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Dr Mark Griffiths is Professor of Gambling Studies in the Psychology Division, Nottingham Trent University.

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The educational benefits of videogames

Videogames have great positive potential in addition to their entertainment value and there has been considerable success when games are designed to address a specific problem or to teach a certain skill.

Most reported effects of videogames - particularly in the popular press - appear to centre upon the alleged negative consequences. These have included my own research into video game addiction,^{1,2} increased aggressiveness,³ and the various medical and psychosocial effects.⁴ However, there are many references to the positive benefits of videogames in the literature.^{5,6} Research dating right back to the early 1980s has consistently shown that playing computer games (irrespective of genre) produces reductions in reaction times, improved hand-eye co-ordination and raises players' self-esteem. What's more, curiosity, fun and the nature of the challenge also appear to add to a game's educational potential.⁷ This paper briefly overviews some of the educational benefits of videogame playing.

Videogames as educational research tools

Videogames can clearly consume the attention of children and adolescents.⁸ However, it is important to assess the extent that videogame technology had an impact on childhood education. Since videogames have the capacity to engage children in learning experiences, this has led to the rise of "edu-tainment" media. Just by watching children it becomes very clear that they prefer this type of approach to learning. However, it appears that very few games on the commercial market have educational value.

Some evidence suggests that important skills may be built or reinforced by videogames. For example, spatial visualization ability (i.e., mentally, rotating and manipulating two- and three-dimensional objects) improve with video game playing.⁹ Videogames were also more effective for children who started out with relatively poor skills. It has also been suggested that videogames may be useful in equalizing individual differences in spatial skill performance. For over 20 years researchers have been using videogames as a means of researching individuals. Many of these reasons also provide an insight as to why they may be useful educationally. For instance :

- ▷ Videogames can be used as research and/or measurement tools. Furthermore, as research tools they have great diversity
- ▷ Videogames attract participation by individuals across many demographic boundaries (e.g., age, gender, ethnicity, educational status)
- ▷ Videogames can assist children in setting goals, ensuring goal rehearsal, providing feedback, reinforcement, and maintaining records of behavioural change
- ▷ Videogames can be useful because they allow the researcher to measure performance on a very wide variety of tasks, and can be easily changed, standardized and understood
- ▷ Videogames can be used when examining individual characteristics such as self-esteem, self-concept, goal-setting and individual differences
- ▷ Videogames are fun and stimulating for participants.

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Consequently, it is easier to achieve and maintain a person's undivided attention for long periods of time.¹⁰ Because of the fun and excitement, they may also provide an innovative way of learning

- ▷ Videogames can provide elements of interactivity that may stimulate learning
- ▷ Videogames also allow participants to experience novelty, curiosity and challenge. This may stimulate learning
- ▷ Videogames equip children with state-of-the art technology. This may help overcome technophobia (a condition well-known among many adults). Over time it may also help eliminate gender imbalance in IT use (as males tend to be more avid IT users)
- ▷ Videogames may help in the development of transferable IT skills
- ▷ Videogames can act as simulations. These allow participants to engage in extraordinary activities and to destroy or even die without real consequences
- ▷ Videogames may help adolescents regress to childhood play (because of the ability to suspend reality in videogame playing).

There of course some disadvantages to researching videogames in an educational context. For instance :

- ▷ Videogames cause participants to become excited and therefore produce a whole host of confounding variables such as motivation and individual skill¹¹
- ▷ Videogame technology has rapidly changed across time. Therefore, videogames are constantly being upgraded which makes it hard to evaluate educational impact across studies
- ▷ Videogame experience and practice may enhance a participant's performance on particular games, which may skew results

Despite the disadvantages, it would appear that videogames (in the right context) may be a facilitatory educational aid.

Videogames and the development of skills among special need groups

Videogames have been used in comprehensive programmes to help develop social skills in children and adolescents who are severely retarded or who have severe developmental problems like autism.^{12,13} Case studies such as those by Demarest¹⁴ are persuasive. Demarest's account of her own autistic 7-year old son reported that although he had serious deficiencies in language and understanding, and social and emotional difficulties, videogame playing was one activity he was able to excel. This was ego-boosting for him and also had a self-calming effect. Videogames provided the visual

patterns, speed and storyline that help children's basic skills development. Some of the therapeutic benefits Demarest outlined were language skills, mathematics and reading skills, and social skills.

Language skills

These included videogame play being able to facilitate (i) discussing and sharing, (ii) following directions (understanding prepositions etc.), (iii) giving directions, (iv) answering questions, and (v) having a discussion topic with visual aides to share with others.

Basic maths skills

These included videogame playing promoting basic maths skills as children learn to interact with the score counters on videogames.

Basic reading skills

These included videogames' character dialogue which are printed on the screen ('Play', 'Quit', 'Go', 'Stop', 'Load' etc.).

Social skills

Videogames provided an interest that was popular with other children makes talking and playing together so much easier. At school there are always other children who share a passion for videogame play.

Horn¹⁵ used videogames to train three children with multiple handicaps (e.g., severely limited vocal speech acquisition) to make scan and selection responses. These skills were later transferred to a communication device. Other researchers have used videogames to help learning disabled children in their development of spatial abilities,¹⁶ problem-solving exercises¹⁷ and mathematical ability.¹⁸ Other researchers have offered comments on how best to use computer technology for improved achievement and enhanced motivation among the learning disabled.^{19,20}

There are now a few studies that have examined whether videogames might be able to help in the treatment of another special needs group - children with impulsive and attentional difficulties. Kappes²¹ tried to reduce impulsivity in incarcerated juveniles (ages 15 to 18 years) by providing either biofeedback or experience with a videogame. Impulsivity scores improved for both conditions. Improvement was also noted in negative self-attributions and in internal locus of control. The authors concluded that most likely explanation for the improvement in both experimental conditions was the immediate feedback. Clarke²² also used videogames to

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help adolescents learn impulse control. A videogame was used for four weeks with four subjects (11 to 17 years) diagnosed with impulse control problems. After the experimental trial, the participants became more enthusiastic and co-operative about treatment.

Brain-wave biofeedback

New (as yet unpublished) research²³ suggests videogames linked to brain-wave biofeedback may help children with attention deficit disorders. Biofeedback teaches patients to control normally involuntary body functions such as heart rate by providing real-time monitors of those responses. With the aid of a computer display, attention-deficit patients can learn to modulate brain waves associated with focusing. With enough training, changes become automatic and lead to improvements in grades, sociability, and organizational skills. Following on from research involving pilot attentiveness during long flights, a similar principle has been developed to help attention-deficit children stay focused by rewarding an attentive state of mind. This has been done by linking biofeedback to commercial videogames.

In their trial, Pope²⁴ selected half a dozen 'Sony PlayStation' games and tested 22 girls and boys between the ages of 9 and 13 who had attention deficit disorder. Half the group got traditional biofeedback training, the other half played the modified video games. After 40 one-hour sessions, both groups showed substantial improvements in everyday brain-wave patterns as well as in tests of attention span, impulsiveness, and hyperactivity.

Parents in both groups also reported that their children were doing better in school. The difference between the two groups was motivation. The video-game group showed fewer no-shows and no dropouts. The researchers do warn that the 'wrong kinds of videogame' may be detrimental to children with attention disorders. For instance, 'shoot 'em up' games may have a negative effect on children who already have a tendency toward short attention and impulsivity. They also state that the technique is an adjunct to drug therapy and not a replacement for it.

Videogames and health care

Videogames have also been used to improve children's health care. Several games have been developed specifically for children with chronic medical conditions. One of the best-studied is an educational game called 'Packy and Marlon'.²⁵ This game was designed to improve self-care skills and medical

compliance in children and adolescents with diabetes. Players assume the role of characters who demonstrate good diabetes care practices while working to save a summer camp for children with diabetes from rats and mice who have stolen the supplies. 'Packy and Marlon' is now available through 'Click Health' (www.clickhealth.com), along with two additional health-related software products, 'Bronkie the Bronchiasaurus' (for asthma self-management) and 'Rex Ronan' (for smoking prevention).

In a controlled study using 'Packy and Marlon',²⁶ 8- to 16-year olds were assigned to either a treatment or control group. All participants were given a 'Super Nintendo' game system. The treatment group was given 'Packy and Marlon' software, while the control subjects received an entertainment videogame. In addition to more communication with parents and improved self-care, the treatment group demonstrated a significant decrease in urgent medical visits.

Rehabilitation

There are also several case reports describing the use of videogames for rehabilitation. In one application, an electronic game was used to improve arm control in a 13 year old boy with Erb's palsy.²⁷ The authors concluded that the game format capitalized on the child's motivation to succeed in the game and focused attention away from potential discomfort.

Electronic games have also been used to enhance adolescents' perceived self-efficacy in HIV/AIDS prevention programs.²⁸ Using a time travel adventure game format, information and opportunities for practice discussing prevention practices were provided to high-risk adolescents. Game-playing resulted in significant gains in factual information about safe sex practices, and in the participants' perceptions of their ability to successfully negotiate and implement such practices with a potential partner.

Concluding remarks

It is vital that we continue to develop the positive potential of videogames while remaining aware of possible unintended negative effects when game content is not prosocial. At the present time, the most popular games are usually violent. Given current findings, it is reasonable to be concerned about the impact of violent games on some children and adolescents. Game developers need support and encouragement to put in the additional effort necessary to develop interesting games which do not rely heavily on violent actions.

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Relationships between playing violent electronic games and negative behaviors and emotions may never be proven to be causal by the strictest standard of “beyond a reasonable doubt,” but many believe that we have already reached the still-compelling level of “clear and convincing evidence.”

Finally, most parents would probably support the use of videogames if they were sure they helped their children learn about school subjects. There are several elements which the teacher, parent, or facilitator should evaluate when choosing a health promoting/educational or helping videogame (adapted from Funk²⁹).

- ▷ **Educational or therapeutic objective.** The objective of the game should be clear. Professional helpers and developers should have a known goal in mind for the players of the game. The outcomes they are seeking should be clear to the teacher and to the player
- ▷ **Type of game.** There are many types of activity content : games, puzzles, mazes, play, fantasy/adventure, simulations, and simulation games. Some games require physical skill and strategy, while others are games of chance. Some videogames are board or adventure game, while others involve simulation involving real events or fantasy. No evidence supports a greater therapeutic or educational effect in either situation
- ▷ **Required level and nature of involvement.** The evaluator should assess whether the videogame player is passive or active. In some games, the computer plays the game while the participant watches the results. In computer-moderated games, the computer provides the environment for the game to occur and presents decisions or questions to the player at key points during the game. The computer then reveals the consequences of the decisions made by the player
- ▷ **Information and rules.** Some games allow the player to have a range of knowledge and information about past experiences with the game. Others provide minimal amounts of information to the player. Part of the strategy may involve the player's response to this lack of information. Rules and player participation in setting rules may vary among games
- ▷ **The role of luck.** Some games are driven by chance. It is assumed that the greater the influence of chance in the working of the game, the less educational and therapeutic in nature. However, some players prefer games of chance over games of strategy
- ▷ **Difficulty.** Some games allow the player to choose the difficulty level. Others adjust difficulty level based on the progression of the player. This approach allows the game to become progressively more interesting as it becomes more challenging

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- ▷ **Competition.** Many games build in competition. Some players are attracted by competition. Teachers may wish to examine if the competition is presented in such a way that all can win and that one does not win at the expense of all others
- ▷ **Duration.** Some games have very short duration, while others may go on at length. Making of user rewards, personal challenges, or changes in color or graphical surroundings to maintain interest some games can hold player interest for long periods of time
- ▷ **Participant age and characteristics.** Computerized games have been developed for a range of ages. It assumes that the participant can understand the rules of the game and has the skill level to accomplish the motor aspects of playing the game. Some games allow for modification of text to meet the needs of poorly sighted players
- ▷ **Number of players.** Some videogames are solitary in nature. Others pit players against each other or the computer. Solitary games may meet the needs of those who find group work difficult
- ▷ **Facilitator's role.** In some videogames, the teacher or facilitator merely observes. In others, the facilitator may be an important part of the game format
- ▷ **Setting.** Fully prepare staff to integrate these games into the curriculum. Without proper acceptance, the games may be used primarily as a game or toy rather than as a therapeutic or educational tool

Videogame technology brings new challenges to the education arena. Videogames represent one technique that may be available to the classroom teacher. Care should be taken that enthusiastic use of this technique does not displace other more effective techniques. Video and computer-based games may possess advantages not present in other learning strategies. For example, the ability to choose different solutions to a difficult problem and then see the effect those decisions have on a fictional game allows students to experiment with problem-solving in a relative safe environment.

Videogames have great positive potential in addition to their entertainment value. There has been considerable success when games are specifically designed to address a specific problem or to teach a certain skill. However, generalizability outside the game-playing situation remains an important research question. What is also clear from the empirical literature is that the negative consequences of playing almost always involve people who were excessive users of videogames. From prevalence studies in this area, there is little evidence of serious acute adverse effects on health from moderate play. Adverse effects are likely to be relatively minor, and temporary, resolving

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spontaneously with decreased frequency of play, or to affect only a small subgroup of players. Excessive players are the most at-risk from developing health problems although more research appears to be much needed.

References

- 1 Griffiths, M.D. & Hunt, N. (1995). Computer game playing in adolescence : Prevalence and demographic indicators. *Journal of Community and Applied Social Psychology*, 5, 189-194.
- 2 Griffiths, M.D. & Hunt, N. (1998). Dependence on computer game playing by adolescents. *Psychological Reports*, 82, 475-480.
- 3 Griffiths, M.D. (1998). Video games and aggression : A review of the literature. *Aggression and Violent Behavior*, 4, 203-212.
- 4 Griffiths, M.D. (1996). Computer game playing in children and adolescents : A review of the literature. In T. Gill (Ed.), *Electronic Children : How Children Are Responding To The Information Revolution*. pp.41-58. London : National Children's Bureau.
- 5 Lawrence, G.H. (1986). Using computers for the treatment of psychological problems. *Computers in Human Behavior*, 2, 43-62.
- 6 Griffiths, M.D. (1997). Video games and clinical practice : Issues, uses and treatments. *British Journal of Clinical Psychology*, 36, 639-641.
- 7 op cit (above, n.1)
- 8 Malone, T.W. (1981). Toward a theory of intrinsically motivated instruction. *Cognitive Science*, 4, 333-369
- 9 Subrahmanyam, K. & Greenfield, P. (1994). Effect of video game practice on spatial skills in boys and girls. *Journal of Applied Developmental Psychology*, 15, 13-32.
- 10 Donchin, E. (1995). Video games as research tools: The Space Fortress game. *Behavior Research Methods, Instruments, & Computers*, 27, 217-223.
- 11 Porter, D.B. (1995). Computer games: Paradigms of opportunity. *Behavior Research Methods, Instruments, & Computers* 27 (2), 229-234.
- 12 Gaylord-Ross, R.J., Haring, T.G., Breen, C. & Pitts-Conway, V. (1984). The training and generalization of social interaction skills with autistic youth. *Journal of Applied Behaviour Analysis*, 17, 229.
- 13 Sedlak, R. A., Doyle, M. and Schloss, P. (1982) "Video Games - a Training and Generalization Demonstration with Severely Retarded Adolescents", *Education and Training in Mental Retardation and Developmental Disabilities*, 17 (4), pp.332-336.
- 14 Demarest, K. (2000). Video games – What are they good for? Located at:<http://www.lesstutor.com/kd3.html>
- 15 Horn, E., Jones, H.A. & Hamlett, C. (1991). An investigation of the feasibility of a video game system for developing scanning and selection skills. *Journal for the Association for People With Severe Handicaps*, 16, 108-115.
- 16 Masendorf, F. (1993). Training of learning disabled children's spatial abilities by computer games. *Zeitschrift fur Pädagogische Psychologie*, 7, 209-213.
- 17 Hollingsworth, M. & Woodward, J. (1993). Integrated learning : Explicit strategies and their role in problem solving instruction for students with learning disabilities. *Exceptional Children*, 59, 444-445.
- 18 Okolo, C. (1992a). The effect of computer-assisted instruction format and initial attitude on the arithmetic facts proficiency and continuing motivation of students with learning disabilities. *Exceptionality*, 3, 195-211.
- 19 Blechman, E. A., Rabin, C., McEnroe, M. J. (1986). *Family Communication and Problem Solving with Boardgames and Computer Games*. In C. E. Schaefer & S. E. Reid (Ed.), *GAME PLAY: Therapeutic Use of Childhood Games* pp. 129-145. New York, NY: John Wiley & Sons.
- 20 Okolo, C. (1992b). Reflections on "The effect of computer-assisted instruction format and initial attitude on the arithmetic facts proficiency and continuing motivation of students with learning disabilities". *Exceptionality*, 3, 255-258.
- 21 Kappes, B. M., & Thompson, D. L. (1985). Biofeedback vs. video games: Effects on impulsivity, locus of control and self-concept with incarcerated individuals. *Journal of Clinical Psychology*, 41, 698-706.
- 22 Clarke, B. & Schoech, D. (1994). A computer-assisted game for adolescents : Initial development and comments. *Computers in Human Services*, 11(1-2), 121-140.
- 23 Wright, K. (2001). Winning brain waves : Can custom-made video games help kids with attention deficit disorder? *Discover*, 22. Located at http://www.discover.com/mar_01/featworks.html
- 24 Pope, A. & Palsson, O. In Wright, K. (2001). Winning brain waves : Can custom-made video games help kids with attention deficit disorder? *Discover*, 22. Located at http://www.discover.com/mar_01/featworks.html
- 25 Brown, S. J., Lieberman, D. A., Gerneny, B. A., Fan, Y. C., Wilson, D. M., & Pasta, D. J. (1997). Educational video game for juvenile diabetes: Results of a controlled trial. *Medical Informatics* 22, 77-89.
- 26 ibid
- 27 Krichevets, A.N., Sirotkina, E.B., Yevsevicheva, I.V. & Zeldin, L.M. (1994). Computer games as a means of movement rehabilitation. *Disability and Rehabilitation : An International Multidisciplinary Journal*, 17, 100-105.
- 28 Thomas, R., Cahill, J., & Santilli, L. (1997). Using an interactive computer game to increase skill and self-efficacy regarding safer sex negotiation: Field test results. *Health Education and Behavior*, 24, 71-86.
- 29 Funk, J.B., Germann, J.N. & Buchman, D.D. (1997). Children and electronic games in the United States. *Trends in Communication*, 2, 111-126.