

Computer Game Interventions for Individuals with FASD

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Issue:

Fetal Alcohol Spectrum Disorder (FASD) is an umbrella term used to describe the range of disabilities and diagnoses that can result from prenatal exposure to alcohol. Intervention and treatment options for individuals with FASD are both costly and resource-intensive because they are tailored to the client. Computer game interventions present a novel approach to interventions that may help mitigate the effects of brain injury associated with FASD.

Background:

An extensive body of research has documented major cognitive, behavioural, adaptive, social, and emotional impairments among individuals with FASD¹⁻³. Without an early diagnosis and the implementation of intervention programs, these individuals are at an increased risk of developing significant secondary challenges, such as mental health issues and conflicts with the criminal justice system⁴. Unfortunately, the development, evaluation, and dissemination of evidence-based interventions for alcohol-exposed individuals are lagging⁵. Because of the persistent nature of the impairments associated with prenatal exposure to alcohol, there is a need for interventions that can assist individuals throughout the lifespan.

Computer Game Interventions¹ for FASD:

Several researchers have been exploring the utility of gaming platforms as a novel approach to managing and improving the symptoms associated with FASD. The use of games has the added advantage of engaging individuals in repeated and challenging activities, with sufficient motivation to potentially improve cognitive abilities. Importantly, these gaming interventions can be delivered in a safe environment that allows students to learn from their mistakes without judgment or penalty.

Computerized Progressive Attention Training (CPAT)

The CPAT program is an intervention that targets attention⁶. Task difficulty automatically adjusts based on the participant's performance. After completing the

¹ It is important however to recognize that not all computer/video games can be used as an intervention.

intervention, children with FASD revealed significant improvements on several measures of attention, including sustained attention and selective attention. In addition, several measures of spatial working memory, math fluency, and reading fluency were also significantly improved, suggesting that better attention leads to better cognitive performance.

Virtual Worlds

Children with FASD are at an increased risk for injuries, however, it is often challenging for parents and educators to teach them the safety skills they need⁷. In sample of children with FASD, fire and street safety was taught using computer games that employed "virtual worlds". After playing the game until mastery, children showed significantly better knowledge of the targeted safety skills. These results suggest that computerized virtual world programs may provide an effective method for teaching safety skills to high-risk children who have learning difficulties.

Cognitive Carnival

The "Cognitive Carnival" game provides training for attention, working memory and inhibitory control⁸. This "game" is comprised of three mini games that require either higher levels of sustained attention or working memory to succeed. Students were encouraged to respond, even if they were unsure, as they were encouraged to learn from their mistakes in a safe environment that is free from judgment, ridicule or a grading system. Children and adolescents with FASD revealed improvements on tasks of memory, attention and inhibition following a 12-week intervention. Brain scans pre- and post-intervention also revealed differences that provided evidence for physical changes to the brain. Finally, children and adolescents learned specific strategies to improve their executive function performance.

Caribbean Quest

The "Caribbean Quest" game was developed based on the "Cognitive Carnival" platform and designed to improve memory and attention in children with FASD⁹. By practicing six different tasks, children exercised various attention and working memory processes within an adaptive and rewarding environment. The games were developed to increase and decrease in difficulty based on the child's unique performance, enabling every child to play the game with success. After implementing this tool in schools, through training of educational assistants, preliminary data suggest that students will experience similar positive outcomes compared to Cognitive Carnival. Furthermore, the effects of this intervention are currently under evaluation, and if found to maintain successful outcomes, this approach will represent a feasible and cost-effective school-based intervention.

Neurofeedback Gaming

Another novel approach to gaming interventions for children with FASD has incorporated the principles of neurofeedback¹⁰. In this approach, popular video games have been adapted to explore whether children with FASD can develop techniques to

alter their patterns of thinking and overcome certain neurological deficiencies. This research is driven by the concept of neuroplasticity, which is the idea that the brain is malleable and can be changed through experience and training (neurofeedback). Children wear special headsets (electrodes) that monitor patterns of brain activity in real-time. Based on this information, which indicates whether a child is starting to become excited, anxious, or less focused, the video games can be manipulated as to how they appear on screen based on the child's brain activity.

Collectively these interventions, although still in the research phase, hold significant promise for addressing many of the complex neurological challenges associated with FASD. Importantly, these interventions can be easily customized to meet the needs of each individual and can adjust for changes in brain function that may occur across the lifespan. Interestingly, continuous, repetitious exercises (as in gaming interventions) that improve attention and working memory can translate into improvements in general intelligence, reading, mathematics, and overall reaction time.

In the future, interventions that build on these concepts and are aimed at improving cognitive function and reducing the likelihood of risky behaviours (e.g., alcohol and drug use) would be especially important for alcohol-exposed teens. Programs that are designed to teach "life skills" (i.e., to live and function independently) would also be highly advantageous to the FASD population as they transition to adulthood. Finally, many of these novel computer game interventions could have wider clinical application for individuals with traumatic brain injury, learning disabilities or other neurodevelopmental disorders.

Recommendations:

- Support the development of novel intervention approaches that address impairments across multiple brain domains of executive function and that could be customized to each individual.
- Provide educational opportunities for clinicians and allied health professionals to expose them to intervention and treatment programs that are effective in the FASD population. Novel intervention strategies have important implications for health professionals who have been reluctant to provide a diagnosis due to their unfamiliarity with available evidence-based treatment and intervention options.
- Train teachers' aides or other educators to deliver computer game based interventions in their schools and support them in measuring the learning and progress of their students. Equip them with successful learning strategies to help mentor and support students with special needs, emphasizing that the ability to adopt and consistently use effective strategies may be a big part of the success of computer game interventions.

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