyment of collaborative learning and the deemed added value of
gaming in education is .157 (sig .000) and the correlation between the acceptance of technology-rich learning and the deemed value of gaming is .225 (sig .000) (Table 3).

Based on this analysis we conclude that although there is no difference between the representatives and non-representatives of the net generation, there is a correlation between learning preferences and the use of gaming. As there is a general preference for active, collaborative and technology-rich learning, gaming could have an added value in education.

7. Conclusion

The assumption behind the use of computer simulations and games in education is that it serves the needs of the new generation of students, often called the ‘net generation’. It is claimed that this generation desires more active, collaborative and technology-rich learning methods, of which gaming is an example. Our sample did not fit the expectations raised by the net generation theory, as only 25% of the respondents were clearly avid computer users and computer-game players.

We observed that the students preferred working together, technology-rich learning, as well as active learning slightly, but these results could not be explained by the existence of a net generation. Very few differences between the representatives and non-representatives of the net generation were found on the indicators of collaborative, active and technology-rich learning. The students agree that gaming could have an added value in their education but, again, this opinion is held by both representatives and non-representatives of the net generation.

Our longitudinal analysis has two points for discussion. Firstly, for most of the years in our analysis period there actually are differences between representatives and non-representatives of the net generation perceivable in Figs. 2–7. Yet these differences generally had no statistical significance. When the differences were statistically significant, they had no meaning as both mean Likert scores lead to the same interpretation. A second point for discussion concerns a perceivable dip in mean scores for the year 2007 in Figs. 4, 6 and 7 especially. We can only offer suggestions for possible explanations for such inconsistencies across the analysis period. As shown in Table 1, in 2007 our population consisted of relatively the most students from Delft University of Technology, which could have an effect on e.g. the deemed (added) value of gaming. Institutions, curricula and many other variables were not controlled throughout our research. As such, with our dataset we can offer no clear explanation for inconsistencies across the analysis period. Yet this lack of explanation does not hamper our conclusions as explained above.

There must be other reasons why gaming could be a valuable learning tool in higher education. One possible explanation is that students prefer experiential learning, active learning or collaborative learning. The results show that there is a significant but low correlation between learning preferences and the deemed value of gaming in education. This means that changes in higher education which favour the use of more computer simulations and games are appropriate to the current generation of students. However, this cannot be specifically related to any tendency to frequent game-play and avid technology use.

Future empirical research should therefore determine the other factors that influence the preference for and effectiveness of gaming in higher education. Demographic variables may still be relevant. As Schulmeister (2009) and Bennett et al. (2008) have pointed out, we would expect that age is a simple variable that could partly determine a student's preference and, consequently, a game's effectiveness. Other
game-related variables could also lead to differences in preferences and in the effectiveness of gaming, such as the perceived quality of a game’s design and its ability to facilitate learning.

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