UTILIZING GAMES IN A GRADUATE LEVEL INSTRUCTIONAL GAME COURSE

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ABSTRACT

Games in education have given rise to a body of research, still small but rapidly growing, on the subject. Organizations are reacting by incorporating games into training. Educational programs that prepare training professionals thus must include in their curriculum courses addressing the design of games. This paper discusses ways to overcome some challenges that may be encountered in teaching such a course. It describes the results of using games as a means of increasing learners' level of engagement when reviewing readings in a face-to-face instructional game class.
Keywords: instructional game, game design, innovative teaching

INTRODUCTION

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. The Duke of Wellington famously said, for example, that the battle of Waterloo was won on the playing fields of Eton, a reference to competitive sports as a simulation of the more serious competition of warfare. In traditional classrooms, students 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 masters 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, I have 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.

INSTRUCTIONAL SIMULATIONS

A simulation is an analogy of a realistic situation, an analogy that may or may not be realistic. 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 (Summerfield, 2004).

This is not to say that all simulations have to be as realistic as possible. Sometimes developing an environment that accents 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. These low-fidelity projects are much less expensive to produce, and many do not use computer technology. Many computer-generated simulations, however, when the artificiality of the system is obvious to the learners, are considered low-fidelity (Squire, 2003).

INSTRUCTIONAL 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 "the 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 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).

INSTRUCTIONAL GAME STUDENTS

If Instructional Game Development is offered as an advanced course in a Master in Instructional Technology program such as the one being discussed here, the participating students will have a solid knowledge base in areas such as instructional design and multimedia production. They will also have various levels of skills in the use of the possible authoring tools to be used to produce a game. Although the students are able to understand the characteristics of various levels of simulations, and the various aspects that make video games such an attractive phenomenon mentioned in the previous paragraphs, this realization does not enable them to become comfortable as game developers. Having their instructor present them with simple but effective games produced specifically for the course and tailored to accomplish routine tasks of class meetings has been shown to be helpful in a variety of ways. It provides them with achievable examples. The detailed discussion of the production of the game after it is used for reviewing the concepts in the reading increases the students' self-efficacy, their confidence in their ability to complete the course projects.

MOTIVATION AND INSTRUCTIONAL GAMES

Educators have been investigating the possibility of harnessing the motivational power of video games for at least 25 years, and they have discovered some telling differences when comparing the characteristics of gaming activity and traditional classroom activity. Gaming puts the player in control, gives clear, immediate feedback on progress, and offers progressively more challenging levels of achievement that the player reaches 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, and the central element of the flow state, and the crucial element in real-life learning, is the cycle of intrinsic motivation. 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. Intrinsic reward, however, is difficult to measure because it depends on highly individualistic perception. 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).

Bates (2001) includes feedback as a basic principle of game design, emphasizing that there must be a reaction to the player's every action to sustain the player's entertainment. 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 him 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. 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/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; Rollings & Adams, 2003; Salen & Zimmerman, 2004). From an educational standpoint, it seems reasonable to assume that this diversity provides games the ability to appeal to a wide range of learning styles, and that one's learning style has something to do with one's favorite game.

GAME GENRES

A review of some game genre descriptions from Rollings and Adams (2003) may be useful to illustrate the point. 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, historically derived from board games, usually allow players whatever time they need to decide on the next move. This type of game fosters higher order thinking and more intellectual satisfaction (Jones, 1999). 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, or 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 command and build 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.

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 that, in fact, virtually and in the mind of the player, is the player.

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 immerse themselves in the necessary mind state that would transform them into game creators. Of course these elements help, but the students need more. In my practice, I have been observing that modeling done by creating games to accomplish everyday class situations like review and exploration of the reading materials is effective in tooling the students for success in the field of instructional game development.

METHOD

In preparation for teaching a graduate level Instructional Game Development course, I began reading on the subject about a year in advance. In addition, I contacted, by phone, e-mail, and personal visits, faculty who were already teaching instructional game courses in other institutions. I found a wide variety of approaches being used 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, I designed a course that includes substantial reading, extensive discussion, and the development of working games. Fortunately, I had some knowledge of the characteristics of students who would take the course; I knew they would be seniors in the program and therefore have a 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. Fortified with this knowledge, I attempted to design the course projects so that each student could choose the most satisfying from a variety of approaches.

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 choose 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 ScrollsIII Morrowind; or Neverwinter Nights from Bioware; or Unreal Tournament; 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 to be used 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
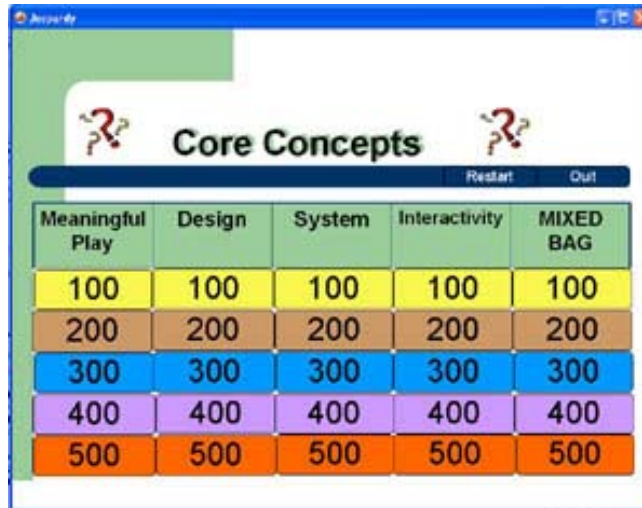
Figure 1: IGD Jeopardy

well when working in groups is an important skill for students to leave the program with. I 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.

The grade for the entire project was one per group. In other words, everybody in the 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 3-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:

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

Previous experience with the students of my program had made me realize that present-day learners do not have the same facility for reading that was considered necessary when I was a student. 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. And the concepts in instructional game theory were new; that is, my 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 addition to the difficulties of understanding and assimilating the concepts from the readings, most students to my surprise choose the option of using 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.

Educational game design, as mentioned before, requires that the students use a different paradigm than for example the rules and principles, mostly derived from Instructional Design and Multimedia Production, my students were accustomed to using to design effective technology-based instructional solutions. They soon understood that they needed to step out of their comfort zone and explore a world with new rules and different motivators. As an aid in making this transition happen, I produced some games during the course, partly to use as examples of completed games but mostly to provoke motivation and enthusiasm, the same elements they were trying to achieve in their own games, while reviewing the weekly readings. Since Director was the tool of choice for most of them, it was the game-authoring software I used to produce my games.

The first effort was IGD Jeopardy (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 players selected a category and amount. Clicking on the chosen square caused a question and an ANSWER button to appear. After the player's answer, clicking on the ANSWER button showed 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 correct or not. 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

Figure 2 : Fishing for Answers

the winners received prizes for their performance. 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, done after class time, was a discussion of the code and tips and tricks in Director.

The second reading review game was Fishing for Answers (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, and the players who got the highest scores received prizes at the end. Thus the atmosphere of the game and the feeling of competition were different. Instead of an active, noisy group in which members vied with each other 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. At the end of the game the students received prizes that varied in accordance with the score obtained.

The students played this game on individual computers, so after they had all finished, the questions were projected and discussed with the entire class. After the class time, we discussed the code and tips and tricks in Director.

The third game was Randominate (Figure 3). To play Randominate we used 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

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
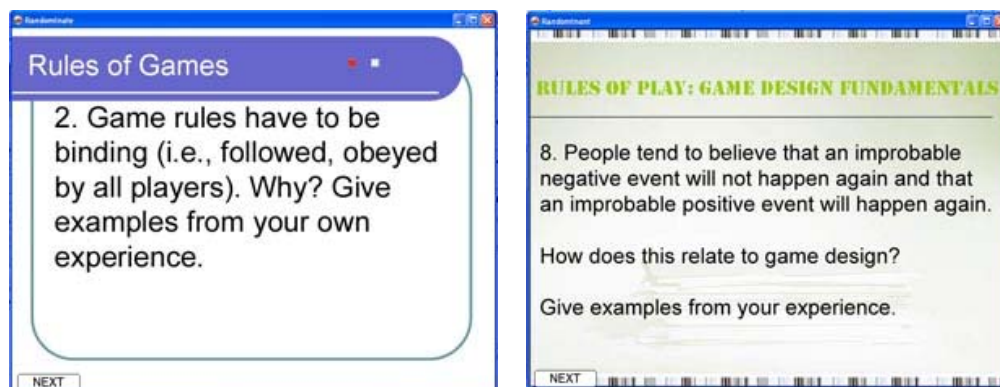

Figure 3 : Randominate

added pizzazz to the potentially boring task of reviewing the readings, provided them with the necessary guidance in the formalization of their own projects, and allowed follow-up discussion on the code, tips and tricks on Director, to help them to solve code problems they were facing in their own production.

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: (1) how effective the instruction was, and why; (2) how the instruction contributed to their learning, and why; and (3) how their participation contributed to the instructional quality. They were also asked to rate their own participation.

Figures 4 through 7 show the survey results for the class meetings in which I used the games to review the readings. Because all the surveys showed very similar results, they are discussed here as a group. In the four class meetings where the games were utilized, the number of responding students was 12, 13, 10, and 12, respectively, for a total of 47. Since each of the four surveys had 6 items, the total responses were 282. There were no negative responses, and only seven, or 2.5% of the total, were neutral. In other words, 97.5% of the responses were either Very Good or Good.

The reflective journals for the class meeting in which we played Jeopardy reinforced what the survey results show about the class objectives. Student A said, "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 B stated:

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 C commented:

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.

When we played the Fishing for Answers game the students' reflective journals were equally positive. Student D stated, "The class was great because the fishing game I played in class help me improve my understanding about chapters I have read." Student B said:

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 that Dr. Byers built to serve as examples. They have been a great help.

Student E added:

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.
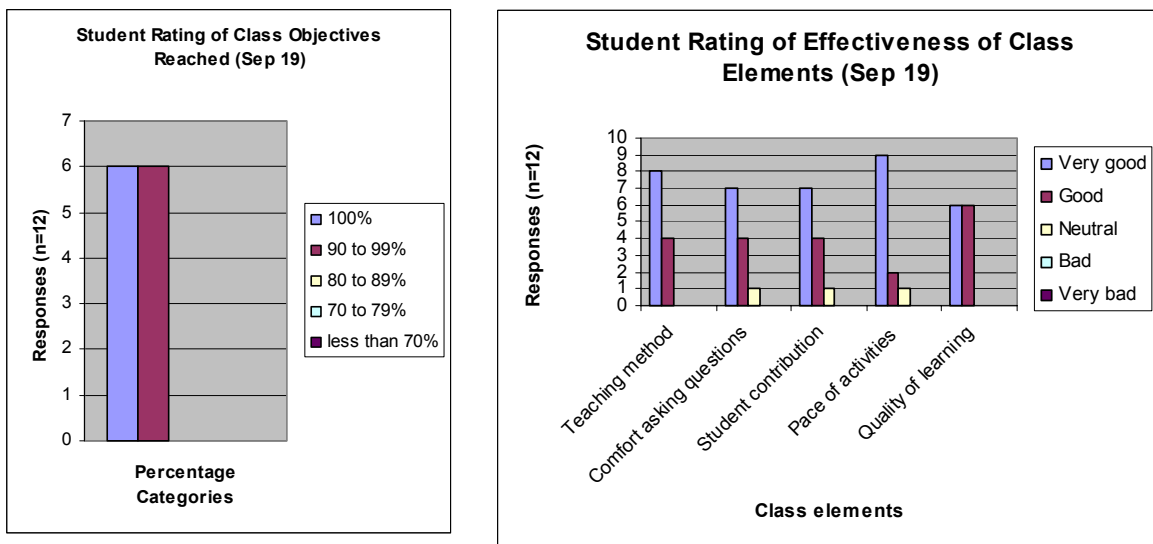

Figure 4 : Class survey results for the class meeting when we played Jeopardy
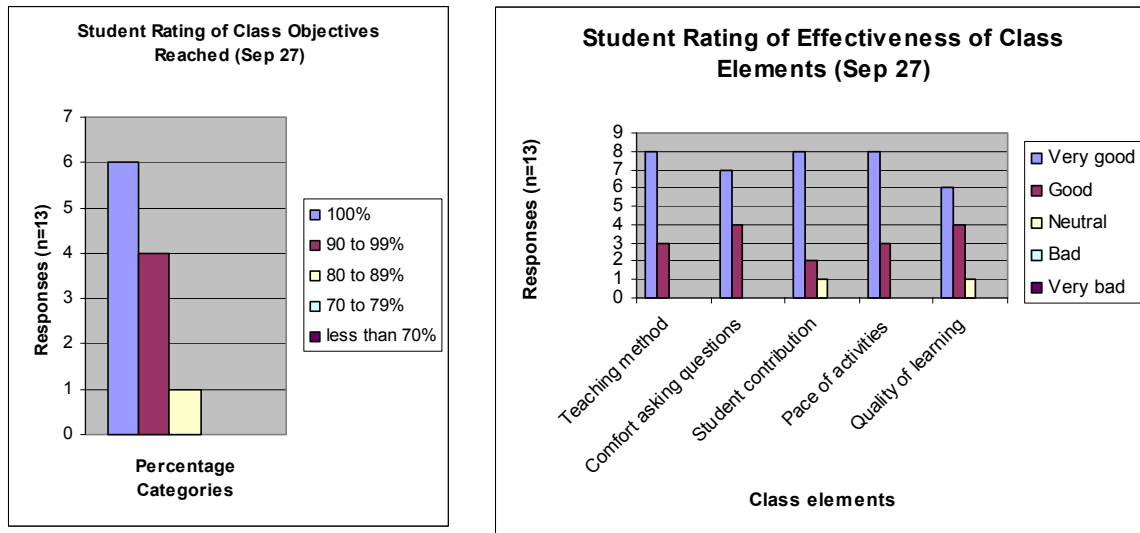
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Figure 5 : Class survey results for the class meeting when we played Fishing for Answers
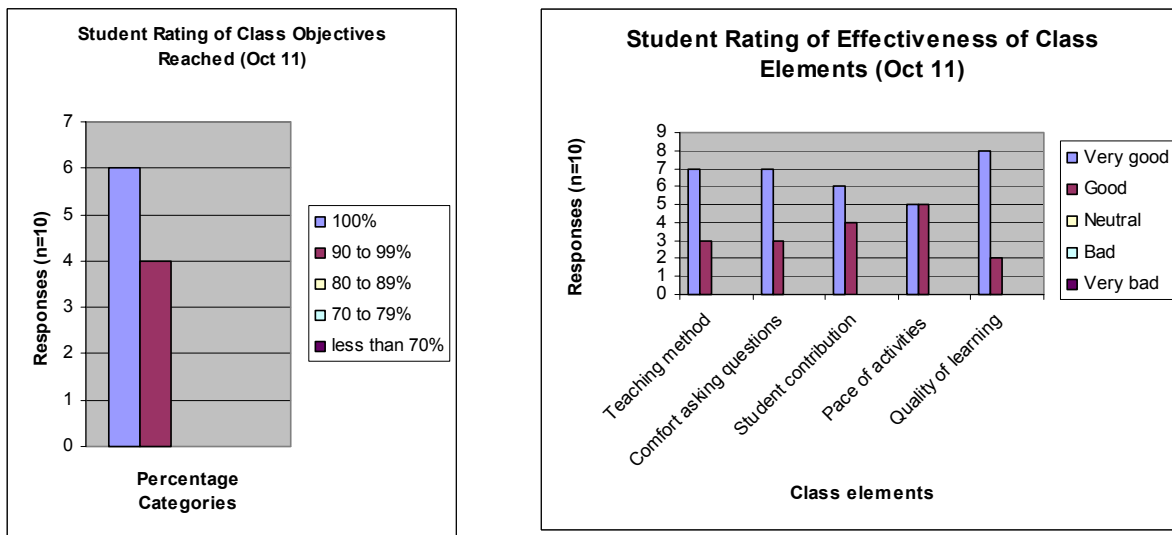

Figure 6 : Class survey results for the class meeting when we played Randominate 1

After playing Randominate Student F, paralleling in his comments the tone found in the journals from the other students, said:

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.

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.

The positive tone was also present in the reflective journals I received for the class in which we played Randominate for the second time. Student G stated:

The class was fun because we played the If game with chapter review …. The overall contribution towards my learning was great because the review game [Randominate] helped fill in the blanks on content/concepts I may have missed from my own readings.
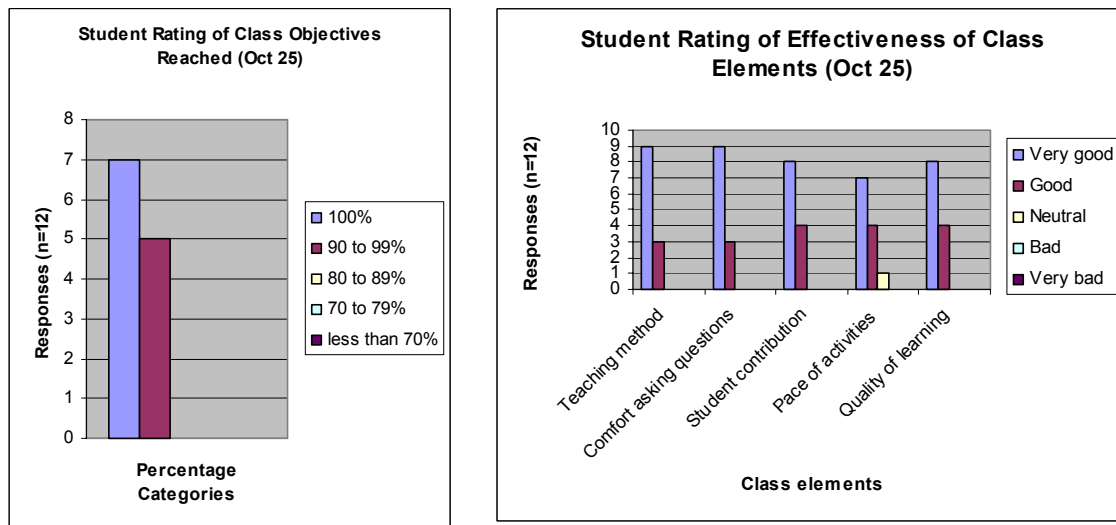
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Figure 7 : Class survey results for the class meeting when we played Randominate 2

Student H added:

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 randominant game. Although, I must admit that I was caught off guard by the question that I received.

Student I reiterated:

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.

The most impressive thing about the student reaction to using games in class was that 97.5% of the opinions expressed about it in the surveys were positive and none negative (2.5% 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 come to any other conclusion than 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.

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.

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 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 (1) this limited experience does not supply sufficient data to allow generalizations, and that (2) 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 is such a productive form of fun, that there is no doubt my students and I will be doing more of it in all my classes.

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