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LESSONS IN LEARNING

The Video Game Debate: Bad for Behaviour, Good for Learning?

November 18, 2009

In 2001, the Canadian Education Association concluded that "technology has become an accepted fact of life and education." Nearly a decade later, digital technologies continue to evolve rapidly and video games are no exception. While the popularity of video games among children is undeniable, the debate about the risks and benefits of gaming remains unresolved. Increasingly though, research suggests that appropriate use of recreational and educational video games can facilitate learning and the development of important skills.

Video Games are Hugely Popular among Young People

In 2002, Canadian children aged six to 11 accumulated an average of two hours per day of screen time—on a computer, playing video games or watching television. Adolescent children ages 12 to 17 spent nearly three hours per day in front of a screen.[1]

While specific numbers for video game play in Canada are not available, data for the United States is striking. It is estimated that young Americans aged 2 to 18 spend an average of 30 minutes per day playing video and computer games. Among boys aged 8 to 13, the amount of time rises to more than an hour per day.[2] By the time they reach college graduation, students in the U.S. accumulate nearly 10,000 hours of video game playing. That's more than twice the amount of time they spend reading.[3] Reflecting the growing popularity of video games among young people, the American video game industry is booming: sales have quadrupled since 1996 reaching 11.7 billion in 2008.[4]

Do Recreational Video Games Help or Harm?

Video games, played outside the classroom, are often viewed as a waste of time, compromising school work and leading to aggressive behaviour. However, supporters of video games for educational purposes affirm their learning value.

Frequent and unrestricted use of recreational video games may compromise academic performance. Several studies have shown that students of all ages who spend more time playing video games have lower grades than their peers who devote less time to video gaming.[5,6,7,8] This type of correlation should be interpreted cautiously: while research implies that playing video games causes students to perform poorly in school—it could also be the case that students who do poorly in school are more inclined to play video games. Interpretive issues aside, devoting long hours to recreational video game playing clearly does not contribute to academic achievement.

Research on aggression has established a strong link between violent video gaming and aggressive behaviour. For example, a review of 54 studies involving 4,262 participants concluded that playing violent video games increases aggressive thoughts, emotions and behaviours and decreases pro-social behaviours.[9] Studies examining the effects of interventions designed to reduce the amount of time spent playing video games provide further evidence for the link between violent video games and aggressive behaviour. For example, some studies have shown that when students decrease their video game playing time, their aggression levels also decrease.[10]

On the other side of the debate, some experts have found there are positive effects of playing video games, even violent ones. Video game advocate James Paul Gee believes that recreational video games engage players in several "powerful forms of learning" because:

- They engage players in a problem-solving cycle similar to that in experimental science, based on hypothesis, experimentation, deduction and renewed experimentation.
- Players can customize games to suit their learning styles, encouraging creativity (e.g., designing new skate parks in Tony Hawk skateboard games).
- Players are able to view the world through multiple identities.
- Players are encouraged to take risks and try new things.[11]

Other proponents argue that video games engage players in a form of productive play that promotes various forms of co-operative and collaborative learning experiences.[12] Some games (e.g., Civilization, Rise of Nations) require players to learn about social, political and historical development. With many games, players develop skills such as teamwork, information seeking, self-assessment, communication, numeracy and spatial awareness.[13]

A few studies have documented the learning and skills development that can emerge from playing recreational video games. For example, lasting improvements in spatial cognition have been demonstrated among novice players of first-person shooter games.[14] And among training surgeons, video game skill is correlated with laparoscopic surgical skills.[15]

Video game advocates argue that researchers and educators should continue to examine the learning applications of recreational games, including Massively Multiplayer Online Games (MMOGs). These virtual worlds support hundreds of thousands of players, creating social community-oriented experiences where players must communicate effectively to solve problems and achieve their goals. To succeed at MMOGs such as World of Warcraft and The Sims the development and use of critical thinking and literacy skills is essential. [16,17]

The emergence of MMOGs has led researchers to look at how learning takes place within video games rather than being simply derived from it. Digital environments such as those created within MMOGs do not simply enable learning through an array of technological tools, but as a result of interactions within these environments.[18]

Video Games in the Classroom

While unrestricted recreational video gaming may have deleterious effects on academic achievement and aggressive behaviour, educational video games can present a powerful tool for increasing student learning.

Two different categories of instructional video games have been described:[19]

- Tutor/drill-and-practice programs provide information, demonstrate concepts and provide opportunities for practice, and
- Exploratory programs encourage students to explore particular domains of knowledge and to learn through discovery.

Both types of programs are useful teaching tools when used appropriately. The key to success, for teachers and their students, is to match the type of program with the instructional goal. Tutor/drill-and-practice programs can be highly effective for developing and practicing computational skills, but these types of programs are often ineffective when teaching students entirely new material.[20] Exploratory programs are ineffective with younger students who have not yet acquired sufficient background knowledge and self-directed learning skills. However, older students can reap substantial learning benefits using such programs, particularly with respect to acquiring deep, conceptual understanding of complex topics.[21,22]

In some cases, educational video games provide no additional benefit beyond traditional instructional methods.[23,24] In other cases educational video games produce impressively large benefits. For example, some reading instruction tutorial/drill-and-practice programs have been shown to be substantially more effective than regular instruction with respect to developing phonological awareness skills (key pre-literacy skills that help beginning readers break words down into individual sounds), with studies indicating that at least 84% of students exposed to computer-based phonological awareness training outperform their peers exposed to regular instruction.[25]

In mathematics, sixth grade students exposed to computer programs involving the manipulation of two- and three-dimensional shapes while learning about area and volume outperform eighth grade students in problem-solving and understanding geometrical concepts. Even two years later, these students outperform peers not exposed to the computer-based learning.[26]

In social studies, researchers have shown that students acquire and retain far more knowledge when they use multimedia software to complete collaborative projects rather than simply learning about the same topics through their textbooks. Some of the research suggests that 97% of students who engage in exploratory learning with multimedia software will outperform students who learn with just textbooks.[27]

In addition to direct-learning benefits, using educational video games can have indirect benefits by increasing student motivation, collaboration and creativity, and by improving classroom behaviour and dynamics.[28] Studies of video games

used for mathematics learning show that students exposed to computer-based learning experience less anxiety toward mathematics and are more likely to enjoy complex challenges than students who receive traditional classroom instruction.[29]

When using games that allow students to discover new features through their own explorations, teachers report increased collaboration and creativity as students share their discoveries with their classmates and find new ways to explore and exploit the game technology. Teachers also report that classroom behaviour improves when students become particularly engaged in educational games. Providing appropriate games can be powerful classroom tool for encouraging compliance with classroom rules (e.g., scheduling game time first thing in the morning to discourage tardiness).[30, 31]

Video Games in e-Learning

e-Learning (learning conducted via electronic media, especially the internet) was initially introduced within a context of inflated expectations. These expectations were quickly proven to be unfounded and an inevitable disillusionment followed.[32] While many proponents had predicted that e-learning would be markedly more effective than classroom learning, the evidence suggests that e-learning is no better than more traditional forms of learning (though, notably, no worse either).[33] In the workplace, many implementations of e-learning have left users dissatisfied, and—in workplaces, schools, and post-secondary institutions—adoption of e-learning has been much slower than anticipated.[34]

The failure, to date, of e-learning to meet initially high expectations is unlikely to be the result of the medium itself. Rather, it likely results from the ways in which e-learning is often used, or misused. The promise of e-learning rests in the power of multimedia for dynamic and interactive representations of information. When e-learning consists of traditional course materials that are simply transferred onto the internet, there is little chance that learners will be particularly engaged by the material. Similarly, when known principles of multimedia learning are violated (e.g., learners cannot focus on both text and graphics at the same time, but are often called upon to do so by poorly designed e-learning programs), e-learning cannot hope to be effective.

The embedding of video games and simulations within e-learning experiences is one way of improving the learning potential of those experiences. Games and simulations foster conditions for successful learning by: demonstrating rather than simply describing information; allowing learners to apply newly acquired knowledge and skills; engaging learners in relevant tasks that unfold over the course of learning; and providing feedback contingent on the degree to which learners are able to demonstrate their newly acquired knowledge or skill.[35]

Lessons in Learning: Limiting the Risks and Maximizing the Benefits

Recreational Video Games

Parents can take comfort knowing that moderate amounts of recreational non-violent gaming can be beneficial or at least harmless. However, they should also recognize that unrestricted access and overuse of all types of video games can put academic achievement at risk and lead to increased aggression. When parents limit violent video-game play, their children have higher academic achievement and display lower levels of aggression (e.g., fewer fights with peers and arguments with teachers).[36] Schools can also play a role in helping children limit their recreational video-game playing. For example, in intervention studies in which school children receive classroom instruction designed to help them reduce their television viewing and video-game playing, students report decreasing amounts of screen time and exhibit decreasing levels of aggression.[37]

Educational Video Games

Incorporating computer games into the classroom can be appealing to both students and teachers: students generally enjoy and are motivated by computer games and teachers benefit from the richness of the resources provided by high-quality games.[38] Using computer technology and video games to enhance classroom learning remains a challenge for many teachers, who can be wary of unreliable or unfamiliar technology.[39] Their time is scarce and any time spent dealing with technical problems and learning how to use new software often means less time devoted to classroom instruction. It is important, therefore, to maximize the effectiveness of educational video games.

Select commercial video games which support educational content

Age of Empires

A popular PC gaming franchise which facilitates an interest in history.

Rome: Total War

The player assumes the role of a leading citizen of Rome, managing armies, cities and economies giving users an in-depth glimpse into ancient Roman customs and military history.

SIM City

A top selling PC game franchise which has been used from kindergarten to post-secondary to teach urban planning.

The SIMS

A household simulation game which attracts more women than men. It allows players to practice and learn about family dynamics, architecture and interior design.

To be effective, educational video games should address a specific problem or teach a specific skill. By extension, video games need to be used selectively, based on teachers' objectives and students' maturity and skill level.[40] Appropriate teacher training and professional development are critical to the successful implementation of educational video games. Students of teachers with more than 10 hours of training significantly outperform students of teachers with five or fewer training hours.[41] In addition, four design characteristics that affect student learning have been identified:[42]

- Instructional control: Students learn more effectively when they, rather than the computer program, control the learning conditions (e.g., pacing, difficulty level).
- Feedback: Students learn more effectively when they receive feedback on their performance. Feedback is especially helpful when the underlying causes of errors are reported along with correctness of answers.[43]
- Cognitive strategies: Learning is facilitated when cognitive strategies (e.g., repetition, rehearsal, paraphrasing, drawing analogies) are embedded in the computer program.
- Animated graphics: Achievement is increased and necessary time on task is reduced when animated graphics are used in educational software.

Teachers who have successfully integrated educational video games into their classrooms value the following design elements: [44]

- The ability to save an individual student's work and record progress at each stage of the game;
- Options for introducing variety to prevent boredom and to accommodate the needs of different students;
- Suitable stopping points in long games to avoid dissatisfaction with an unfinished game; and
- Operating systems that do not require lengthy instructions (especially for young users).

Teachers can consult Playing to Learn, a comprehensive guide to more than 100 video-game activity ideas for students in grades four to 12. The guide addresses a range of subjects from language arts, to geography and visual arts. Included is a discussion by scholars and journalist on the merits and limitation of using video games as a teaching strategy.

Conclusion

The tremendous popularity of video games means they have enormous potential as learning tools that capture students' attention and fire their imaginations. Harnessing that potential requires careful attention to design features and appropriate training for teachers. The understanding of links between video games and learning is still very much at a nascent stage both with regards to game design and effective delivery.[45] As video games in education are gaining attention, it becomes more and more critical to understand why and how games can affect students.

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