

Running Head: EVALUATING SUITABILITY OF VIDEO GAMES

Evaluating the Suitability of Video Games for K-12 Instruction

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Abstract

As video games have risen in prominence and complexity, interest in tapping into their powers of engagement for pedagogical purposes has risen as well. Two camps exist in the literature regarding video game assessment, that of utility and that of interaction. Drawing upon these two points of view, a broader set of pertinent evaluative questions can be ascertained, specifically for the K-12 classroom teacher, based on corresponding literature. This paper briefly examines predominant theoretical approaches for studying video games; research approaches to video games; and concludes with recommendations for teachers' consideration when assessing the suitability of any given video gaming product for classroom use.

### Evaluating the Suitability of Video Games for K-12 Instruction

Social scientists have discovered video games. Not just the simple video games of yore, such as *Tetris* or *Windows Solitaire*. Researchers are increasingly interested in complex video games, such as those involving massively multiplayer online (MMO) virtual worlds, in which thousands of people login through the Internet and interact with one another. Educators, likewise, are increasingly tuned in to video games, and the possibilities for classroom appropriation seem intriguing. This paper will examine methods in which educators can make informed decisions regarding the suitability of any given video game for classroom use.

Video games were born when a government employee mated a computer at Brookhaven National Laboratory to an oscilloscope (Flatow, 1992). The year was 1955. When the Digital Equipment Corporation introduced a new model in 1962 with a cathode ray tube monitor for output, graduate students quickly began writing games that could be played on the monitor (Juul, 1999). In due course, games made their way into the home, first through the Magnavox Odyssey console, then migrating over to the IBM PC following its debut in 1981. Research interest in video games followed, although computer aided instruction and similar fields seemed to receive more attention. Within time, however, theorists developed a variety of approaches to studying video games.

One approach involved adapting narrative study to video games. This effort seemed to make sense because many advanced games appear to follow a narrative of their own. Don (1990) stated that computers may act as storytellers once did in more primitive times. Efforts to study video games through the lens of narrative studies owe a strong history to prior efforts found in story, film, and drama study. Gee (2003), in his influential book *What video games have to tell us about learning and literacy*, took a narrative approach.

Likewise, the cognitive approach is a popular tack for researchers to take, as they examine the cognitive effects and efficiencies video games have on their users. This seems to be popular among educational researchers trying to ascertain the benefits video games might hold in classroom applications. A wide variety of research efforts focus on the cognitive approach, the most prominent of which include that of Squire and Jenkins (2003). Representation is also an angle of interest for researchers to take. Laurel (1991) is renowned for indicating virtual representations do not need to be highly realistic in order to afford a suspension of disbelief among users. Indeed, since ancient times, audiences have suspended their disbelief while engaged in popular drama with far inferior stage props and special effects than those of today.

In due course, theorists asserted video games were so significantly different from previous media that they warranted a new paradigm for study. From this movement sprang the notion of ludology. While some portions of the underlying taxonomy may still be under development and open to debate, advocates such as Frasca (2001) argue that engaging and interactive elements are more crucial to understanding video games, rather than primarily focusing on their narrative elements. As games become more open-ended, and computer gamers in particular are notably migrating to large persistent worlds which have no “end” for their users to attain, the generic principles of the ludology lens may well become increasingly accepted and promoted in the coming years.

### Video Game Research

Research into the efficacy of using computer games for pedagogical purposes is a particularly interesting one to educators. Teachers are aware that students are interested in video games, and it seems if the interest can be appropriated for educational pursuits, all the better. Much of the more intriguing research carried out in recent years has involved the creation of new

academically-focused video games in order to research their effectiveness. Barab, Thomas, Dodge, Carteaux, and Tuzun (2002) describe the Quest Atlantis project from Indiana University, where students engage in various learning quests both online and off. Dede, Ketelhut, and Ruess (2003) describe the Harvard River City project, a partnership which includes the Smithsonian and George Mason University. The project involves an online world set in America's past with a polluted river. Students investigate the city, exploring digitized artifacts, and report to the mayor their assessment of the ecological damage. Both Quest Atlantis and River City were funded by the National Science Foundation, and are based on the Active Worlds environment, which mimics properties found in commercial MMO games.

More simplistic efforts have sought to find correlations between "drill and kill" practice problems programmed into gaming environments with those in traditional pencil and paper worksheets. One of the more intriguing experiments was carried out by Lee, Luchini, Michael, Norris, and Soloway (2004), who offered a custom designed Game Boy math practice game to second graders. Students in the control group completed traditional paper worksheets. Lee and colleagues noted a threefold increase in problem completion with the experimental group.

Other efforts at creating more complex mathematical video games have occasionally met with less success. A team at Georgia Tech found students disappointed with graphics in the *AquaMOOSE* application, opining that the custom math program did not measure up to current state of the art gaming graphics (Elliott, Adams, & Bruckman, 2002). Researchers have managed to bypass perceived graphical quality issues by modifying commercial games for educational uses. The MIT Media Lab developed *Revolution*, a modification for the Neverwinter Nights' gaming engine, that offers students opportunities for American history role-playing (Squire & Jenkins, 2003).

Another set of researchers have sought to investigate the efficacies of using high quality commercial products for classroom purposes without modifying them at all. Squire's (2004) dissertation remains exemplary among qualitative efforts in this arena to date, studying the use of *Civilization III* in the classroom and other educative settings. Among the more promising features of taking this commercial route, Squire noted minority students felt empowered to bring world dominance in the game to countries traditionally not of industrial significance. In addition, when enthusiasm was sparked, students researched traditional paper sources in an effort to gain an edge in winning the game. This motivation to learn more is one of the key aspects of video games that seems so promising to many educators. Mundane and abstract concepts such as geopolitical clout and national economic issues became real to students involved in games like *Civilization III*. On the down side, Squire spent considerable time connecting the game content to the standards, and he found that time constraints of the school day tended to prevent deep engagement in the game by students. As to be expected with any technology or technique in the classroom, even *Civilization III* (arguably one of the best social studies products available at the time of Squire's research) was not universally beneficial for all students in his study.

#### Recommendations for practitioners

Stipulations for evaluation of video games for pedagogical purposes are slim in the literature. What indicators do exist tend to fall under two separate camps: interaction and utility. Dickey (2005) provides an excellent example of recommendations falling in the interaction camp. Plot combined with interaction, Dickey states, can be appropriated for educational use. She notes elements of the interactive design include settings, roles and characters, action, feedback, and performances. Good design can therefore result in good interaction. Within the utility camp, games often comprise a subset of larger evaluations of instructional software in

general. Deubel (2002) offers one of the better sets of evaluation standards. Several questions Deubel suggested teachers should ask when assessing software specifically for test enhancement include potential for modifications, curriculum alignment, and electronic tracking of progress. Based upon prior recommendations falling within both the interactive camp and the utility camp, it is possible to facilitate a broader set of recommended questions for classroom practitioners to ask when evaluating the potential benefits of instructional video gaming software in the classroom.

*Is the game's cognitive load appropriate for the students?* When dealing with issues of cognitive complexity, a concern exists for the age appropriateness of the software. Simpler titles focusing on lower level thinking skills should probably be reserved for younger children, or those with lower mental capacity (although anecdotal evidence suggests older mentally challenged students dislike “childish” games, and that factor should be taken into consideration when choosing instructional software aimed at their level). A simple addition game, such as what Lee and colleagues (2004) used in their research, was reserved for second grade students. More complex games focusing on higher thinking, and consequently more difficult in nature, should probably be given higher priority with older students.

*Does the game align with the local, state, and national standards the teacher is operating under?* As Squire (2004) realized, aligning a game's content with the required standards is a time consuming endeavor. Games which are popular among educators may have had the alignment done already, either by other educators who have helpfully posted them online, or by the software company. If that is not the case, teachers must undertake the effort themselves, otherwise they will have a difficult time explaining to parents and principals why they are using the software without standards justification.

*Does the game offer problem solving or tasks that are germane to the subject?* Many complex and commercially successful titles offer profound problem solving opportunities within their environments. While these titles may indeed help students to think, teachers will not find correspondingly higher scores on assessments if the problems the students spend time solving are never seen on standardized tests. In many ways, this is the primary consideration against the use of off the shelf computer video games in the classroom. Most were developed for the marketplace first, and classroom considerations are secondary. For this reasons, researchers such as Barab, Thomas, Dodge, Carteaux, and Tuzun (2002), Dede, Ketelhut, and Ruess (2003), and Elliott, Adams, and Bruckman (2002), designed their own educational games. Gredler (2002) notes that in order for games to be useful to educators, they should include significant content rather than trivia.

*Is the gaming environment three dimensional and human-based?* Games that involve three dimensional worlds and the use of avatars, or digital puppets controlled by the users, offer profound opportunities for higher order thinking (Rice, in press). Within such human simulative environments, teaching techniques such as problem-based learning and constructivism can be effectively replicated. Games that do not offer a three dimensional synthetic human environment may have a more difficult time offering simulations of classroom learning activities.

*Is the game training or teaching?* The phrase “video games” covers a broad swath of applications, leading to confusion among practitioners and researchers alike. Is a flight simulator a simulation, a computer game, or both? For the sake of classroom purposes, software used for training is probably not preferable to software designed for educational purposes. Such terms as “training” and “education” can be as equally confusing as using “video games” interchangeably with “simulators.” McLellan (1996) offered assistance in defining characteristics of virtual

reality programs. “Cab simulator” was the term McLellan used to describe environments used to facilitate training on vehicles, machinery, and equipment (p. 462). Such training should be differentiated from pedagogical environments focusing on standardized content students will face on exams.

*Is the game easily customizable by the teacher?* Echoing Deubal’s (2002) concerns, the level of dynamic adaptability of the program will be of paramount importance to teachers who often have to change lessons rapidly in order to meet changing classroom situations. Promising results involving commercial products such as *The Sims* have been reported by Purushotma (2005), who indicates changing the language on the product is a simple registry tweak, making the popular game an instant immersive language learning environment. Additional modifications such as pop-up text in different languages allow users to get help on terms they do not understand within either their native language or a new one. Games which do not allow easy modifications will be rendered less useful to the teacher within practical classroom applications.

### Conclusion

Video games offer an attractive format in which pedagogy can be introduced to students. Due to the commercial appeal of the genre as a whole, appropriation or creation of products for classroom use will require teachers critically examine the products before placing them in front of students. Hopefully the questions offered here will assist in such endeavors. As video games continue to grow in complexity, and as new offerings are prepared for classroom appropriation, new considerations will likewise gain relevance in the future.

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