

2 **The educational benefits of videogames**

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

12 **Videogames as educational research tools**

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

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

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

38  
39 Consequently, it is easier to achieve and maintain a person's undivided attention for long  
40 periods of time.<sup>10</sup> Because of the fun and excitement, they may also provide an innovative way  
41 of learning

- 42  
43 • Videogames can provide elements of interactivity that may stimulate learning

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

54 There of course some disadvantages to researching videogames in an educational con-text. For  
55 instance:

- 56 • Videogames cause participants to become excited and therefore produce a whole host  
57 of confounding variables such as motivation and individual skill<sup>11</sup>
- 58 • Videogame technology has rapidly changed across time. Therefore, videogames are  
59 constantly being upgraded which makes it hard to evaluate educational impact across  
60 studies
- 61 • Videogame experience and practice may enhance a participant's performance on  
62 particular games, which may skew results

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

### 65 **Videogames and the development of skills among special need groups**

66 Videogames have been used in comprehensive programmes to help develop social skills in  
67 children and adolescents who are severely retarded or who have severe developmental problems  
68 like autism.<sup>12,13</sup> Case studies such as those by Demarest<sup>14</sup> are persuasive. Demarest's account  
69 of her own autistic 7-year old son reported that although he had serious deficiencies in language  
70 and understanding, and social and emotional difficulties, videogame playing was one activity  
71 he was able to excel. This was ego-boosting for him and also had a self-calming effect.  
72 Videogames provided the visual patterns, speed and storyline that help chil- dren's basic skills  
73 development. Some of the therapeutic benefits Demarest outlined were language skills,  
74 mathematics and reading skills, and social skills.

#### 75 *Language skills*

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

#### 79 *Basic maths skills*

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

#### 82 *Basic reading skills*

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

### 85 *Social skills*

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

89 Horn<sup>15</sup> used videogames to train three children with multiple handicaps (e.g., severely limited  
90 vocal speech acquisition) to make scan and selection responses. These skills were later  
91 transferred to a communication device. Other researchers have used videogames to help  
92 learning disabled children in their development of spatial abilities,<sup>16</sup> problem-solving exer-  
93 cises<sup>17</sup> and mathematical ability.<sup>18</sup> Other researchers have offered comments on how best to  
94 use computer technology for improved achievement and enhanced motivation among the  
95 learning disabled.<sup>19,20</sup>

96 There are now a few studies that have examined whether videogames might be able to help in  
97 the treatment of another special needs group - children with impulsive and attentional  
98 difficulties. Kappes<sup>21</sup> tried to reduce impulsivity in incarcerated juveniles (ages 15 to 18 years)  
99 by providing either biofeedback or experience with a videogame. Impulsivity scores improved  
100 for both conditions. Improvement was also noted in negative self-attributions and in internal  
101 locus of control. The authors concluded that most likely explanation for the improvement in  
102 both experimental conditions was the immediate feedback. Clarke<sup>22</sup> also used videogames to  
103 help adolescents learn impulse control. A videogame was used for four weeks with four subjects  
104 (11 to 17 years) diagnosed with impulse control problems. After the experimental trial, the  
105 participants became more enthusiastic and co-operative about treatment.

### 106 **Brain-wave biofeedback**

107 New (as yet unpublished) research<sup>23</sup> suggests videogames linked to brain-wave biofeedback  
108 may help children with attention deficit disorders. Biofeedback teaches patients to control  
109 normally involuntary body functions such as heart rate by providing real-time monitors of those  
110 responses. With the aid of a computer display, attention-deficit patients can learn to modulate  
111 brain waves associated with focusing. With enough training, changes become automatic and  
112 lead to improvements in grades, sociability, and organizational skills. Following on from  
113 research involving pilot attentiveness during long flights, a similar principle has been developed  
114 to help attention-deficit children stay focused by rewarding an attentive state of mind. This has  
115 been done by linking biofeedback to commercial videogames.

116 In their trial, Pope<sup>24</sup> selected half a dozen 'Sony PlayStation' games and tested 22 girls and  
117 boys between the ages of 9 and 13 who had attention deficit disorder. Half the group got  
118 traditional biofeedback training, the other half played the modified video games. After 40 one-  
119 hour sessions, both groups showed substantial improvements in everyday brain-wave patterns  
120 as well as in tests of attention span, impulsiveness, and hyperactivity.

121 Parents in both groups also reported that their children were doing better in school. The  
122 difference between the two groups was motivation. The video-game group showed fewer no-  
123 shows and no dropouts. The researchers do warn that the 'wrong kinds of videogame' may be

124 detrimental to children with attention disorders. For instance, ‘shoot ‘em up’ games may have  
125 a negative effect on children who already have a tendency toward short attention and  
126 impulsivity. They also state that the technique is an adjunct to drug therapy and not a  
127 replacement for it.

## 128 **Videogames and health care**

129 Videogames have also been used to improve children’s health care. Several games have been  
130 developed specifically for children with chronic medical conditions. One of the best-studied is  
131 an educational game called ‘Packy and Marlon’.<sup>25</sup> This game was designed to improve self-  
132 care skills and medical

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

139 In a controlled study using ‘Packy and Marlon’,<sup>26</sup> 8- to 16-year olds were assigned to either a  
140 treatment or control group. All participants were given a ‘Super Nintendo’ game system. The  
141 treatment group was given ‘Packy and Marlon’ software, while the control sub- jects received  
142 an entertainment videogame. In addition to more communication with parents and improved  
143 self-care, the treatment group demonstrated a significant decrease in urgent medical visits.

## 144 **Rehabilitation**

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

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

## 155 **Concluding remarks**

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

162 Relationships between playing violent electronic games and negative behaviors and emotions  
163 may never be proven to be causal by the strictest standard of “beyond a reasonable doubt,” but

164 many believe that we have already reached the still-compelling level of “clear and convincing  
165 evidence.”

166 Finally, most parents would probably support the use of videogames if they were sure they  
167 helped their children learn about school subjects. There are several elements which the teacher,  
168 parent, or facilitator should evaluate when choosing a health promoting/educational or helping  
169 videogame (adapted from Funk<sup>29</sup>).

- 170 • **Educational or therapeutic objective.** The objective of the game should be clear.  
171 Professional helpers and developers should have a known goal in mind for the players  
172 of the game. The outcomes they are seeking should be clear to the teacher and to the  
173 player
- 174 • **Type of game.** There are many types of activity content: games, puzzles, mazes, play,  
175 fantasy/adventure, simulations, and simulation games. Some games require physical  
176 skill and strategy, while others are games of chance. Some videogames are board or  
177 adventure game, while others involve simulation involving real events or fantasy. No  
178 evidence supports a greater therapeutic or educational effect in either situation
- 179 • **Required level and nature of involvement.** The evaluator should assess whether the  
180 videogame player is passive or active. In some games, the computer plays the game  
181 while the participant watches the results. In computer-moderated games, the computer  
182 provides the environment for the game to occur and presents decisions or questions to  
183 the player at key points during the game. The computer then reveals the consequences  
184 of the decisions made by the player
- 185 • **Information and rules.** Some games allow the player to have a range of knowledge  
186 and information about past experiences with the game. Others provide minimal amounts  
187 of information to the player. Part of the strategy may involve the player’s response to  
188 this lack of information. Rules and player participation in setting rules may vary among  
189 games
- 190 • **The role of luck.** Some games are driven by chance. It is assumed that the greater the  
191 influence of chance in the working of the game, the less educational and therapeutic in  
192 nature. However, some players prefer games of chance over games of strategy
- 193 • **Difficulty.** Some games allow the player to choose the difficulty level. Others adjust  
194 difficulty level based on the progression of the player. This approach allows the game  
195 to become progressively more interesting as it becomes more challenging
- 196 • **Competition.** Many games build in competition. Some players are attracted by  
197 competition. Teachers may wish to examine if the competition is presented in such a  
198 way that all can win and that one does not win at the expense of all others
- 199 • **Duration.** Some games have very short duration, while others may go on at length.  
200 Making of user rewards, personal challenges, or changes in color or graphical  
201 surroundings to maintain interest some games can hold player interest for long periods  
202 of time
- 203 • **Participant age and characteristics.** Computerized games have been developed for a  
204 range of ages. It assumes that the participant can understand the rules of the game and  
205 has the skill level to accomplish the motor aspects of playing the game. Some games  
206 allow for modification of text to meet the needs of poorly sighted players
- 207 • **Number of players.** Some videogames are solitary in nature. Others pit players against  
208 each other or the computer. Solitary games may meet the needs of those who find group  
209 work difficult

- 210 • **Facilitator's role.** In some videogames, the teacher or facilitator merely observes. In  
211 others, the facilitator may be an important part of the game format
- 212 • **Setting.** Fully prepare staff to integrate these games into the curriculum. Without proper  
213 acceptance, the games may be used primarily as a game or toy rather than as a  
214 therapeutic or educational tool

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

222 Videogames have great positive potential in addition to their entertainment value. There has  
223 been considerable success when games are specifically designed to address a specific prob- lem  
224 or to teach a certain skill. However, generalizability outside the game-playing situ- ation  
225 remains an important research question. What is also clear from the empirical literature is that  
226 the negative consequences of playing almost always involve people who were exces- sive users  
227 of videogames. From prevalence studies in this area, there is little evidence of serious acute  
228 adverse effects on health from moderate play. Adverse effects are likely to be relatively minor,  
229 and temporary, resolving spontaneously with decreased frequency of play, or to affect only a  
230 small subgroup of players. Excessive players are the most at-risk from developing health  
231 problems although more research appears to be much needed.

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