

Frontal Lobe Assist

Hardware and Software

Supplements to the Prefrontal Cortex in Adolescents with ASD

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POPARD consultant Brenda Dussault has worked extensively with older children who have a diagnosis of Autism Spectrum Disorder (ASD). One of her goals for her students has been to enhance their ability to manage their lives as independently as they can. Students enrolled in secondary school are confronted with multiple assignments with multiple timelines originating in multiple classrooms. This context can be challenging for any student, but for students who also face difficulty in managing time and planning and assigning priorities, it can be particularly anxiolytic.

Intrigued by the potential of new small, portable devices to enhance the ability of students to manage their time, Brenda reached out to

consultants Lorraine and Janet at SET BC, and the three of them considered how new hardware and software technologies might assist secondary students with ASD who often experience challenges in Executive Functions that involve planning and completing tasks.

Autism Spectrum disorder is one of several disorders that are implicated in academic underachievement (Shapiro, 2011). And an often-cited characteristic of students with Asperger's Syndrome is a deficit in Executive Functioning, especially with regard to the Executive Function (EF) of planning and organization that involves turning in assignments, managing long-term projects, completing homework, scheduling activities and organizing materials

(Robinson, S., Goddard, L., Dritschel, B., Wisley, M., & Howlin, 2009). While Executive Functions (Planning & Organization, Working Memory, Initiation, Self-Monitoring, Regulation, Shifting, and Attention) involve the application of intelligence and direct and enable information processing (Kaufman, 2010), they are to some extent independent of intelligence. However academically



talented a student may be, deficits in Executive Functions contribute to underachievement in students, who are often academically capable and prevent them from reaching their potential.

Such under-achievement that may result causes frustration on the part of parents, teachers, and students themselves who may not understand why they are not achieving as well as might be expected on the basis of their native intelligence. This is not a new story, but the enduring narrative of this circumstance led the POPARD-SET BC consultants to examine the impact of a technological intervention on support for students with these Executive Functioning deficits. They intended that the selected students would employ their SET-BC computers and an iPod® Touch, along with applications designed to enhance organizational skills, to improve their management of their schooling. The applications provided both visual and auditory cueing to increase the students' ability to accomplish long- and short-term projects, organize materials, and create study outlines.



Executive Function Intervention

EFs are often described as superordinate to overall intelligence and broad cognitive abilities – a “conductor” or “general” for planning and organization (Kaufman, op. cit.). The EF of Planning and Organization is considered to reside in the prefrontal cortex of the brain (Fuster, 2008). Individuals with damage to these lobes may suffer impairments in EFs (Goldberg 2001, cited in Kaufman, 2010). Anderson, Levin, and Stuss (2002) cite expectations of impairments in EFs for individuals who have injury to the frontal lobes.

Many, if not most adults, enhance the EFs of our frontal lobes with adaptations and accommodations (sticky notes, pocket calendars, electronic calendars, etc.). Students often are given assignment books to assist them in managing their schooling, but the use of such books requires

attention and planning as well.

Recent advances in technology have resulted in hardware that is small and very portable, relatively cheap, and socially acceptable. The ubiquity of such devices is such that teachers must often restrict their use in classrooms. The software that is now available is powerful, fairly easy to use, and often socially desirable. It is now possible to automatize planning tasks that once required significant attention. It might be argued that we are, in effect, providing technological support to our frontal lobes.

In this study..

... participants were recruited from a group of students diagnosed with high functioning Autism Spectrum Disorder who were on the current caseload of SET-BC consultants in the Lower Mainland. Students were selected based on their current Individual Education Plan (IEP) goals and objectives. Their IEP goals and objectives included EF-related goals, such as handing in homework on time, organizing long-term projects and completing assignments on time. Each of the participants was enrolled

in high school, followed a regular curriculum program, and had been provided SET BC computers. Five boys and one girl, ranging in age from 14 to 18 years, were recruited.

Teachers involved were Resource Room staff who supported the students from one to five blocks a week. Parents of selected students were asked to consent to their children's participation and were also offered an opportunity to view their children's instruction in the use of the technology.

The Plan

Participating students would be helped to improve their overall organization skills in order to meet IEP goals on completion of academic coursework. Students would increase their ability to complete course work (assignments, homework) in a given academic subject.

The Intervention

The intervention initially involved provision of iPods, three software packages and a workshop to train students in their use.

Weekly student coaching was provided by resource teachers. Brenda, Lorraine, and Janet contacted teachers to support them at least

twice/month. An opportunity to become familiar with the devices was provided to teachers, as well as to parents.

The iPod was selected because it does not require a subscription but is able to be programmed as a "personal assistant" with free or very cheap software and was considered by all students as a socially desirable accessory that they would likely take with them everywhere they went during the day. Students were shown how to use it for music and were encouraged to "make it their own." The software selected was believed by the team to have the potential to address the EF problems experienced by the participants. The software included:

iPod Calendar - a scheduling tool built into the iPod Touch; it features support task scheduling, auditory and visual cueing, and three different views: list, day and month.



iPod Calendar

What Next - an organizational app that

syncs directly to *iCalendar* and includes a visual countdown timer between programmed tasks and a list view of upcoming tasks. It costs \$.99 to purchase from iTunes.



What Next

Time-Timer - a time management application that provides a visual countdown (not auditory) of time periods and costs \$1.99 to download from iTunes.



Time Timer

Measures

Students, key teachers, and parents were asked to complete rating scales before intervention to assess their perception of the intensity of Executive Function problems.

Teachers completed the Behavior Rating of Individual Executive Functions (BRIEF) before intervention. The Executive Skills Questionnaire (ESQ) was completed before and after the intervention.

Pre-Intervention Performance

On the BRIEF, for problem behaviours involving Planning and Organization, Teacher scores for students (Figure 1) ranged from high average to well above average with regard to problem intensity.

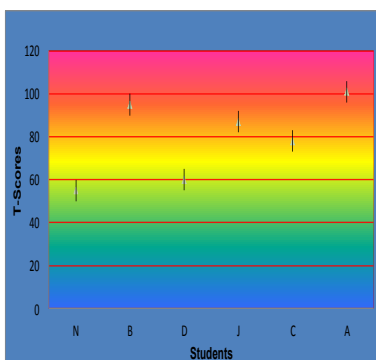


Figure 1. BRIEF Ratings: Green is Average; Red is very problematic.

Most of the students were rated by their teachers on the BRIEF as very problematic with regard to having problems in EF.

Not all students completed both pre and post ratings with the ESQ. One student decided, after the initial training, not to participate in the project. And for one other student, no post-

treatment ratings were acquired. As shown in Figure 2 (below, p. 5), some pre- and post-treatment ratings were obtained for four of the five remaining students, and complete ratings were obtained from three of the five students.

Inspection of the results in Figure 2 reveals sharply diminished ratings for “Big Problems” (in red) from pre- to post-treatment. As well, the number of “Slight or No Problem” ratings (in white) increased over the same time period.

The results shown in Figure 2 are summarized in Figure 3: most ratings 10 months later showed positive changes (green) in participants’ responses to rating the intensity of EF problems. Ratings for some behaviours did not change (blue) and a small number of ratings worsened (yellow).

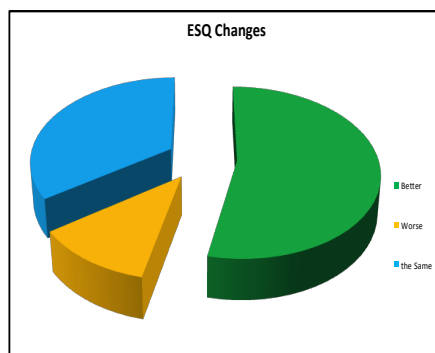


Figure 3. Group Changes in EF Behaviour

Because there was not a control group, it is possible that history or maturation contributed to the positive changes in ratings. However, two of the students were interviewed subsequently by POPARD-SET BC team members to qualitatively evaluate what went well and what did not go well with the intervention. Both students indicated that for them the success of the intervention was directly related to the extent to which the iPods became part of their lives. These students took their iPods with them wherever they went; they used them for downloading and playing music, as well as for organizing their schoolwork. They replaced the agenda-books that they had used previously with their iPods.

Team members also considered what went well or did not. They noted that, while most school staff and parents participated in evaluations of students EF behaviours before and after the intervention program, they were not actively involved, and project members suggest that lack of involvement by significant adults in the students’ lives may have diminished the positive outcomes that were found.

Changes Only: ESQ Ratings: Feb. to Dec.

3-5	Big Problem
6-8	Moderate Problem
9-11	Mild Problem
12-15	Slight or No Problem

Executive Skills Questionnaire			ESQ RS Pre Tx	ESQ RS Post Tx
Student	Rater	EF		
A	Self	Planning /Prioritization	5	8
		Organization	13	11
		Time Management	10	9
	Parent	Planning /Prioritization	3	6
		Organization	5	10
		Time Management	3	3
	Teacher	Planning /Prioritization	6	6
		Organization	14	NA
		Time Management	14	6
B	Self	Planning /Prioritization	4	8
		Organization	8	9
		Time Management	4	12
	Parent	Planning /Prioritization	3	5
		Organization	3	8
		Time Management	4	9
	Teacher	Planning /Prioritization	6	14
		Organization	15	15
		Time Management	11	14
C	Self	Planning /Prioritization	6	10
		Organization	5	8
		Time Management	11	11
	Parent	Planning /Prioritization	10	9
		Organization	11	6
		Time Management	7	8
	Teacher	Planning /Prioritization	5	6
		Organization	12	13
		Time Management	3	6
D	Teacher	Planning /Prioritization	6	14
		Organization	15	15
		Time Management	11	14

Figure 2.

While students seemed initially positive, their enthusiasm alone was not sufficient for them to easily persist in the use of their iPods and the software provided.

It became clear to the consultants that developing a social and institutional infrastructure to support the use of the iPods was essential to success.

So what happened?

Overall, these results suggest that electronic personal assistants can facilitate organization and accomplishing tasks in a more timely fashion. This is not surprising – many adults, including teachers - use such devices to assist themselves. What might be surprising to the reader is the extent to which electronic personal assistants can support students in high school in managing the tasks of their schooling. One student remarked that the system prompted him during the day, even when he was not actively using it:

“The reminders pop up even when the iPod is turned off. They also will interrupt my music

when I am listening to it.”

The same student added that problems with legibility of his notes was no longer an impediment:

“I could never read my writing when I used my agenda.”

And, because the iPod became a personal attachment, as might a watch or phone, he hardly ever went anywhere without it:

“I rarely forget my iPod.”

These students were not unrealistic about some of the difficulties that they encountered:

“It took a while to get used to the keyboard.”

“I’m really used to using my agenda – it’s hard to change something I’ve done for five years already.”

But those who were interviewed were positive about the enhancement to their schooling provided by the technology.

The project team concluded that active support by

parents and teachers is needed for a change of this nature. This might require a parent or teacher to check a student’s electronic calendar in the same way that a paper and pencil agenda book might be checked: And an adult may need to help a student use Time Timer to make realistic decisions to allocate and apportion time to various tasks.

Bumps in the Road

Challenges in the implementation of this intervention included:

- Lack of teacher time for meetings and data collection
- Variations and the need for clarity in school expectations regarding technology use in class
- Consideration of the iPod as a personal item rather than a shared tool
- A need for discussion of boundaries around use of the iPod in and out of school

Suggestions for Practice

Team members suggest that teachers who are considering use of an iPod or other electronic device and software to assist students in managing their schooling:

- **Include assessment of a student's profile to determine if technology can support his/her needs**
- **Be aware of available assistive technologies**
- **Educate themselves as to how technology can be built into IEPs as a strategy.**
- **Understand the support required to make the technology successful (e. g., commitment from the student's home as well as school support).**

The results obtained from this project inform us that we cannot simply provide technology and hope for the best for individuals who have deficits in EF. To maximize the success of an EF intervention requires planning to develop active support by students, staff, and parents to enhance outcomes for participants.

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