

Playing to Learn: Game-Driven Comprehension of Complex Content

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Instructional games have become an established factor in corporate and government training, and they are beginning to appear to a greater extent in educational institutions. As a result, courses on instructional game development are being incorporated into educational programs. Students in these courses find themselves faced with the task of confronting, understanding, and internalizing concepts that they have never before encountered. This article reports the practice and result of using games in one such course, and uses student commentary to support the conclusion that the games used were successful in reducing anxiety, increasing motivation, and improving understanding.

In training and education, technology-based games and simulations are now popular and becoming more so, but thinking of games and simulations as learning tools has a long history in the literature (Cameron & Dwyer, 2005; Dekkers & Donath 1981; Fraas, 1980; Saunders, 1997) and an even longer one in common knowledge. For example, the statement that the battle of Waterloo was won on the playing fields of Eton, famously attributed to the Duke of Wellington, refers to competitive sports as a simulation of the more serious competition of warfare. In traditional classrooms, it is common for students to have trouble understanding how learning to solve word problems in math class will help them in life, and they find the teacher's examples of balancing their checkbooks or figuring their income tax unconvincing. The teacher, on the other hand, considers practicing arithmetic and writing expository prose a kind of simulation of real life and hopes that the learning transfers to useful job skills like doing expense accounts and writing interoffice memos.

The purpose of this paper is to report the use of original games as a teaching aid in an instructional game course in a master's program. Specifically, the games were designed to provoke, encourage, and expand the discussion of the reading that is a necessary part of the course. Understanding instructional game theory requires reading and thinking about ideas that are unusual to most people. Discussion, examples from the learners' experience, input from the instructor, and contentious debate all contribute to achieving this understanding. To date, this author has produced three games designed to stimulate and intensify students' participation in reviewing the reading, and although all three of them have been successful to some degree, they have had different effects.

Background

Simulations

A simulation is an analogy of a realistic situation, an analogy that may or may not be realistic (Dekkers & Donath, 1981; Rice, 2007). Unlike traditional teaching

strategy, modern technology-based simulations create an environment in which students easily suspend their disbelief, become immersed in their roles, and assume the reality of their learning. An instructional simulation is a manufactured situation that gives learners realistic hands-on practice, be it landing an airliner or closing a sale with a difficult client. To be effective, however, it has to be realistic enough to enable the learner to believe in it. The flight simulator has to act and feel enough like an airliner and the simulated client has to act and feel enough like a real client (Green & McNeese, 2007; Rice, 2007; Summerfield, 2004).

This is not to say that all simulations have to be as realistic as possible. Sometimes developing an environment that accentuates specific elements of the real environment is sufficient, or even more effective, because it excludes nonessential variables that might distract the learners from the desired central focus (Saunders, 1997; Squire, 2003; Vogel, Vogel, Cannon-Bowers, Bowers, Muse, & Wright, 2006). These low-fidelity projects are much less expensive to produce, and many do not use computer technology. Many computer-generated simulations, however, are considered low-fidelity when the artificiality of the system is obvious to the learners (Squire, 2003).

Video Games

The video game industry produces games that engender strong emotions like awe, fear, power, and happiness in the players by creating a virtual reality that allows collaboration, social interaction, victory, and defeat (Squire, 2003). Video game players achieve a level of involvement with the game that Csikszentmihalyi (1991) has named "flow," or "flow state." While in this state, they forget their normal cares, the passage of time, and derive intense satisfaction from the sheer pleasure of performing the activity required by the game. Bates (2001) corroborates this idea when he calls one of the basic principles of game design "immersion" and says "a successful game sucks the player in and doesn't let him [or her] go" (p. 27). Rollings and Adams (2003)

recognize the same concept and connect it to interface design, saying that players get into “a sort of ‘groove’” where they become one with the machine and are “no longer aware of the user interface at all,” having entered “the infamous *Tetris Trance*” (p. 13).

Motivation and Instructional Games

Educators have been investigating the possibility of harnessing the motivational power of video games for at least 25 years (Cameron & Dwyer, 2005; Fraas, 1980; Dekkers & Donath 1981; Saunders, 1997), and they have discovered some telling differences when comparing the characteristics of gaming activity to traditional classroom activity. Gaming puts the player in control; gives clear, immediate feedback; and offers progressively more challenging levels of achievement at the player’s own pace. By contrast, the classroom puts the teacher in control; gives sketchy, infrequent feedback; and expects the entire group of students to progress at the same rate (Csikszentmihalyi, 1991; Squire, 2003).

Arguably the most important element of game-playing, the central element of the flow state, and the crucial element in real-life learning is the cycle of intrinsic motivation (Cameron & Dwyer, 2005). Under the right conditions, the player/learner sees each frustration, each failure, as an opportunity to get it right on the next try. Finally getting it right automatically establishes a new level of skill that encourages the player/learner to attempt a more difficult move, the achievement of which enables reaching a still higher skill level (Prensky, 2001; Salen & Zimmerman, 2004). Race car drivers spend hours practicing seemingly identical laps around an oval track and are gratified to shave fractions of a second off their personal records. Piano players spend hours practicing the same piece of music to achieve minute differences of tone and timing that others may not even detect. One person’s boredom is another’s obsession, and feedback so subtle as to be imperceptible to one person is another’s vital information (Aldrich, 2004; Csikszentmihalyi, 1991).

Channeling the power of games, using their ability to capture the attention of the player and focus it strongly on specific learning activities, is no longer just speculation, but an everyday reality (Cameron & Dwyer, 2005; Squire, Giovanetto, Devane, & Durga, 2005). Games are used extensively to promote learning in industry, educational institutions, and, perhaps most impressively, the American military. The military, in fact, conducts continuous game-based training for a constantly shifting population of over three million military and civilian personnel (Prensky, 2001).

Feedback is a basic principle of game design; there must be a reaction to the player’s every action to sustain the player’s entertainment, and therefore the player’s

motivation (Bates, 2001; Cameron & Dwyer, 2005). If the player hits keys or clicks the mouse and the game does not respond, the player becomes frustrated or bored, and either state may make the player stop playing the game. However, the player will quickly recognize a simple beep or tone as a signal that there is no play-relevant response (Salen & Zimmerman, 2004). With similar reasoning, Rouse (2001) stresses non-linearity as an essential design requirement. Creating non-linear stories and non-linear sequencing enables each player to live the world of the game in his or her own way and enables the same player to find different ways to replay the game, thereby expanding the opportunities for interest and enjoyment.

For player/learners, games provide a huge diversity of involvement and types of interaction ranging from very simple to very complex. They can require passive observation, rapid and continual choices, thoughtful strategy planning, good eye-hand coordination, and fast physical reflexes. They can induce players to follow a linear process, to create their own worlds, to participate in social activities, to form effective teams, to kill, and to save lives (Bates, 2001; Prensky, 2001; Rollings & Adams, 2003; Salen & Zimmerman, 2004). Saunders (1997), discussing experiential learning theory and learning styles in instructional games and simulations, supports the idea that the diversity of learning approaches that games present has the potential to appeal to a wide range of learning styles.

Game Genres

The following review of some game genre descriptions, all drawn from Rollings and Adams (2003), may be useful to illustrate the diversity of learning afforded by games.

Action games. Action games are “twitch” games; they come in a variety of styles, but successful play in all of them depends on developing quick reactions and eye-hand coordination. These games, perhaps because they are mechanically simpler, were the first generation of video games and are still, because they exploit speed in place of complexity, the least expensive to produce. Their interfaces do not require high fidelity realism; in fact, the speed of play would prevent players from using or appreciating fine environmental detail.

Strategy games. Strategy games, historically derived from board games, usually allow players whatever time they need to decide on the next move. Incidentally, Jones (1999) holds that this type of game fosters higher order thinking and more intellectual satisfaction. The exceptions are the less common real-time strategy (RTS) games, where events in the game do not wait for the next move, but progress in immediate reaction to the last move, adding the pressure of time to the other variables governing the

game's outcome. This pressure also forces a more physical conflict between players and their foes, thereby reducing the proportion of higher-level thought. Jones (1999) suggests that a balance of twitch and strategy in the same game may be the best format. Strategy games are generally built around conquest, exploration, trade, or, often, an interdependent blend of two or all three of these themes. Player/game interaction is quite complex and promotes opportunities for players to practice commanding and building teams at levels from squad leader to general. Incidentally, market demographics indicate that these games, perhaps because they focus on conquering all or a major part of a virtual world, tend to have much more appeal for male than for female players.

Role-playing games. Computer role-playing games (CRPGs) invite players to incorporate themselves into the story and to make it their own. CRPGs are typified by strong story lines and by equally strong character development, and players tend to be attracted to one or the other of these elements. A story-line player empathizes with a character, becomes that character, and focuses play on developing the story. This usually means that the story comes to revolve around the player's character, who becomes the center of the action. A character-development player is more interested in using the experiences of the game to enhance, for good or evil, the capabilities, understanding, and emotional power of the game piece that represents the player. In fact, virtually and in the mind of the player, the game piece is the player.

Construction and management simulations. Construction and management simulations (CMSs) tend to be single-player games that lack swift action and competition, focusing instead on building something (e.g., a city or a theme park) and maintaining it. CMSs appeal to people who enjoy creating and planning and continually tweaking to make improvements and to repair damage caused by natural disasters like earthquakes, fires, disease, and pollution. Players of these global process games nearly always have an omniscient point of view within the world of the game, rather than seeing only what is in front of their game character's gun or what can be seen through their game character's windshield.

This sampling of genres serves to establish that games accommodate and promote a wide variety of player attitude and behavior. Understanding the relationship between players and their games may well be the first step in creating games that apply the motivational force inherent in game play to achieving educational goals and objectives. However, the exploration of a sample of genres in conjunction with readings on the principles and processes to create games is not enough to enable students to achieve the mind state that is necessary to transform them into

game creators. Of course these elements help, but the students need more. This author has been observing that modeling is an effective instructional strategy, and, in the case of the game course discussed here, has done that by creating games to accomplish everyday class situations like review and exploration of the reading materials.

Course Description

Preparation

In preparation for teaching a graduate level Instructional Game Development course, this author began reading on the subject about a year in advance and contacted, by phone, e-mail, and personal visits, faculty who were already teaching instructional game courses in other institutions. A wide variety of approaches were found in the game development courses, ranging from almost entirely theory and research to almost entirely hands-on production. Being part of a program that equally emphasizes knowing underlying theory, producing practical solutions, and employability upon graduation, this author designed a course that included substantial reading, extensive discussion, and the development of working games. Fortunately, some knowledge of the characteristics of students who would take the course was available from previous experience with them. They would be seniors in the program and therefore have well-developed experience in areas that provide preparation for game design, areas like instructional design, multimedia production, and the use of authoring tools appropriate for producing a game. This knowledge helped in designing the course projects so that each student could choose the most satisfying from a variety of approaches.

Assignments

The students were to produce two projects, one individually and one in group. The individual project was research-based. The group work involved developing an instructional game for a client. The individual project had flexible guidelines to allow for the students to choose the approach that best fit their interest and skill level. The options were:

1. Choose to work in a more theoretical framework in which you will select a game, play it, observe others playing, document your research, and report.
2. Or, if you feel that technical knowledge is your forte then you can choose a game like *Nexus: The Jupiter Incident* or *Half Life II*, both from Sierra; or *Elder Scrolls III*

Morrowind, from Bethesda Softworks; or Neverwinter Nights from Bioware; or Unreal Tournament, from Epic Games, Inc., which allows you to add content to it and create an instructional MOD within it.

3. Or, still in the high-tech realm, you can choose a tool other than Flash and create an instructional game.
4. Or, if you want to explore new avenues you can research and create an instructional game using StarLogo—a decentralized system available for free from MIT.

The reason for excluding Flash (option 3) was that it was the tool designated for the development of the group project for the client.

The group project involved the production of an instructional game to attend the needs of a client. An integral part of the project was the ability of each of the group members to work well together and complete their part of the work. Teamwork is very common in the Instructional Technology field and learning how to function well when working in groups is an important skill for students to leave the program with. This instructor was available to participate in group meetings when the group was unable to solve a problem by themselves, but this resource was to be used only as last resort. The students were also instructed that “last resort” did not mean waiting until the last minute to seek help. It was the group’s responsibility to have the work completed according to the project guidelines and timeline.

Since each finished project was the work of a group, all the members of each group received the same grade. In order to provide each group with an idea of the quality of their work and allow the group the opportunity to improve their performance while executing the project, they received grades on portions of the project as they completed them, but all portions were parts of the same project and were to form a seamless whole.

In addition to the electronic submission of each group’s project, each group was asked to start a three-hole binder and add the pieces of the project as they were being produced. The final product was to be burned onto a CD. The parts of the project to be turned in for grade were, in sequential order, as follows:

1. Proposal for client
2. Prototype
3. Design document
4. Developed product
5. Group work presentation.

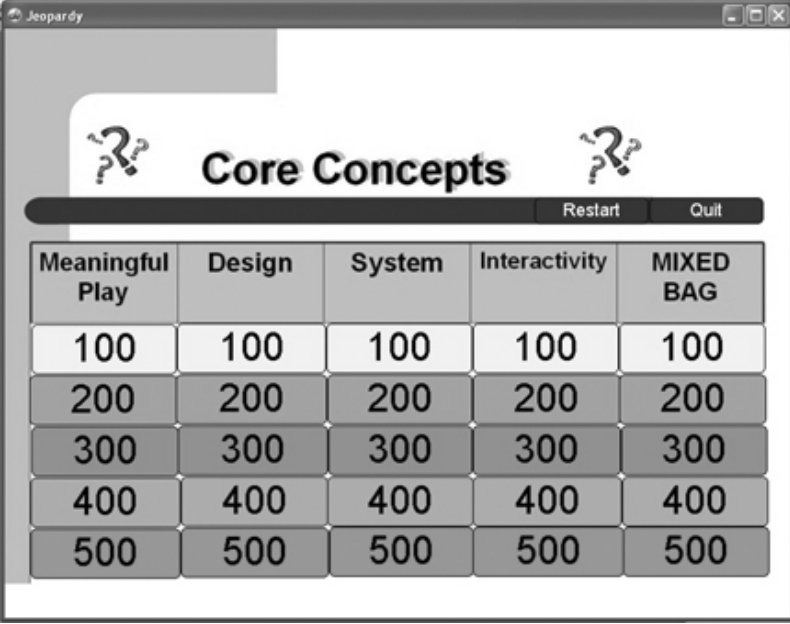
Learner Characteristics

The course discussed here is Instructional Game Development, which is an advanced course in a master’s program in Instructional Technology. The participating students had a solid knowledge base in areas such as instructional design and multimedia production. They also had various levels of skills in the use of the possible authoring tools to be used to produce a game. Although the students were able to understand the characteristics of various levels of simulations and the various aspects that make video games such an attractive phenomenon, this realization did not enable them to become comfortable as game developers.

Previous experience with the students of this master’s program had led to the realization that some of them often have trouble grasping new and difficult content from reading alone. Reading reinforced by discussion, however, normally leads to greatly increased understanding, as the participants collaborate in making connections between their knowledge base and new concepts. Moreover, the concepts in instructional game theory were new; that is, these students had not encountered them before. Learning to incorporate into their thought and language such things as the mathematical basis of a game, its operational and implicit rules, and its role in the cultural fabric of society requires careful reading and thoughtful debate (Salen & Zimmerman, 2004). In spite of the difficulties of understanding and assimilating the concepts from the readings, most students, to this author’s surprise, added another difficulty by choosing, for the individual projects, to use an authoring tool to develop an educational game “from scratch.” The tool of choice, due to availability and the fact that most of them were taking a class on advanced authoring was Director, from Macromedia.

The students were accustomed to designing technology-based instructional solutions by using rules and principles derived from Instructional Design and Multimedia Production courses. Instructional game design, however, required that they use a different paradigm. Game design requires, for example, the understanding that games are systems of interlocking systems governed by inviolable rules that paradoxically can be circumvented under certain circumstances. A game designer can use such a system of rules to create a virtual environment where the skilled player can produce effects that are far beyond the designer’s ability to predict, but that satisfy the necessities implied by the rules (Salen & Zimmerman, 2004). The students soon understood that they needed to step out of their comfort zone and explore a world with new restraints

FIGURE 1
IGD Jeopardy



Meaningful Play	Design	System	Interactivity	MIXED BAG
100	100	100	100	100
200	200	200	200	200
300	300	300	300	300
400	400	400	400	400
500	500	500	500	500

and different motivators. As an aid in making this transition happen, this author produced some games during the course, partly to use as examples of completed games but mostly to provoke motivation and enthusiasm while reviewing the weekly readings. Not coincidentally, motivation and enthusiasm were the same elements the students were trying to achieve in their own games. Since Director was the tool of choice for most of them, it was the game-authoring software this author used to produce the games employed as in-class instructional devices.

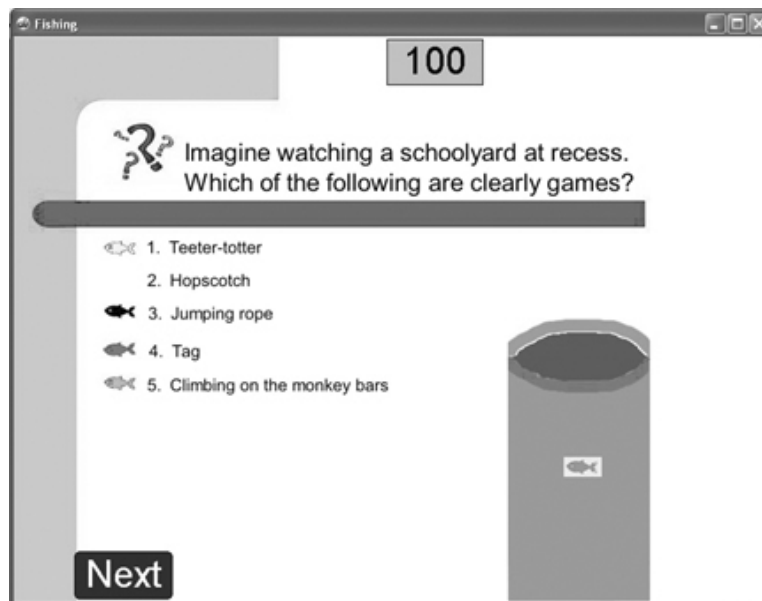
Games Developed for the Course

IGD Jeopardy. The first effort was IGD Jeopardy (see Figure 1), based upon the popular television game show. Three students were selected as a judging panel to decide if the players answered correctly or incorrectly. The game was projected on a screen and each player in turn selected a category and amount. Clicking on the chosen square caused a question and an ANSWER button to appear. After the player's answer, which was given verbally, the host clicked on the ANSWER button to show a screen containing the answer and a SCORE button. Sometimes discussion between the judges and entire class was necessary to determine whether the player's answer was sufficiently correct. Then clicking on the SCORE button showed the score sheet, which contained a list of the students' names with a field to update their score. At the end of game the winners received token prizes (e.g., little

bouncing balls, stick-on stars) for their performance. Upon reflection, this author regrets including the prizes, which were perhaps an afterthought influenced by the television version of Jeopardy. In the use of games in the course, they added an extra variable that was not meant to be measured. After playing the game, and in the process discussing each point from the readings, the class explored both the educational effect of using the game in class and effectiveness of the game design. The final portion was an optional, after-class discussion of the code and tips and tricks in Director.

Fishing for Answers. The second reading review game was Fishing for Answers (see Figure 2), an original multiple choice game in which the players got points by moving fish into an aquarium. The fish were markers for the multiple choice options, and making a correct choice automatically added 100 points to the player's score. Making an incorrect choice subtracted 100 points. Unlike IGD Jeopardy, which was visually open to the entire group and demanded voluntary participation from the group, Fishing for Answers was played individually by each student on each student's computer. Thus the atmosphere of the game and the feeling of competition were different. Instead of an active, noisy group in which various members tried to answer first, Fishing for Answers produced a quiet group, each member of which was focused on an individual screen and felt little or no time pressure. After the game, the students received token prizes that varied in accordance with the score obtained. Because the students played this game on individual computers,

FIGURE 2
Fishing for Answers



upon completion of play the questions were projected and discussed with the entire class. As before, the instructor dismissed the class at the normal time but invited any class members who wished to stay for a discussion of the code and tips and tricks in Director.

Randominate. The third game was Randominate (see Figure 3). Playing Randominate utilized a slightly different approach. A random selection from a set of questions based on the reading of the week was projected on a screen visible to the entire class. A student who had volunteered to answer responded first and then the entire class contributed to the response and discussed the implications generated by the question. Although playing Randominate involved no scoring, and there was no “winner,” there was a real sense of competition as students rushed to add, and emphasize the significance of, their contributions. The questions raised important points and generated enthusiastic debate about their application to the practice of instructional game design. This game was played on two different occasions.

Results

These simple games produced specifically for the course and tailored to accomplish routine tasks of class meetings were shown to be helpful in a variety of ways. First, the game was an attractive device for reviewing the concepts in the reading. Second, it served as an achievable example. Third, detailed discussion of the process that produced it increased the students’ self-efficacy, that is, their confidence in their ability to

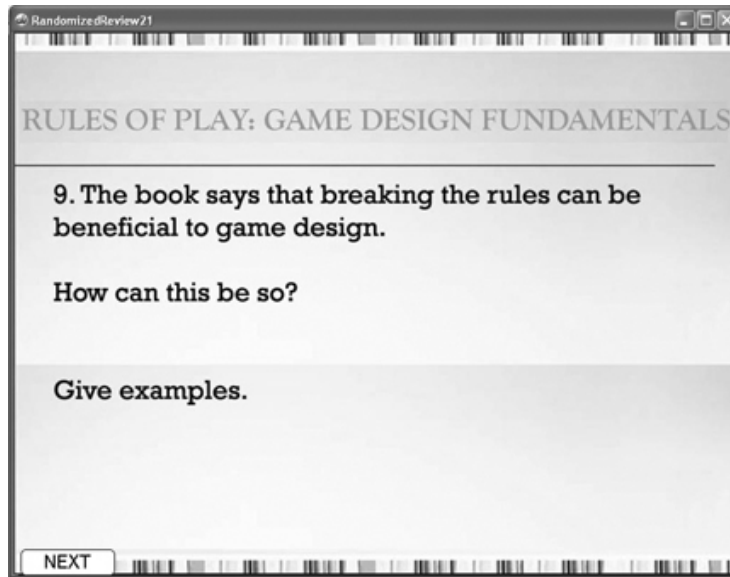
create their own games and thus complete the course projects.

The students liked the approach of using games to review the readings, and they reported that they profited in multiple ways from this approach. The game atmosphere added pizzazz to the potentially boring task of reviewing the readings, provided students with the necessary guidance in the formalization of their own projects, and allowed follow-up discussion on the code, tips, and tricks in Director, which helped them to solve development problems they were facing in their own production.

Learner Feedback

In each class meeting the students were provided with a class agenda containing a list of the planned activities, the class objectives (designed to support the course objectives), and a checklist of the activities to be completed before the next meeting. After each class, the students were asked to complete an anonymous six-question survey to evaluate the class meeting in relation to the class objectives. The six items addressed (a) the percentage of the objectives reached, (b) the methods used to deliver the content, (c) their level of comfort to ask questions, (d) their contribution to the success of the meeting, (e) the instructional pace, and (f) the quality of their learning. In addition, after each instructional meeting the learners were asked to submit a journal entry, three short reflective paragraphs evaluating the quality of instruction and their learning experience. The paragraphs addressed three points: (a)

FIGURE 3
Randominate



how effective the instruction was, and why; (b) how the instruction contributed to their learning, and why; and (c) how their participation contributed to the instructional quality.

Table 1 shows the survey results for the four class meetings in which the games were used to review the readings. Because all the surveys showed very similar results, they are discussed here as a group. In the class meetings where the games were utilized, the number of responding students was 12, 11, 10, and 12, respectively, for a total of 45 responses per item. Since each participant provided 6 responses per survey, the total responses were 270. For the Percent of class objectives achieved item, one of the responses was 80-90%; all the others were either 100% or 90-99%. In other words, 98% indicated above 90% achievement of the class objectives. Of the 225 responses to the other items, there were no Bad or Very Bad responses, and 6, or 2.7% of the total, were Neutral. In other words, 97.3% of these responses were either Very Good or Good.

In their reflective journals, the students recorded their impressions and opinions about using instructional games as a technique to enhance learning. Their comments overwhelmingly corroborate the survey results. In the interests of consistency and thoroughness, excerpts from the reflective journals are presented in the same order as the chronology of the classes that they represent: IDG Jeopardy, Fishing for Answers, the first playing of Randominate, and finally the second playing of Randominate.

The following are student comments about the class meeting when IDG Jeopardy was played:

The game was an awesome way to review the chapter. It is the most successful chapter review I have seen since I have been here. I was glad to help by judging. (Student A)

I enjoyed this class. The game we played was a good reinforcement of your repeated statements that our individual games do not have to be works of art that are ready for market. It was simple and straightforward, but functioned very nicely. (Student B)

The class was fun because we got to play the Jeopardy-style trivia game and I almost won towards the end but got a little excited and ended up trying to answer questions haphazardly. I still tied for second, though. The overall contribution towards my learning was great because we basically went over all of the major points covered in the "Rules of Play" textbook in our required readings thus far. (Student C)

When we played the Fishing for Answers game the students' reflective journals were equally positive:

The class was great because the fishing game I played in class help me improve my understanding about chapters I have read. (Student D)

TABLE 1
Class survey results for the class meetings when games were played

	IGD Jeopardy					Fishing for Answers					First Playing of Randominate					Second Playing of Randominate					Totals
	10	9	8	7	6	10	9	8	7	6	10	9	8	7	6	10	9	8	7	6	
Responses for Percent of class objectives achieved	6	6	0	0	0	6	4	1	0	0	6	4	0	0	0	7	5	0	0	0	45
Responses for Teaching methods	vg	g	n	b	vb	vg	g	n	b	vb	vg	g	n	b	vb	vg	g	n	b	vb	45
Responses for Comfort asking questions	8	4	0	0	0	8	3	0	0	0	7	3	0	0	0	9	3	0	0	0	45
Responses for Student contribution	7	4	1	0	0	7	4	0	0	0	7	3	0	0	0	9	3	0	0	0	45
Responses for Pace of activities	7	4	1	0	0	8	2	1	0	0	6	4	0	0	0	8	4	0	0	0	45
Responses for Quality of learning	9	2	1	0	0	8	3	0	0	0	5	5	0	0	0	7	4	1	0	0	45
Totals	43	26	3	0	0	43	20	3	0	0	39	21	0	0	0	48	23	1	0	0	270

Note. For percent of class objectives achieved the possible responses, in order from left to right, are 100% (10), 90-99% (9), 80-89% (8), 70-79% (7), and < 70% (6). For the other items the possible responses, in order from left to right, are Very Good (vg), Good (g), Neutral (n), Bad (b), and Very Bad (vb).

I feel that the Game Design classes are definitely coming together. As we work through the exercises, I feel a better sense of understanding of games. I'm beginning to see how they might fit into an instructional strategy. I've really enjoyed the games ... built to serve as examples. They have been a great help. (Student B)

This particular class was very interesting because we got to see another example of a game that you developed. I find this interesting because it makes the readings and the creation of our individual projects more clear seeing examples like this. (Student E)

After playing Randominate, students commented:

As the semester continues, I feel that I'm getting a somewhat better appreciation of the concepts that form the basis of many games. The reading is quite interesting. Unfortunately, we tend to be so busy with our many projects that the reading tends to take a back seat. I very much appreciate the effort that you have put forth in order to give us some examples of basic games and the code that is

behind them. This adds a practical aspect that provides grounding to the rest of the course. (Student F)

I found the exercise on randomization interesting for the discussions that it generated as well. We tend to take fairly firm stands on certain topics. I find that we continually come back to the question of just what constitutes a game. You would think that this would be easy to determine. I, however, believe that a person's personality and belief set tends to play a large role in where he or she draws the magic circle. The point of view that a person brings to the game would have a significant impact on this as well. (Student F)

The positive tone was also present in the reflective journals received for the class in which Randominate was played for the second time:

The class was fun because we played the ... game with chapter review...The overall contribution towards my learning was great because the review game helped fill in the blanks on content/concepts I may have missed from my own readings. (Student G)

The class was very good because I felt like we reviewed a lot of information, but at the same time it was also more challenging than other weeks because of the fact that we were covering two weeks worth of material. But it was fun and interesting playing the randominate game. Although, I must admit that I was caught off guard by the question that I received. (Student H)

The game session at the start of the class is a very good review of the materials from the text. Although we do the reading and create and answer the discussion questions as assigned, I often find it difficult to use the information effectively. The review offered by the game, and the discussion that ensues, provides an excellent exploration of the material. (Student I)

The most impressive thing about the student reaction to using games in class was that 97.3% of the opinions expressed about it in the surveys were positive and none were negative (2.7% were neutral). More surprising yet, 100% of the written comments about it were positive. This kind of unanimity is surprising when a new learning strategy or tactic is introduced, but in the four classes in which games were employed no one disagreed with the effectiveness of their use. With this kind of enthusiastic reception, it was difficult to avoid the conclusion that using games as a mechanism to enhance learning improved the class. Further, the enthusiasm was not simply because the games made the learning more fun. Many students included in their comments direct references to the way the games made it possible to more easily absorb and expand knowledge about the course content.

This display of testimonials from the students may be discounted as simply a "smile sheet" reaction, showing only that the students liked the activities involved in using the games. It does not demonstrate what learning took place and whether that learning was more or less than would occur without using games, which is beyond the scope of this paper.

Conclusion

Instructional games are entering the realm of education, and educators, trainers, and learners are hoping that the powerful, even addictive, motivation that is embedded in game play can be channeled into formal, institutionalized learning. Games can reduce boredom, generate a healthy competitive atmosphere, give learners a sense of progress and achievement, and produce a rapt involvement in the virtual world in which they operate. Games can be played in groups, pairs, or alone. Competition can be with other players or with computers. The flexibility and variety that

games afford the learner are vast (Cameron & Dwyer, 2005; Dekkers & Donath 1981; Fraas, 1980; Prenski, 2001; Saunders, 1997).

This description of the use of games in a graduate course is a small example of the use of games as a means of instruction, yet it serves to reinforce the idea that games can be a constructive, motivational force in education. The students' reflections connecting game play to the content of their course, as well as their overwhelmingly positive reactions to the games as an educational device, emphasize the possibility that there can be a fruitful transfer of learning from games to course content.

It is important to include here, however, that (a) this limited experience does not supply sufficient data to allow generalizations, and that (b) the content of this course is instructional game development, which may have had a bearing on student reaction. In spite of these caveats, learner reaction was so positive, and making and playing the games was so productive and enjoyable, that game-based learning will be incorporated into all of this author's courses.

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