

Games in Schools: Teachers' Perceptions of Barriers to Game-based Learning

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Abstract

The purpose of this study is to explore inhibiting factors teachers in the United States have personally encountered or perceived in using games for instruction, and how teacher perceptions of barriers are influenced by their gender, teaching level and experience of using games for instruction. Four factors have been found to hinder teachers' use of games in the classroom: challenges of implementing games effectively, challenges with using technology, current educational system, and challenges with obtaining games. Male teachers, more than female teachers, regarded challenges of implementing games effectively as a serious barrier, whereas female teachers perceived challenges with using technology and obtaining games as a more serious barrier. Middle/intermediate and high school teachers believed challenges of implementing games effectively to be a more serious barrier than primary school teachers, while primary school and middle/intermediate school teachers viewed challenges with obtaining games as a more inhibiting barrier than senior high school teachers. Teachers who have used games for teaching, more so than teachers who have not used games for teaching, thought that use of games is less hindered by challenges of implementing games effectively and current educational system.

Introduction

An increasing number of practitioners and researchers are advocating for video games as a promising form of instruction that can both engage students and strengthen skills important in the current information age (Aldrich, 2004; Federation of American Scientists, 2006; Foreman, Gee, Herz, Hinrichs, Prensky, & Sawyer, 2004; Prensky, 2001; Quinn, 2005). The Federation of American Scientists (2006) has identified video games as well suited for educating learners in preparation for working in today's knowledge economy, providing motivating instruction for the development of higher order thinking skills, expertise, teamwork, and problem solving.

Despite the strong push for the use of educational video games and a research base stretching back decades, the research literature contains very few quality studies on how effective educational games are at promoting learning (Fletcher & Tobias, 2006; Ke, 2009). Furthermore, researchers highlight the importance of also focusing on the implementation of the game in the learning environment (Garris, Ahlers, & Driskell, 2002; Leemkuil, de Jong, de Hoog, & Christopher, 2003; O'Neil, Wainess, & Baker, 2005; Wolfe, 1997), but there is limited literature examining how games can best be used in formal learning environments, and some researchers claim that video games are ill-suited to the structure of school and therefore likely do not have a place in the classroom (Squire, 2004).

Birmingham holds that teachers in digital game-based learning (DGBL) take on many roles in terms of receiving training, understanding the game, guiding students and solving problems so that a teacher plays a role as important as the game itself in promoting students' learning (as cited in Kirriemuir & McFarlane, 2004, p27). Therefore, in order to make DGBL more popular in K-12 education, it is important to conduct in-depth study on teachers' perceptions of the barriers to using video games for instruction.

Although some studies have examined teachers' perceptions of games (Baek, 2008; Koh, Kin, Wadhwa, &

Lim, 2011; Pastore & Falvo, 2010; Razak, Connolly & Hainey, 2012; Schrader, Zheng & Young, 2006), they contain some limitations. Firstly, the previous studies either did not define the term *game* or failed to clarify that the games should have educational value as originally intended by the authors in the surveys, which could easily mislead the participants to relate to commercial video games. In addition, most of the previous research employed quantitative methods with surveys designed involving researchers' preconceptions, which might not reflect teachers' authentic and in-depth perspectives. Further, most of those studies are conducted in other countries rather than the US, which poses a limitation in generalization of the results to American classrooms.

This study will try to overcome the limitations of previous studies and fill an important gap in the literature by gathering US K-12 teachers' perceptions of the barriers they face in implementing video games in the classroom. We will survey both teachers who have used games and teachers who have not used games on the barriers they personally encountered or perceive. The term game will be specified as computer and video games utilized for educational purposes, including both commercial games with educational value and games especially designed for education. In terms of methodology, this study uses both qualitative and quantitative methods. The use of individual interviews to generate themes surrounding attitudes toward, existing barriers and challenges facing the use of educational video games in K-12 schools results in the development of a survey based on these themes that drives a large scale, quantitative study of teacher perceptions of barriers, which is similar to Baek (2008)'s study done with teachers in South Korea. This study will help us better understand US teachers' perceptions of and experience with teaching using video games and thus contribute to the research on this topic. This study will seek to answer the following research questions: What barriers in using games for instruction do the teachers perceive? Do gender, teaching level, experience of teaching with games influence teachers' perceptions of barriers?

Literature Review

Teacher Attitude Towards Using Video Games in Classroom

Gee (2003) defines "video games" as "both games played on game platforms (such as the Sony PlayStation 2, the Nintendo GameCube, or Microsoft's XBox) and games played on computers" (p.1), and he gives them a simple name "video games" to replace "video and computer games". This paper uses the term video games or games to indicate video and computer games. A number of studies have suggested that the majority of K-12 school teachers adopt a positive attitude towards the use of video games in education. Most teachers think that video games could motivate students to learn and playing games can support the development of a variety of skills (Can & Cagiltay, 2006; Koh et al., 2011; Razak et al., 2012; Sandford, Ulicsak, Facer, & Rudd, 2006; Wastiau, Kearney, & den Berghe, 2009).

Sandford et al. (2006) conducted a survey to 924 primary and secondary school teachers in England on their attitude towards the use of commercial-off-the-shelf (COTS) games. 31% of them considered motivating students as their reason for using games for instruction. More than 60% of them thought that COTS games improved students' motor/cognitive skills, information and communications technology skills, higher order thinking skills and knowledge in a specific area. Wastiau et al. (2009) investigated more than 500 teachers in several European countries about their opinions of using games for instruction, and found that most of the teachers have used games in their teaching and they wanted to know more about how to use games as teaching tools. They believed that students are motivated by DGBL and can obtain certain skill such as social and spatio-temporal skills. Razak et al.'s (2012) study revealed that teachers considered challenge, curiosity, pleasure and cooperation as the four main reasons for playing computer games for learning.

However, while the majority of teachers view games as a useful tool in education and are willing to use games in the future, they maintain a reserved attitude towards the adoption of games for instruction due to various reasons. In Koh et al.'s (2011) study, teachers in Singapore thought games can only be used occasionally. Their perception was influenced by external factors such as policies and curriculum, and internal factors such as personal interest and attitude towards gaming. Some preservice teachers in Turkey expressed their doubts concerning classroom management and educational effectiveness of the computer games on the present Turkish market (Can & Cagiltay, 2006). The European teachers were not sure about the positive effects of playing games on students' critical skills and performance in the specific subject matter being taught (Razak et al., 2012; Wastiau et al., 2009). Some teachers even considered games a distraction to students (Pastore & Falvo, 2010). The negative views pose barriers to the adoption of games in classrooms and also imply the inadequacy of current research concerning DGBL.

Teachers' perceptions of using games for education may be also influenced by their own limited experience with video games, and others' perceptions, such as those of students, parents, other teachers, and experts (Bourgonjon, Valcke, Soetaert & Schellens, 2010; Selfe & Hawisher, 2004). Adult perceptions of video games in

education are influenced by their experiences with video games as entertainment or a reward for hard work or their little experiences with video games (Selfe & Hawisher, 2004). While students generally have positive attitude toward DGBL, some students do not think games should be used in schools (Sanford et al., 2006), and the negative views affect parents and teachers' views of using games in education (Bourgonjon et al., 2010).

Clearly, the literature presents the potential for teachers to include game as part of their curricula as well barriers teachers face in their adoption of games. When looking at barriers specifically, there are some studies examining the barriers to utilization of games in schools.

Teacher Perceived Barriers to The Use of Video Games in Education

Based on a review of scholarly papers and reports, we found that the major teacher-perceived barriers to implementation of video games in classrooms arise from five aspects: schools, using games, teachers, students and theoretical research.

A number of studies suggest that the current educational framework is a huge barrier to the adoption of games in education (Baek, 2008; Egenfeldt-Nielsen, 2004; Koh et al., 2011; Rice 2009; Squire, 2005; Wastiau et al., 2009). In Koh et al.'s (2011) research, the Singapore teachers highlighted that although the Ministry of Education supported the use of games in education, it made no specific policies regarding game adoption, which led to lack of instructional game materials, inadequate training for teachers and inadequate administrative support for innovation. Other frequently mentioned barriers concerning schools include inflexible curriculum, limited budgets, and lack of adequate hardware resources (Baek, 2008; Koh et al., 2011; Rice, 2009).

Teachers consider games' weak alignment with curriculum and state standards as a huge barrier (Kirriemuir & McFarlane, 2004; Koh et al., 2011; Rice, 2009; Simpson & Stansberry, 2009; Wastiau et al., 2009). The other barriers arising from games and using games include inaccurate or inappropriate game content, lack of supporting materials, negative effects of gaming, high cost, licensing and technical issues, limited affordances (Baek, 2008; Wastiau et al., 2009;) and difficulty in assessing learning from playing games (Razak et al., 2012).

In respect to barriers relating to teachers themselves, although teachers generally consider their lack of or inadequate skills of playing games as a barrier, studies show that this should not be a real barrier (Sandford et al., 2006; Watson, Mong, & Harris, 2011). Sandford et al. (2006) indicate that meaningful use of game depends far more on teachers' knowledge of the curriculum, their working context and effective use of their existing teaching skills than on their skills of playing games. This idea is supported by Watson et al.'s (2011) study. In their study, the teacher, who has taught with games for several years, said that a non-gamer could implement a game in his/her classroom because the modern students could figure out the gaming problems easily. Some researchers observed that teachers lack time to prepare for a lesson using games and also lack the knowledge and skills, professional collaboration, and initiatives to explore new methodologies (Kirriemuir & McFarlane, 2004; Simpson & Stansberry, 2009), though these are not mentioned by the teachers in the studies.

The other barriers teachers perceive include students' varied computer literacy, gaming experiences and habits (Baek, 2008; Egenfeldt-Nielsen, 2004; Sandford et al., 2006), and little theoretical research on how to use games for instruction (Simpson & Stansberry, 2009; Wastiau et al., 2009).

Method

This study uses both qualitative and quantitative methods. 15 teachers who have utilized video games in the K-12 classroom were asked to brainstorm and record what barriers they and their colleagues have faced in implementing games in schools. This was followed up by individual interviews in order to further discuss these barriers and their impacts. The written barriers and transcribed interview data were coded in order to identify a list of barriers that were utilized to develop a survey which was then sent out to large number of teachers in order to identify what teachers perceive are impediments to the adoption and utilization of games in the classroom.

Step One: Designing a Survey

Participants. A list of K-12 teachers from local schools in Indiana, US who have utilized video games in the classroom for instruction were contacted via a recruitment email. This list was compiled from a previous study with IRB approval. Fifteen teachers replied the email and agreed to be interviewed individually either face-to-face or through Skype, with the interviews being audiotaped. Of the fifteen teachers, seven were females and eight were males. Five of them were teaching in elementary school, and the other ten teachers were teaching in middle school or high school or across both.

Procedure. Before the interview began, each participant was instructed to list the barriers that inhibited them from using video games in formal learning environments. After completing the list, the participant was interviewed by one of the authors using semi-structured questions for 20 to 40 minutes. The individual interviews focused on obtaining in-depth information about teacher-perceived barriers to the use of the game and teacher attitudes toward the use of games.

After the interviews, the data were transcribed and coded individually by each of the three researchers to generate existing barriers facing the use of educational video games in K-12 schools. Then we discussed the differences in our barrier codes, and finally reached consensus in the barrier codes generated from the interview data. Based on these codes, the three researchers worked together to create two versions of web-based survey-one survey for teachers who have used games for instruction, and the other survey for teachers who have not used games for instruction. The two versions of the survey had the same 33 statements about barriers to using games, and participants of the two populations were asked to rate how much they agreed or disagreed with each statement on a Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The difference between the two versions of the survey is that the survey for teachers who have used games for instruction contained questions asking about teachers' experience with using games, while the other version of the survey did not have those questions.

Step Two: Examining Factor Structure

Participants. The list of teachers we used to recruit teachers for interviews, along with another list of teachers who have not used games for instruction, were contacted via email to fill out the survey on a voluntary basis. This list was compiled from a previous study with IRB approval. In total 109 teachers responded, with 28 male teachers and 81 female teachers, with an age range from 25 to 60. Of the 109 teachers, 57 teachers (16 elementary teachers, 23 middle/intermediate teachers, 18 senior high teachers) have used games for instruction and 52 teachers (14 elementary teachers, 15 middle/intermediate teachers, 23 senior high teachers) have not used games. Among the teachers who provided information about their years of teaching, 42 teachers has taught for at least 10 years, 13 teachers has taught ranging from 6 to 10 years, and 10 teachers had less than 5 years of teaching experience. The subjects the teachers were teaching included general education (a variety of subjects to the same class rather than the specific subject courses), English, science, social studies, mathematics, and other subjects (e.g., world language, life skills, engineering).

Procedure. In our recruitment email to the teachers, we provided the link to an online survey. After we obtained the responses from the two populations, we exported the data of each population from Qualtrics to Excel, and created a new Excel file to combine the two populations' responses to the 33 statements for analysis.

Data Analysis

Of the 109 teachers who filled out the survey, 5 teachers did not finish it, and thus the responses of 104 teachers were used for analysis. In order to extract factors from the 104 teachers' responses to barriers to the use of games in classrooms, a principle axes factor analysis was conducted. Both oblimin rotation and varimax rotation were run initially, but the results showed the factors were weakly correlated. Therefore, varimax rotation of factors was applied, and we used SAS to calculate the regression scores of the factors as factor scores.

Result

Result I: Examination of factor structure. Table 1 shows 25 items and their loadings for the 4 interpretable factors. Three rounds of analysis using the criterion of eigenvalues greater than 1 were conducted. After the 1st round of data running and analysis, 3 items with factor loadings less than 0.40 across all the factors were removed. After the 2nd round of data running, another 3 items were removed. After running the data in the 3rd round, 2 items were removed based on the same criterion. Finally, an analysis of 25 items using the criterion of eigenvalues greater than 1 resulted in 3 factors, and the fourth factor had eigenvalue of 0.98. An examination of the scree plot of eigenvalues showed that the fourth factor should be kept. The 4 factors explained 100% of the common variance in the items and 47.03% of the total variance, and all 25 items loaded above 0.40 on one of the 4 factors. The Cronbach's alpha coefficients for the 4 factors were 0.88, 0.78, 0.81, and 0.70 respectively, which displayed acceptable to high reliability. These 4 factors were labeled: challenges of implementing games effectively, challenges with using technology, current educational system, and challenges with obtaining games.

Table 1.

Summary of Exploratory Factor Analysis Results for Perceptions about Barriers to Using Games in Classrooms Using Varimax Rotation (N=104)

Result II: Analysis of factor scores according to participant gender, teaching level and experience of using

Item	Factor Loadings			
	Factor1	Factor2	Factor3	Factor4
30 Students get sidetracked and do not focus on learning when games are used	0.72	-0.07	0.09	-0.09
29 It is difficult to manage a gaming class	0.70	0.11	0.1	0.06
41 Games are unrealistic – there is a disconnect between the real world and the game world	0.68	0.05	0.12	-0.11
46 It is difficult to evaluate student performance/learning from playing video games	0.65	0.08	0.06	0.09
40 Lack of clear alignment between games and learning objectives	0.64	-0.09	0.39	-0.05
37 Games take too long to play through to fit within the course structure	0.58	-0.13	0.25	-0.02
39 Lack of availability of games that match the teacher's subject area	0.58	-0.02	0.28	-0.13
42 Educational games are not engaging	0.56	-0.05	0.2	-0.03
43 Lack of evidence that games promote learning	0.53	-0.22	0.33	-0.21
23 Some games are too complicated for students	0.52	0.18	-0.04	0.42
45 Students don't recognize the value of games for learning	0.50	0.24	0.01	0.02
27 Teachers lack interest in games	0.41	-0.02	0.15	0
21 Inadequate technology support	0.17	0.81	0.12	0.01
17 Lack of available technology to play video games on	-0.14	0.69	-0.14	0.28
16 Older computer hardware	-0.13	0.66	0.06	0.36
18 Lack of administrative support	-0.05	0.54	0.43	-0.09
22 Using technology in school presents challenges	0.1	0.43	0.05	0.18
33 The pressures of standards-based assessment limit creative instruction like games	0.15	0.04	0.6	0.19
19 Lack of supporting materials for how to best use the game(s) for learning	0.45	0.29	0.6	0.03
20 Lack of teacher resources available for training	0.41	0.3	0.52	0.31
38 Lack of time for professional development on how to use games	0.46	0.24	0.47	0.31
34 There is limited or no available time to play games due to the need to meet all of the required curriculum standards	0.23	-0.02	0.45	0.05
15 Price of games is too costly	-0.18	0.07	0.16	0.66
14 Lack of available funds for purchasing games	-0.24	0.25	0.13	0.59
25 Newer computer hardware does not support older game software	0.13	0.19	0.04	0.59
Eigenvalues	6.26	3.41	1.11	0.98
% of variance	20.47	10.3	8.74	7.53

Note: Factor loadings over .40 appear in bold.

games for teaching. Table 2 presents a t-test table of the factor scores by participants' gender. It shows that male teachers and female teachers had different opinions about Factor 1, Factor 2, and Factor 4 ($t = 2.64, p < 0.01$; $t = -2.82, p < 0.01$; $t = -2.38, p < 0.05$). Figure 2 depicted the means of factor scores for factors 1 to 4 by participants' gender. It showed that male teachers, more than female teachers, regarded Factor 1 as a serious barrier, whereas female teachers, more than male teachers, felt Factor 2 and factor 4 were inhibiting them from using games in classes.

Table 2. Paired t-test of factor scores by gender

Paired-samples	Group	N	Mean	SD	t
Factor1	Males	25	0.42	0.83	2.64**
	Females	78	-0.13	0.93	
Factor2	Males	25	-0.41	0.96	-2.82**
	Females	78	0.16	0.84	
Factor3	Males	25	-0.03	0.77	-0.14
	Females	78	0	0.89	
Factor4	Males	25	-0.36	1	-2.38*
	Females	78	0.09	0.78	

* $p < 0.05$. ** $p < .01$. *** $p < .001$

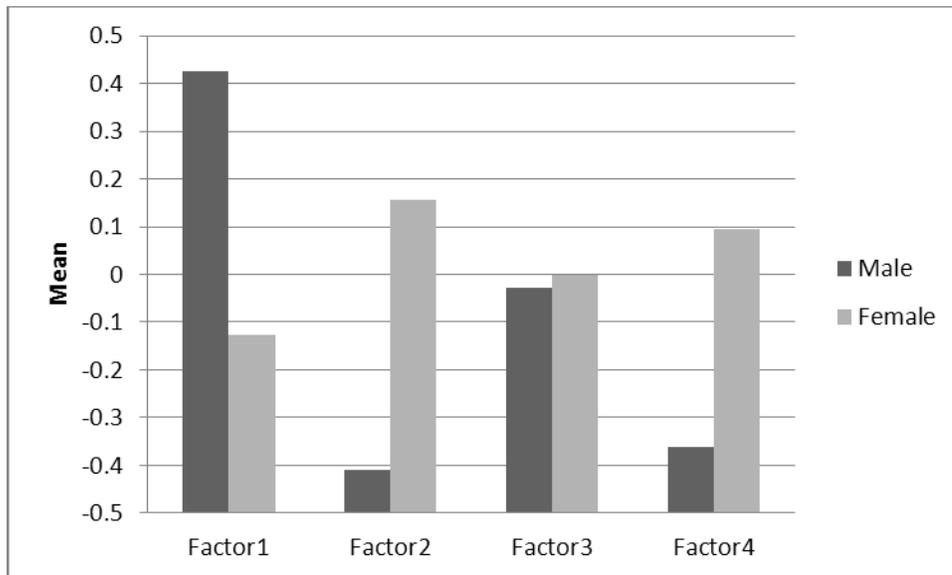


Figure 2. Patterns of means of factor scores by gender

Table 3 presents a one-way ANOVA table of the factor scores by participants' teaching level. Teachers of different teaching levels viewed Factor 1 and Factor 4 significantly differently, with $F(2, 100) = 3.36, p < 0.05$, $F(2, 100) = 5.56, p < 0.01$. Figure 3 depicts the means of factor scores for factors 1 to 4 by participants' teaching level. It is obvious that primary school teachers considered Factor 1 as a much less serious barrier than middle/intermediate and high school teachers did, and senior high school teachers took Factor 4 less seriously than primary and middle/intermediate school teachers did.

Table 3. Analysis of factor scores by teaching level

	SS	df	MS	F	P
Factor1					
Between groups	5.64	2	2.82	3.36	0.0386*
Within groups	83.8	100	0.84		
Total	89.43	102			

Factor2					
Between groups	1.03	2	0.52	0.63	0.5325
Within groups	81.54	100	0.82		
Total	82.57	102			
Factor3					
Between groups	0.24	2	0.12	0.16	0.8533
Within groups	74.41	100	0.74		
Total	74.64	102			
Factor4					
Between groups	7.41	2	3.71	5.56	0.0051**
Within groups	66.58	100	0.67		
Total	74	102			

* $p < 0.05$. ** $p < .01$. *** $p < .001$

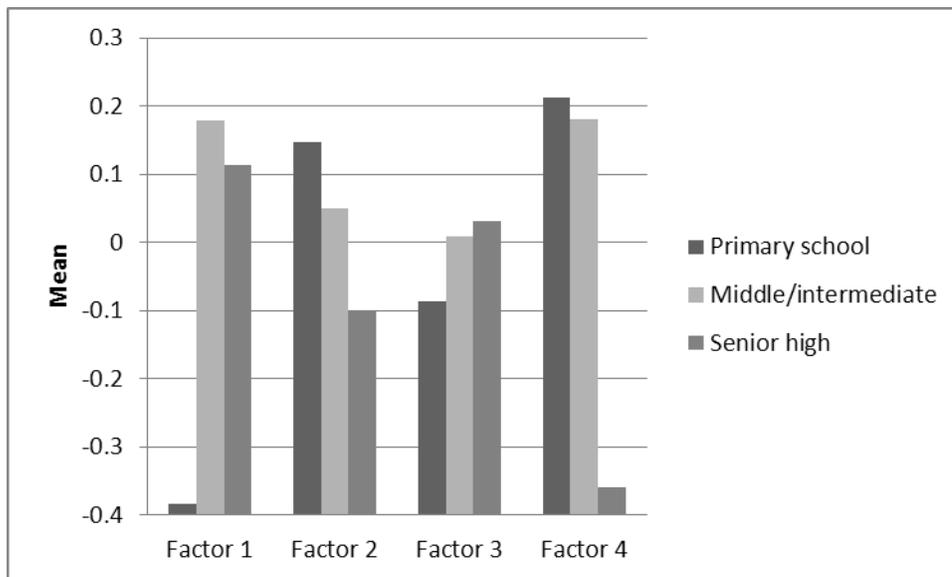


Figure 3. Patterns of means of factor scores by teaching level.

Table 4 displays a one-way ANOVA table of the factor scores by participants' experience of using games for instruction. Teachers who have used games for instruction perceived Factor 1 and Factor 3 significantly differently from those who never used games for instruction, with $F(1, 102) = 12.65, p < 0.001$, $F(1, 102) = 6.60, p < 0.05$. Figure 4 demonstrates the means of factor scores for factors 1 to 4 by participants' experience of using games for instruction. It is notable that teachers who have used games for teaching viewed Factor 1 and Factor 3 as less inhibiting factors than those who never used games for teaching.

Table 4. Analysis of factor scores by experience of using games for instruction

	SS	df	MS	F	P
Factor1					
Between groups	9.91	1	9.91	12.65	0.0006***
Within groups	79.92	102	0.78		
Total	89.83	103			
Factor2					
Between groups	2.71	1	2.71	3.31	0.0717
Within groups	83.33	102	0.82		
Total	86.04	103			

Factor3					
Between groups	4.58	1	4.58	6.60	0.0116*
Within groups	70.71	102	0.69		
Total	75.29	103			
Factor4					
Between groups	0.66	1	0.66	0.88	0.3503
Within groups	75.95	102	0.74		
Total	76.61	103			

* $p < 0.05$. ** $p < .01$. *** $p < .001$

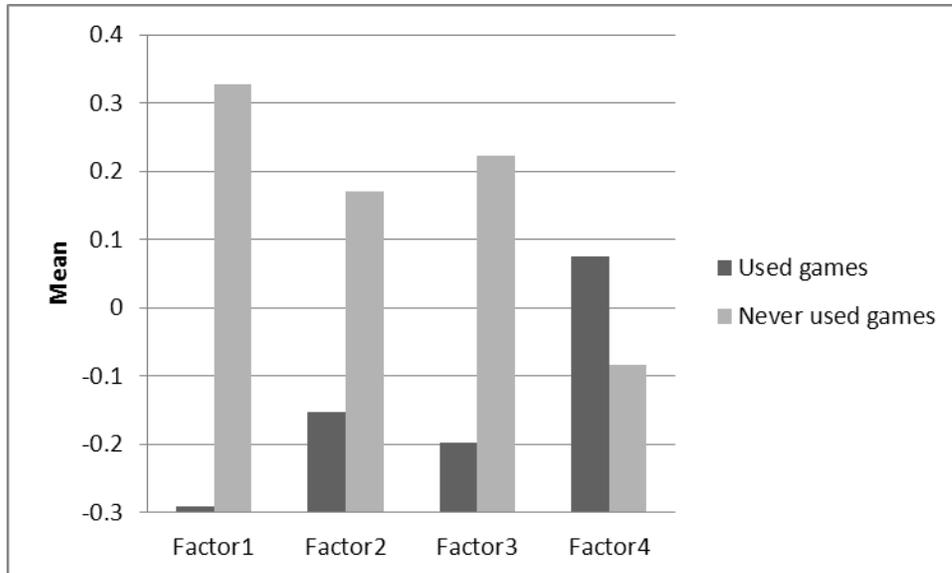


Figure 4. Patterns of means of factor scores by experience of using games for instruction

Discussion

Four types of barriers to using games for instruction were distracted, and how teacher perceptions are influenced by their gender, teaching level and experience of using games were explored. These findings are consistent with the results of previous studies (Baek, 2008; Kirriemuir & McFarlane, 2004; Koh et al., 2011; Simpson & Stansberry, 2009; Wastiau et al., 2009), and complement previous findings.

Challenges of implementing games effectively include issues about students and teacher interest, student attention, class management, game content and its alignment with learning objectives, game availability, and assessment. These findings are supported by previous studies (Kirriemuir & McFarlane, 2004; Koh et al., 2011; Simpson & Stansberry, 2009). The result shows that this is a more serious barrier for male teachers than for female teachers, which is not revealed in the literature. Perhaps male teachers and female teachers viewed the issues within this factor differently. For instance, a high school male science teacher said that even if his students all had their assigned laptops, “they still not get many games and install them on their computers. The biggest barrier is probably resources, and the second one is finding a good appropriate fit”. An elementary female teacher said: “I think the biggest barrier to using games, especially video games, is that sometimes they’re not educationally focused enough”. Additionally, the survey shows that female teachers, more than male teachers, felt challenges with using technology and challenges with obtaining games were inhibiting them from using games in classes. This finding is consistent with the result of previous research (Baek, 2008). Many teachers interviewed mentioned inadequate computers and technology glitches, and all the teachers interviewed thought lack of funding a big barrier. Some schools do not have money to buy any game or games that meet teacher needs, and some schools only have money to purchase very basic stuff. Lack of funding for buying games may partially explain why free web-based games and computer games attached with the textbook were used most often by the participating teachers who have used games for instruction. Therefore, teachers should be provided more technology assistance and financial support for purchasing computers and suitable games.

Teaching level also affects teacher perceptions of barriers. Elementary school teachers viewed challenges of implementing games effectively a less serious barrier than middle/intermediate and high school teachers. Younger students usually have lower expectations of game quality than older students and thus are easy to deal with. One teacher who taught computers from Grade 1 through 8 noted: "My video games with 1st through 5th grade work very well. 6th, 7th, and 8th, they're more trained on their home video games, and it's hard to keep them focus on educational video games because the quality of home versions of web-played war games or whatever, is so much better than the quality of educational games. You cannot retain, I cannot retain their interests." Furthermore, challenges with obtaining games are perceived more serious by primary and middle/intermediate school teachers than by senior high school teachers. It is possible that primary and middle/intermediate school teachers use games more often than high school teachers due to less academic pressure, so this factor is more outstanding for them.

The results also indicate that teachers who have used games for teaching viewed challenges of implementing games effectively and current educational system as less inhibiting factors than those who have not used games for teaching. It is understandable that teachers who have used games at least have overcome the barriers at some point and thus are more confident to deal with challenges of implementing games and the existing educational system than those who have not used games.

Conclusion

This study explores what barriers in using games for instruction US teachers have personally encountered or perceived, and how teacher perceptions of barriers are influenced by their gender, teaching level and experience of using games for instruction. Due to the small sample size of participants, the study is more of an exploratory study. Despite this, it may still serve as a reference for researchers who promote digital game-based learning in formal education. Future research could investigate the perceived barriers of larger numbers of US teachers who have or have not used games for instruction, and more importantly, their perceptions of how to reduce the barriers.

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