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The Influence of Computerized Intervention on the Cognitive Flexibility in Social Problem Solving Process among Children with High Functioning Autism

Liron Rubabshi

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Abstract

Cognitive flexibility and problem solving are two interrelated areas of executive functions. These cognitive mechanisms enable an independent organization of all components required for learning.

Among individuals with autism spectrum disorder (ASD), some executive functions were found deficient (Hill, 2004; Ozonoff, South, & Provencal, 2007), in particular cognitive flexibility (De Vries & Geurts, 2012; Wang, 2010). Various studies have shown that difficulties in cognitive flexibility affect the social functioning of children with ASD. For example, impaired attention to social stimuli interferes with the ability to understand the situation (Bauminger, 2002; Bauminger & Kasari, 2000) and the mental states of others (Hill, 2004). The literature also shows that multimedia and technological aids help to increase motivation for learning of children with ASD (Battocchi et al., 2008; Ploog, Scharf, Nelson & Brooks, 2013). In addition, these tools are effective in promoting cognitive flexibility (Panerai et al., 2014) and social problem solving (Bernard-Opitz, Srirman, & Nakhoda-Sapuan, 2001; Parsons & Mitchell, 2002; Wainer & Ingersoll, 2011).

Previous studies, which examined the relationship between these domains, used very small samples (Sansosti & Powell-Smith, 2008; Wang & Jai-Chin, 2010). furthermore, few studies examined cognitive flexibility processes in early childhood, especially within social problem-solving processes (Bernard-Opitz et al., 2001; Wainer & Ingersoll, 2011).

The purpose of this study was to examine whether a computer mediated intervention program, including the presentation of social problems, will affect cognitive

flexibility and problem-solving ability among children with high-functioning autism (HFASD).

Study participants included 29 children with HFASD and 15 children with typical development. All participants were aged 5-7 years. Children with HFASD were educated in special education frameworks and children with typical development were educated in regular education frameworks. The first experimental group consisted 15 participants with HFASD who participated in a computerized intervention. The second experimental group consisted of 14 participants with HFASD who participated in a non-mediated computerized intervention program. The third group included 15 participants with typical development which served as a control group and did not undergo intervention.

Parents of all participants completed a demographic questionnaire in order to obtain personal data about the participants. Parents of children with HFASD were asked to complete the SCQ questionnaire which provided information on the child's functioning in language, communication, and social networking (Rutter et al., 2003). In addition, on the pre-intervention phase, all participants underwent language assessment using the PPVT-III test. This assessment determines the level of verbal IQ (Dunn & Dunn, 1997). Likewise, the ability of cognitive flexibility and social problems solving have been evaluated among all study participants using a test of cognitive flexibility of (Torrance, 1966) and test of social problems solving (Shure & Spivack, 1974). All participants with HFASD underwent the same assessment after the intervention program. The study included an individual intervention program based on the principles of Cognitive-Behavioral Therapy (CBT), which includes cognitive learning and practice. The intervention program included four situations with social problems (playmate

invitation, help request, joint activity and conversation initiation) whose solutions focused on social initiative behaviors.

The problems were presented in three different environments: home, garden and in the playground. The computerized intervention program included a phase of learning and a phase of practice, according to the CBT principles. Every social problem was presented in a video clip, in a spoken voice and written text. The child was asked to think of as many solutions as possible to the problem. After the child completed offering solutions, he was asked to choose one solution. This solution has been recorded by the child to the computer. The experimenter unveiled the three solutions proposed by the computer: adaptive solution, avoidance solution and unrelated solution, in addition to his solution. Afterwards, the child was presented with all the solutions offered by him and by the computer and then he was asked to choose the best solution. During the practice phase, a child role-play was conducted with the experimenter, in which the chosen solution was videotaped by a web camera attached to the computer. Finally, the child and the experimenter watched the recorded video and the experimenter gave the child feedback and processed together the social information.

The non-computerized intervention program included the same problems and solutions, presented in the same order, only in color photographs and without recording a selected solution and the role playing.

In examining the cognitive flexibility variable, it was found that in the pre-intervention phase, children with HFASD, presented a lower level of cognitive flexibility than children with typical development. After the intervention, children with HFASD presented a higher level of cognitive flexibility following the computerized

intervention, compared to children with HFASD who experienced non-computerized intervention.

An analysis of the problem-solving variable revealed that children with typical development presented a greater range of solutions to social problems among children compared to children with HFASD. On the other hand, no difference was found between the populations in the ability to solve social problems between children and mothers. In addition, after the intervention, no difference was found between children with HFASD who participated in computerized intervention and children who participated in non-computerized intervention on this subject. There was also no positive pre-intervention relationship between the range of solutions to social problems and cognitive flexibility in children with HFASD.

The results of this study shed light on the relationship between social problem solving and cognitive flexibility and may contribute to early intervention programs aimed at improving the social functioning of children with ASD.