

Executive Functioning and Psychopathology in Psychotherapy for Adolescents With Specific Learning Disorders

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Abstract

This study examined the contribution of executive functioning (EF) to improvements in psychiatric symptomatology following I Can Succeed (ICS; Kopelman-Rubin, 2012) psychotherapy, a skill-enhancement intervention designed to target EF and socio-emotional aspects of specific learning disabilities (SLD). Forty adolescents with SLD underwent ICS in an open clinical trial. Executive functions and psychiatric symptomatology were measured before and after treatment plus at a six-month followup. Findings indicated that greater improvement in EF (specifically inhibitory control and semantic fluency) during psychotherapy was linked with lower severity of internalizing symptoms at the end of treatment. In addition, only better baseline inhibitory control was linked to greater improvement in the severity of both internalizing and externalizing symptoms from the end of treatment to the six-month followup. The findings highlight the importance of addressing EF and psychopathology symptoms in psychotherapy with adolescents with SLD.

Keywords: Adolescents, Specific Learning Disorders, Psychological Intervention, Executive Functions, Psychopathology Symptoms

Specific learning disorder (SLD) is one of the most common neurodevelopmental disorders in children and adolescents, with 5-15% prevalence rates across languages and cultures (*Diagnostic and Statistical Manual of Mental Disorders* [5th ed.; DSM-5], American Psychiatric Association, 2013). SLD often co-occurs with other neurodevelopmental disorders such as attention deficit-hyperactivity disorder (ADHD) (e.g., Barkley, 2014; DuPaul, Gormley, & Laracy, 2013), as well as psychiatric disorders such as anxiety, depression (e.g., Capozzi et al., 2008; Goldston et al., 2007; Sideridis, 2007), and conduct disorders (Carroll, Maughan, Goodman, & Meltzer, 2005).

Further, SLDs are also frequently associated with deficits in the cognitive processes known as executive functioning (EF) (Meltzer & Krishnan,

2007) – an umbrella term used to describe mental functions such as problem solving, reasoning, planning, and cognitive flexibility (Blair & Razza, 2007). Core EFs include cognitive inhibition, verbal fluency, working memory, and selective attention (Diamond, 2013) as well as self-control and self-regulation (e.g., Miyake et al., 2000). Verbal fluency tasks are among the most common and widely used measures of EF (Lezak, Howieson, Bigler, & Tranel, 2012) in both research and clinical practice in the fields of clinical and educational neuropsychology (Gonçalves et al., 2017). Semantic verbal fluency involves semantic knowledge, construction of semantic associations in one's memory and retrieval, and controlled search (Kave, 2006), all related to EF (Hurks et al., 2010).

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Students diagnosed with SLD experience difficulties with complex academic tasks that require the ability to plan one's time and organize and prioritize information (Diamond, 2013). They also exhibit difficulties in distinguishing major ideas from details and monitoring progress in goal-oriented actions (Blair & Razza, 2007). In addition, these students often experience difficulties in the social realm, including social understanding and judgment, emotion regulation, and behavioral control (Meltzer & Krishnan, 2007). As a result, adolescents diagnosed with SLD frequently experience maladjustment within social and academic domains.

To date, most interventions among children and adolescents with SLD have focused on enhancing learning skills, such as reading (Lovett, Barron, & Frijters, 2013; Siegel & Mazabel, 2013; Solis et al., 2012), writing (Graham, Harris, & McKeown, 2013), and mathematics (Fuchs, Fuchs, Schumacher, & Seethaler, 2013). Various kinds of cognitive-skill interventions have also been used, such as working memory training (Gropper, Gotlieb, Kronitz, & Tannock, 2014). Finally, interventions targeting socio-emotional aspects of SLD have also been quite common, such as group therapy (Freilich & Shechtman, 2010; Mishna & Muskat, 2004), cognitive behavior therapy (Kroese, Dagnan, & Loumidis, 1997), social skills training (Vaughn, LaGreca, & Kuttler, 1999), and academic motivational programs (Brier, 2007).

Based on a meta-analysis of studies that have examined social skills programs for children with SLD, Kavale and Mostert (2004) concluded that although findings revealed limited efficacy for social skills training, in light of the importance of social skills in dealing with social situations, these interventions should not be dismissed. They further suggested that there may be a need for closer coordination between academic remediation and social skills training and that these interventions should be "rebuilt" as part of a comprehensive treatment for students with SLD. Moreover, Palombo (2001) suggested that the treatment of children with SLD should include work with parents, teachers, and other professionals who maintain close relations with the children.

These suggestions, and the accumulating knowledge about the reciprocal influences between SLD, EF, social-emotional functioning, and psychopathology (e.g., Blair & Diamond, 2008; Mat-

tison & Mayes, 2010), point to a need for a comprehensive therapy that would target all of these aspects as interconnected components of multilayered phenomena.

I Can Succeed (ICS)

We previously published a study on the feasibility and acceptability of a new psychotherapy intervention called I Can Succeed (ICS; Kopelman-Rubin et al., 2012) for adolescents diagnosed with SLD. A manual-based psychotherapy, ICS aims to promote the interpersonal, emotional, and academic functioning of adolescents with SLD and related psychiatric disorders. As such, it targets both the EF and socio-emotional aspects of SLD and enhances skills in three major areas: *intrapersonal* (increasing and promoting levels of self-awareness of both strengths and weaknesses, developing self-direction towards setting goals while establishing priorities and providing organizational strategies); *interpersonal* (effective communication, decision making/problem solving, and self-advocacy); and *school/community* (strengthening the family-school relationship by choosing a significant figure at school to accompany the process of psychotherapy and guiding parents about effective communication with school staff).

The ICS protocol consists of two phases: acute and followup. The acute phase includes 13 weekly, 50-minute sessions (over a three-month period). The followup phase includes six sessions over an 18-month period (conducted 2 weeks and 1, 3, 6, 12, and 18 months after treatment ends). Most of the sessions are individual 50-minute sessions; however, parents may attend up to four sessions.

The intervention integrates ongoing work with the adolescent's school, including one session at school with school staff, parents, and the adolescent. (For additional details about ICS, see the procedure section below and Kopelman-Rubin et al., 2012). Previous publications showed significant pre-/post-improvements on measures of internalizing and externalizing symptoms (Kopelman-Rubin et al., 2012) and significant positive changes in feelings of loneliness, attachment orientations towards parents, and attachment-related representations of teachers (Brunstein Klomek et al., 2013).

Purpose of the Study

The current study examined the contribution of EF to an improvement in psychiatric symptomatology resulting from ICS psychotherapy. We formed the following hypotheses:

1. An adolescent's baseline levels of EF (inhibitory control and verbal fluency) will predict the psychiatric symptom severity level at both the end of the acute phase of treatment and the six-month followup.
2. EF improvement (delta) during ICS intervention will predict the psychiatric symptom severity level at both the end of the acute phase of treatment and the six-month followup.

Method

Participants

The participants consisted of 40 adolescents diagnosed with SLD and their parents. All participants were junior-high-school students, with a mean of 7.44 years of schooling. All of them resided in central Israel. The majority came from a middle-class socioeconomic background and fairly well-educated families (see Table 1).

All the participants went through a comprehensive psycho-educational assessment (performed by school psychologists) and a semi-structured psychiatric interview (MINI-KID; administered by child and adolescent psychiatrists). Inclusion criteria consisted of an SLD diagnosis, normal range of IQ, and regular class attendance. Exclusion criteria included suicidal ideation and psychosis. The participants were either self-referred or referred by community service providers (schools and municipal psychological services).

All were diagnosed with learning disorders, and 77.5% ($n = 31$) had more than one learning disorder, particularly co-morbid reading disorder and written expression disorder. The sample reported high co-morbidity of other psychiatric disorders (see Table 1). Three adolescents dropped out after the third session, and one did so after the fourth session. These participants were not significantly different from the other participants in terms of demographic characteristics, including age, severity of learning disorders, psychiatric comorbidity,

parents' age, educational level, and socio-economic status (SES). Ten participants were treated with medication prior to ICS intervention. During ICS, nine participants began taking medication, and two stopped doing so. Sixteen participants were taking methylphenidate, and one was taking an SSRI (selective serotonin reuptake inhibitor).

Measures

The following measures were administered to parents and/or the adolescent participants.

Demographic questionnaire. Parents completed a demographic questionnaire to gain information regarding age, grade, gender, racial/ethnic background, household composition, and social-economic status (SES).

The Mini-International Neuropsychiatric Interview for Children and Adolescents (MINI-KID; Sheehan et al., 2010). The MINI-Kid is a short, comprehensive, structured diagnostic interview for DSM-IV and ICD-10 psychiatric disorders in children and adolescents. It measures 25 diagnoses, including mood disorders, anxiety disorders, substance use disorders, Tourette's disorder, ADHD, oppositional defiant disorder (ODD), conduct disorder (CD), psychotic disorders, eating disorders, trauma-related disorders, and pervasive developmental disorder.

Standardized Brain Resource Cognition assessment (IntegNeuro™) (Brain Resource, Ltd., 2009). IntegNeuro is a touchscreen-based, computerized battery that evaluates the following domains of cognitive functioning: motor speed, attention/vigilance, working memory, verbal learning, visual learning, speed of processing, language, reasoning and problem solving, and social cognition. It takes most children and adolescents approximately 60 minutes to complete (Silverstein et al., 2010). This neurocognitive assessment has demonstrated good reliability against paper-and-pencil tests as well as good test-retest reliability (Clark et al., 2006). We also used the Stroop color-naming task to measure inhibitory control and verbal fluency.

Child Behavior Checklist (CBCL; Achenbach, 1991). This Hebrew adaption of a standardized instrument for rating children's behavior (Zilber, Auerbach, & Lerner, 1994) includes 112

Table 1
Demographic Characteristics of the Sample

Variable	N	% / M (SD)
Adolescent Characteristics		
Gender	40	
Female	12	30%
Male	28	70%
Grade	40	
6 th grade	1	2.5%
7 th grade	24	60%
8 th grade	13	32.5%
9 th grade	2	5%
Learning Disability Diagnosis (DSM-IV-TR)*		
Reading Disorder	27	67.5%
Disorder of Written Expression	25	62.5%
Mathematics Disorder	11	27.5%
Reading and Writing	18	40%
Reading, Writing, and Mathematics	4	10%
Reading and Mathematics	5	12.5%
Writing and Mathematics	5	12.5%
DSM-IV Comorbidity Diagnosis**		
ADHD	21	52.5%
Anxiety Disorders	11	27.5%
Major Depression Disorder	3	7.5%
Oppositional Deficient Disorder	3	7.5%
Tourette's Disorder and Tic Disorder	1	2.5%
Parents and Family Characteristics		
Mother's age	40	43.1(4.45)
Father's age	39	44.77 (5.1)
Mother's education level	40	14.16 (2.45)
Father's education level	39	13.71 (2.89)
Family Income***		
Below average	5	12.5%
Average	27	67.5%
Above average	8	20%

*Includes ADD/ADHD; **20% (n = 8) had psychiatric comorbidity; ***Determined based on parents' self-report demographic questionnaire.

behavioral items scored on a 3-point scale (0 = not true; 1 = somewhat or sometimes true; 2 = very/often true). Achenbach's principal-components analysis yielded two subscales: internalizing problems scale (.870; .751; .869; *N* of items = 32) and externalizing problems scale (.893; .853; .869; *N* of items = 35). Higher CBCL scores indicate more maladaptive behaviors.

Procedure

At baseline, all the adolescent participants underwent a comprehensive psycho-educational assessment administered by educational psychologists; a structured psychiatric interview administered by psychiatrists; and the standardized IntegrNeuro battery assessment administered by trained undergraduate psychology students. The participants underwent the IntegrNeuro battery assessment once again at the end of the acute phase of treatment. Parents completed the CBCL three times: at the start to establish a baseline, at the end of the acute phase of treatment, and at the six-month followup.

The IRB of the Schneider Children's Medical Center of Israel and the Interdisciplinary Center (IDC) Herzliya approved the study.

The Intervention – I Can Succeed (ICS)

I Can Succeed (ICS; Kopelman-Rubin et al., 2012) is a manual-based psychotherapy intervention aimed at addressing both academic EF skills and social-emotional skills of adolescents who have been diagnosed with SLD. The intervention consists of an acute phase (13 weekly sessions) and a followup phase (6 sessions over a period of 18 months). During the acute phase, the ICS protocol includes a meeting at the school in which the adolescent's teacher is included. The current study included only the first six months of followup sessions. Most sessions of both the acute and the followup stages were conducted on an individual basis; however, parents may have attended up to four sessions. Each session lasted 50 minutes, with the exception of the first session, which lasted 70 minutes.

The starting point of ICS is the conceptualization of academic EF and the emotional and in-

terpersonal components of SLD as interconnected aspects of a complex, multilayered phenomenon. ICS attempts to encompass intrapersonal as well as interpersonal domains. The interpersonal domain aspects of the intervention are theoretically grounded in Interpersonal Psychotherapy for Depressed Adolescents (IPT-A) (Mufson, Dorta, Moreau, & Weissman, 2004a, 2004b).

The intervention consists of the following modules: psychoeducation about SLD and the unique neuropsychological profile of the teen; self-awareness of both personal strengths and weaknesses; developing self-direction towards setting realistic goals and establishing priorities; improving organizational strategies; interpersonal communication skills; decision-making/problem-solving skills; self-advocacy skills (i.e., learning to effectively express what I need and what would help me); and strengthening the adolescent-parent and the family-school relationships (by choosing a significant figure at school to support the process and guide the adolescent and parents with regard to effective communication with the school staff about school-related issues). (See Kopelman-Rubin et al., 2012, for a detailed description of the intervention.)

Nine therapists delivered ICS in an outpatient psychiatric clinic as part of an open clinical trial. The therapists were trained in the intervention at a six-day workshop. Biweekly group supervision, led by an expert educational psychologist, was provided during the trial and all sessions were recorded to ensure adherence to the manual.

Data Analysis

In order to examine the pattern of associations among predictors and outcome measures, we conducted a series of Pearson correlations. Next, we examined whether the adolescents' baseline levels of EF (T1) and changes in EF from T1 to T2 (at the end of the acute phase of treatment) predicted their levels of psychopathology (internalizing and externalizing symptoms' severity) at the end of the acute phase of treatment (T2). We also checked whether there was a change in psychopathology severity between the end of treatment and the six-month followup (T2 to T3). To do so, we conducted a series of multiple-regression analyses. Specifically, we introduced the measures of the Stroop color-nam-

ing task (measuring inhibitory control; baseline and extent of change) and of semantic fluency as predictors. Further, we added the measures of psychopathology severity at T1 (ADHD/ADD diagnosis: 0.5 = has the disorder, -0.5 = does not have the disorder) and any changes in medication during the course of the study as covariates in order to adjust the analyses of their contribution. Therefore, the contribution of EF to the explained variance of psychopathology was tested above and beyond the contribution of ADHD/ADD, any changes in medication, and the level of psychopathology at the onset of the treatment.

The measures of the outcome were the end-of-treatment levels of psychopathology at T2 (severity of the internalizing and externalizing symptoms) and the change in these measures from the end of treatment to the six-month followup (T2 to T3). Little's MCAR test (Missing Completely At Random) was used to examine the pattern of missing data (Little, 1988). A multiple-imputation procedure (Rubin, 2004) was employed to handle missing data (using SPSS v.21 imbedded function). Finally, the Breusch-Pagan and Koenker tests (Koenker, 1981) were used to test for heteroscedasticity, and tolerance scores were used to test for multicollinearity.

Results

Missing Data Analysis

Overall, 5.83% of the data were missing. According to Little's (1988) MCAR test, the data were completely missing at random, $\chi^2_{(33)} = 28.39, p = .70$. No indications of heteroscedasticity were found.

Associations Between Major Study Measures

Correlation coefficients, which are based upon the pooled results of the multiple imputation, are presented in Tables 2 (among predictors) and 3 (among outcome measures). Analysis of the predictors revealed that EF scores did not correlate significantly with each other, indicating high discriminant validity. Analysis of the outcome measures, on the other hand, revealed significant correlations (see Table 3) and that greater improvement in one psychopathology

measure was linked with greater improvement in the other psychopathology measures.

Severity Level of CBCL Symptoms

We used the two CBCL broadband syndrome scales, *internalizing* – referring to 30 internalizing behaviors such as withdrawal, somatic complaints, and expressions of anxiety/depression – and *externalizing* – referring to 30 externalizing behaviors such as delinquency and aggressiveness.

Analysis revealed that CBCL symptoms decreased during treatment. Specifically, before the intervention, 42.5% were in the clinical and sub-clinical range of internalizing problems and 22.5% in those ranges for externalizing problems, whereas after treatment, the numbers were 24.3% and 13.5%, respectively. Further, at the six-month followup, only 11.1% ($p < .001$; i.e., significant reduction) and 7.4% ($p = .16$; nonsignificant reduction) were in the clinical and subclinical range of internalizing and externalizing problems, respectively.

The Contribution of EF to Psychopathology Levels at the End of the Acute Phase of Treatment and at the Six-Month Followup

The pooled results of the multiple imputation are presented in Table 4. As illustrated, the analyses indicated that the greater improvement in inhibitory control (as indicated by the Stroop score) from T1 to T2, and in semantic fluency, was linked to lower severity of internalizing symptoms at the end of treatment, but not to the severity of externalizing symptoms. In addition, only better inhibitory control (as indicated by the Stroop score) before treatment (T1) was linked to greater improvement in the severity of internalizing and externalizing symptoms from the end of treatment (T2) to the six-month followup (T3). Semantic fluency was not related to the change of severity of internalizing and externalizing symptoms.

Controlling for ADHD/ADD and other measures, as described above, made it possible to conclude that all of the effects of EF on psychopathology were significantly above and beyond the contribution of ADHD/ADD, any change in medication, and baseline levels of psychopathology.

Table 2
Correlation Coefficients to Examine the Pattern of Association Between Predictors Accompanied by Means and Standard Deviations

	1	2	3	4
1 Stroop (T1)	--			
2 Semantic fluency (T1)	.10	--		
3 Stroop (T1 to T2)	-.64***	-.09	--	
4 Semantic fluency (T1 to T2)	.16	-.31*	-.19	.16
Mean	10.60	17.38	1.26	-70.15
SD	2.99	3.92	3.03	87.48

* $p < .05$, *** $p < .001$.

Table 3
Correlation Coefficients to Examine the Pattern of Association Between Outcome Measures Accompanied by Means and Standard Deviations

	1	2	3	4
1 Internalizing (T2)	--			
2 Externalizing (T2)	.48**	--		
3 Internalizing (T2 to T3)	-.64***	-.29	--	
4 Externalizing (T2 to T3)	-.49**	-.69***	.66***	--
Mean	7.59	6.92	0.43	-1.83
SD	6.39	6.02	9.00	4.76

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4
Regression Coefficients for Predicting Psychopathology EF Scores

	Δ Externalizing			Δ Internalizing			Externalizing			Internalizing		
	β	SE	b	β	SE	b	β	SE	b	β	SE	b
Psychopathology T1	-.30	0.10	-0.20*	-.13	0.20	-0.16	.48	0.11	0.41***	.65	0.12	0.58***
Medicine	.21	1.56	2.23	-.03	3.24	-0.60	-.48	1.81	-6.33***	-.13	1.83	-1.85
ADHD	-.09	1.43	-0.81	-.16	2.96	-2.88	.22	1.65	2.64	.17	1.66	2.18
Stroop	-.27	0.75	-1.27~	-.37	1.55	-3.37*	.15	0.86	0.89	.18	0.87	1.18
ΔStroop	-.12	0.74	-0.58	-.02	1.54	-0.16	.16	0.86	0.96	.27	0.87	1.69*
Semantic fluency	-.22	0.93	-1.07	-.06	1.92	-0.50	0.11	1.07	0.68	-.17	1.08	-1.10
ΔSemantic fluency	.19	0.89	0.92	.19	1.85	1.72	-0.10	1.03	-0.06	-.33	1.04	-2.12*
	$R^2 = 36.4\%$			$R^2 = 23.5\%$			$R^2 = 47.0\%$			$R^2 = 41.5\%$		

Note. ~ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$. Δ = change.

Discussion

The present study examined whether adolescents' baseline levels of EF (inhibitory control and verbal fluency) and their improvement (delta) during ICS psychotherapy can predict their psychiatric symptom severity level (at both the end of the acute phase of treatment and the six-month followup).

The major results indicate that better baseline inhibitory control (but not verbal fluency) was linked to greater improvement in the severity of internalizing and externalizing symptoms from the end of the acute phase of treatment to the six-month followup. In addition, greater improvement in both inhibitory control and verbal fluency during treatment was linked to lower severity of internalizing (but not externalizing) symptoms at the end of treatment.

Implications for Practice

Our findings are consistent with those of previous studies of typically developing students in showing that interventions targeting EF prevent the development of later psychopathology (Riggs, Greenberg, Kusche, & Pentz, 2006), and suggest that the protective role of EF is also applicable to adolescents with SLD.

The current results are also in line with the literature on the link between EF and psychopathology (e.g., Martel, Nikolas, & Nigg, 2007; Riggs et al., 2006; Rinsky & Hinshaw, 2011) and the role of EF in social functioning. Thus, our findings encourage implementation of EF-focused prevention programs for adolescents with SLD, especially those showing EF deficits.

These findings also support ICS's basic assumption regarding the importance of addressing

both EF and psychopathology symptoms as being interconnected and the importance of targeting both EF and psychopathology symptoms in treatment of teens with SLD. The objectives of the ICS intervention are to enhance the abilities of teens with SLD to plan and choose possible actions in social situations, to develop better organizational skills, and to be able to inhibit impulsive responses in order to better advocate for themselves. All of these skills incorporate both EF and social-emotional skills.

The finding that greater improvement in EF during treatment was only linked to lowered severity of internalizing symptoms at the end of the acute phase of treatment, and not to externalizing symptoms, may be explained by the fact that ICS is theoretically grounded in IPT-A. IPT-A focuses upon internalizing problems (Mufson et al., 2004a) and, therefore, improvement of EF during ICS might have facilitated the acquisition of skills specifically targeted to improve coping with internalizing symptoms.

Limitations

The study has several limitations. First, this is a feasibility study, and treatment was carried out in an open clinical trial rather than a randomized controlled trial. Second, the sample size was small, allowing for examining the contribution of only two EF functions. Since EF seems to play an important role in the improvement of psychopathology symptoms, it is important to examine the contribution of other EF functions upon psychiatric outcomes among adolescents who have been diagnosed with SLD and who are treated with psychotherapy.

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