International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 15, Issue 4, 2021

Effects of Dodge & Crick's SIP on Developing Working Memory, Inhibition and Cognitive Flexibility Among Children with ASD

Mourad Ali Eissa Saad[a], Ayman Gamal Khalifa[b], [a]PhD, Full Professor of Special Education, Vice President of KIE University, KIE University, Egypt, [b]PhD, TVTC Directorate of Research and Studies, Saudi Arabia, Email: [a]profmouradali@gmail.com, [b]a.ghanem@tvtc.gov.sa

The purpose of this study was to investigate the effect of Dodge and Crick's Social Information-Processing Model on developing working memory, inhibition and cognitive flexibility among primary school children with autism spectrum disorder. For the purpose of this study, a two-way repeated measures ANOVA, with pre-post testing in two groups was employed. 32 (29 boys and 3 girls) were previously diagnosed by the school licensed psychologists not associated with the current study, based on the DSM-5. Findings from this study revealed the effectiveness of Dodge and Crick's Social Information-Processing Model on developing working memory, inhibition and cognitive flexibility among primary school children with autism spectrum disorder.

Keywords: *Dodge and Crick's Social Information-Processing Model, Working Memory, Inhibition, Cognitive Flexibility, Primary School children With Autism Spectrum Disorder*

Introduction

Autism spectrum disorder (ASD) can be defined as a neurodevelopmental condition characterised by deficits in social communication and interaction, as well as restricted, repetitive patterns of behaviour, interests, or activities (Abdullah, 2014; Ahmed, 2014; Ebrahim, 2019; Mahmoud , 2015; Mahmoud ,2015; Mohammed , 2016; Mortada, 2017;Mostafa , 2018; Mourad,2016; Mourad,2017 a;Mourad,2017 b; Mourad, 2018a, Mourad, 2018b; Mourad & Borowska-Beszta,2019) irrespective of their level of intellectuality (Mourad, 2018b).

Baron-Cohen , Leslie& Frith(1985), Happé & Frith(2006), among others, proposed useful cognitive models(theory of mind, and central coherence)to explain difficulties observed across the life span in ASD (Olde &Geurts,2017). One such model, the executive dysfunction hypothesis(Hill,2004) posits that ASD is partly due to impairment in the higher-order cognitive processes that underlie goal-directed behaviour, such as mental flexibility and inhibition. This model developed following observation of difficulties in set shifting (ability to shift mindset to new concepts), response inhibition (ability to inhibit a dominant response), and working memory (retaining and updating information in short-term memory) (Demetriou, DeMayo, & Guastella, 2019).

Executive functions include: planning skills, working memory, cognitive flexibility, response inhibition, impulse control and action monitoring (Turda ,Crisan& Albulescu, 2019). Executive functions can predict academic. Social and work success throughout an individual's lifetime and are considered important to good adjustment and to success in the social and family context, to good physical and mental health, etc. Deficits in them hinder children's independence, affecting their problem solving processes, decision making, adaptation to the environment, inhibition of inappropriate behaviour that may offend others, and the generalisation of learning (Gómez-Pérez& Dolores,2020). According some authors (e.g. Blijd-Hoogewys et al., 2014; Mostert-Kerckhoffs, Staal, Houben, & De Jonge, 2015; Van Eylen, Boets, Steyaert, Wagemans, & Noens, 2015), ASD children present difficulty across a range of executive functions, including cognitive flexibility, inhibition and working memory (Gómez-Pérez& Dolores,2020). It was suggested (Leung, Vogan, Powell, Anagnostou, & Taylor, 2016; Peterson, Noggle, Thompson, & Davis, 2015) that adaptation and social interaction problems are influenced by deficits in executive functions.

Social Information Processing in Children with ASD

Crick & Dodge (1994) formulated a model that seeks to conceptualise or define the mental processes that are responsible for the processing of social interactions in children, give details of how children process and interpret cues in social situations and finally how they come up with a decision whether behaviourally or emotionally regarding these cues (Nirit et al.,2019). Crick & Dodge (1994) hypothesised six stages for their model (see Figure 1). These are: (a) encoding social cues (i.e., attending to appropriate cues, chunking/storing information), (b) mentally representing and interpreting the cues (i.e., integrating cues with past experiences, arriving at meaningful understanding, considering one's own and others' perspectives on situations), (c) clarifying social goals (e.g., joining a group game, maintaining ongoing conversation), (d) searching for possible social responses, (e) making a response decision after evaluating various responses' consequences and estimating the probability of favourable outcomes, and (f) acting out a selected response while monitoring its effects on the environment and regulating behaviour accordingly (Nirit et al.,2019).

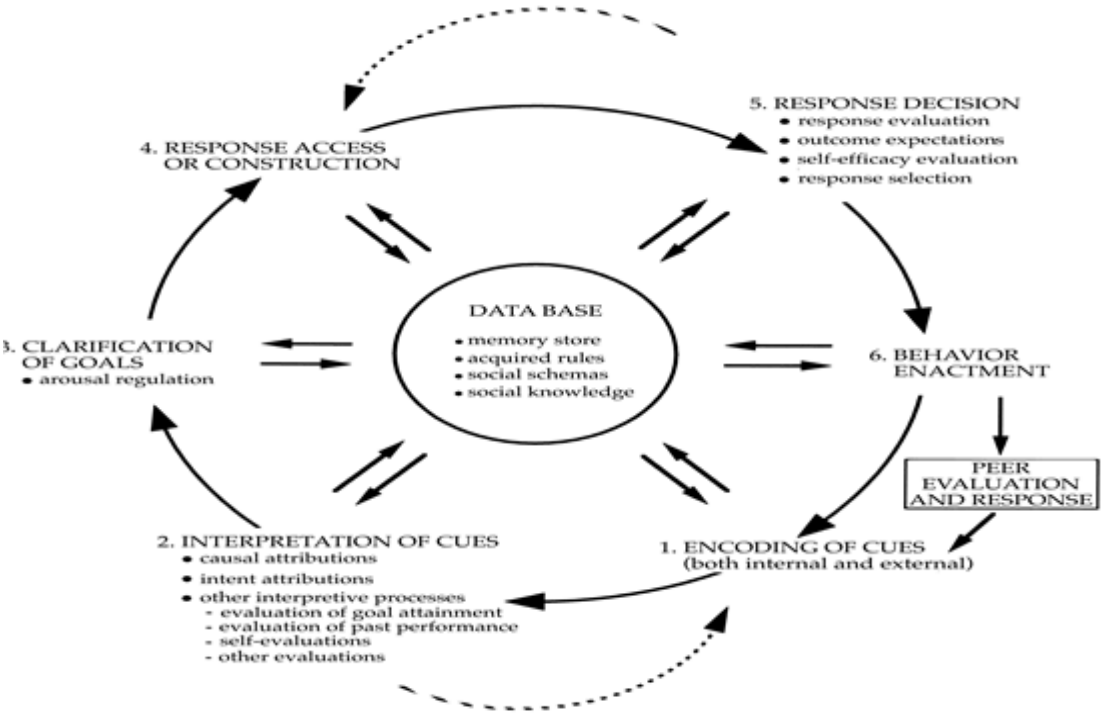


Figure 1. Crick & Dodge's (1994) Reformulated Social Information Processing Model

Children with ASD are impaired in various social-cognitive capabilities. Thus they have difficulties in the different processes of the SIP model (Flood, Hare& Wallis,2011). They always add nonrelevant information (encoding). Unfortunately, they prefer passive and withdrawn responses but not assertive ones (searching). They also cannot understand the social appropriateness of responses(deciding), and finally, they find it difficult to execute assertiveness (acting out) (Nirit et al.,2019).

There are no but few studies that have directly examined the social information processing of children with ASD. For example, Embregts & Van (2009) found that compared to their typically developing peers, boys with ASDs and mild to borderline intellectual disability failed to encode social information in an accurate way as they focused on the negative aspects of the social situation and positively evaluated what was supposed to be socially unacceptable (i.e., aggressive) responses to the situations where they were.

Moreover, Flood et al. (2011) found that compared to their typically developing peers, children with ASDs had difficulties in social information processing as they interpret the social situations (intent attribution), generate a response, and evaluate different responses to social situations. Additionally, Yair, Bat & Yasmine (2014) stated that children with ASDs process social information in a markedly less socially competent way than typically developing children. Van et al. (2015) examined the effect of SIP training implemented in

small groups and found that the program at school led to more stimulation and, more importantly, to a greater possibility of transfer to academic learning.

Executive Functions in Children with ASD

Working memory

Working memory (WM) can be defined as the simultaneous process of storing and processing information, in addition to the role it plays in reasoning (Baddeley,2012). WM is generally considered to be a core component of executive functions. There are three processes involved in WM: active conservation of information for short periods of time, context-relevant updating of information, and rapid biasing of task-relevant cognitions and behaviours (Evelien et al., 2013). Baddeley's (2012) . Some researchers (e.g. Luna, Doll, Hegedus, Minshew & Sweeney, 2007; Steele, Minshew, Luna & Sweeney, 2007; Williams, Goldstein & Minshew, 2006; Williams, Goldstein, Carpenter & Minshew, 2005) clearly demonstrate impairments associated with WM and other executive functions in high-functioning adolescents with autism, most of which are found in the spatial domain of WM.

Inhibition

Inhibition is generally considered to be a core component of executive functions (Evelien et al., 2013). It is one's ability to control his/her behaviour, attention, thoughts and/or emotions. Moreover, it requires from a person to self-regulate and attend to a number of stimuli (Waite,2013). Blackwell, Chatham, Wiseheart, & Munakata (2014) indicated that inhibition supports higher order executive functions such as working memory and task-switching. Inhibition has a role to play in flexibility. Switching from one task or one dimension to another requires inhibition of the tendency to stay on the former task or process the former dimension (Honoré, Houssa, Volckaert, Noël & Nader-Grosbois,2 020). Relative to typically developing children, children with autism spectrum disorder showed greater difficulty inhibiting behavioural responses(Amanda et al.,2020). Some researchers (e. g. Colombi & Ghaziuddin, 2017; Yerys et al., 2009) indicate that inhibition and working memory are more impaired among children with ASD.

Cognitive flexibility

Cognitive flexibility refers to "the ability to shift to different thoughts or actions depending on situational demands" (Geurts, Corbett, & Solomon, 2009, p. 74). Cognitive flexibility as one component or process of executive functions prepares children and enables them to adapt to changes in the environment (Waite, 2013). Blackwell et al. (2014) also found that children who were effective in task shifting were able to focus on the desired goal. This result indicates that task shifting may be linked to working memory and the ability to only attend to information that is important to the desired outcome. However, it was shown that flexibility

deficits in ASD related to repetitive behaviours (Yerys et al.,2009).

The present study

The aim of the present study was to assess the effectiveness of Dodge and Crick's Social Information-Processing Model on developing working memory, inhibition, and cognitive flexibility among primary school children with autism spectrum disorder

Problem Statement

Training in Social Information Processing (SIP) yielded several advantages, among them were peer acceptance and reduction of aggressive problem behaviours (Abu al-Fadl, 2014; Khalifa, 2014). However, little is known about using Social Information Processing to train children with ASD in developing working memory, inhibition, and cognitive flexibility.

This study posed the following hypotheses:

1. Training in SIP will develop working memory in the experimental group in the post testing compared to the control group.
2. Training in SIP will develop inhibition in the experimental group in the post testing compared to the control group.
3. Training in SIP will develop cognitive flexibility in the experimental group in the post testing compared to the control group.

Method

Study design

The purpose of this proposed study was to investigate the effects effect of Dodge and Crick's Social Information-Processing Model on developing working memory, inhibition, and cognitive flexibility among primary school children with autism spectrum disorder. A quasi-experimental non-equivalent comparison group pre-test post-test design was used to measure children's changes in working memory, inhibition, and cognitive flexibility during 10 sessions.

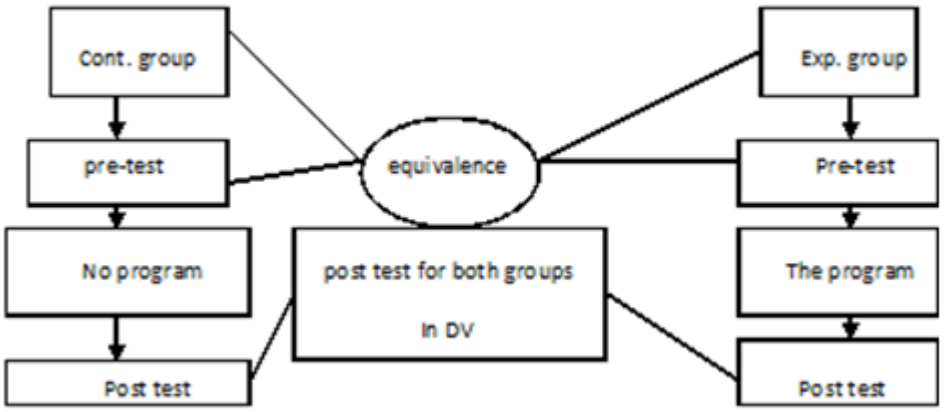


Figure 2. study design

Participants

32 (29 boys and 3 girls) were previously diagnosed by the school licensed psychologists not associated with the current study, based on the DSM-5 (APA, 2013). To verify an autism diagnosis, Autism Spectrum Disorder Evaluation Inventory (Mohammed, 2006) was administered. Demographic information was obtained from school records and as reported by families. Exclusion criteria included the presence of comorbid conditions (i.e. ADHD, or seizures), a diagnose of any psychiatric illness, in addition to an IQ below 70 (On Wechsler Intelligence scales for children (two subtests were used: vocabulary and matrix reasoning, Albeheri,2017). Two cases were excluded due to these criteria, (the two had seizures). This procedure yielded a final ASD group size of 30 children. Children were divided randomly into two groups: one experimental (n=15) and other was the control group (n=15) . Both groups were matched for chronological age (t (73) = -1.88, p = .5). Just before and after the intervention, the children in the experimental and control groups were tested for their performance in working memory, inhibition, and cognitive flexibility. Table 1 presents participants' characteristics.

Table 1. Participants 'characteristics

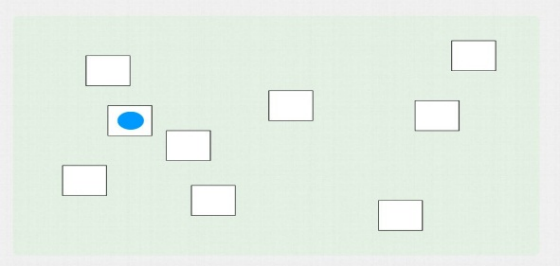
Group	Exp.	Cont.	Group Differences
Variables	n=15	n=15	t-test
Age (in months)	7.23 (SD= .027)	7.29(SD= .061)	-1. 88
Working memory (Pretest)	3.12(SD=1.02)	3.20(SD=1.13)	-1. 23
Inhibition (Pretest)	4.10(SD=1.14)	4.65(SD=1.22)	-1. 33
Cognitive flexibility (Pretest)	4.32(SD=1.17)	4.01(SD=1.06)	-1. 19

($p > 0.05$)

Measures

Working memory.

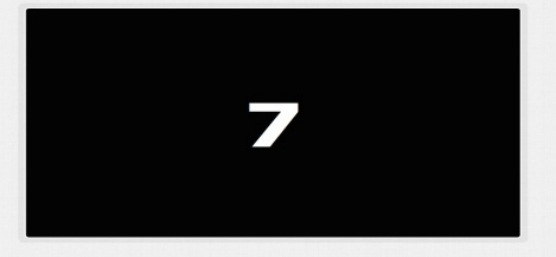
Working memory was assessed using an adapted version of a spatial span measure known as corsi blocks (Corsi, 1972). 10 empty boxes placed spatially on a computer screen were presented to children. Children were then instructed that they would view a series of boxes light up one at a time. The goal was to click on the boxes in the exact same order as they were lit. The boxes that were lit begin with a simple pattern and become more complex as the children progresses. This was the "forward" phase of the task. During the second phase of the task children see a series of lit boxes one at a time for which they must click on the pattern of boxes but this time in the reverse order. The task, within each phase, ends when the child succeeded at replicating the pattern more than five times in a row. Child's efficiency scores were calculated on both the forward and backward phase of the task. The test–retest reliability is satisfactory ($r = 0.73$), and internal validity was high.



Inhibition.

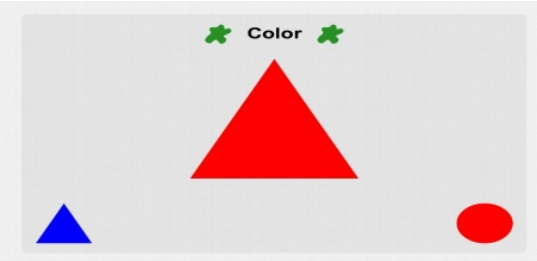
A computerised sustained attention task for children (Servera & Cardo, 2006) was used to assess response inhibition. The task consists of 40 trials in which the stimulus (numbers 0-9)

were presented on a computer screen, one at a time for approximately 250ms. Children were asked to press the space bar on the computer keyboard as quickly as possible each time a number is presented. This task is designed to measure response inhibition or the ability to discontinue a dominant response to allow a subdominant response. Children must continue through to the end of the 40 trial task. The higher score indicates greater attentional capacity. The test–retest reliability is satisfactory (r = 0.71), and internal validity was high.



Cognitive flexibility.

A computerised figure-matching task (based on Ellefson, Shapiro, & Chater 's, 2006) was employed. The aim was to measure cognitive flexibility. In this study, 4 blocks of 10 trials were presented, where children must match objects by their shape (circle or triangle) or colour (red or blue). For each block there is a specific rule (1) match colour only, (2) match shape only, (3) alternating, (4) alternating-runs. This task is considered as a measure of attention shifting, rule-guided behaviour, and response inhibition. The test–retest reliability is satisfactory (r = 0.68), and internal validity was high.



Procedures and Intervention

As a first step, the assent of a child participant and the permission of the parents to participate in this study were obtained. Parents were informed about purpose of the study. The training program is a 10-lesson intervention that is comprised of Crick and Dodge's (1994) SIP skills with one lesson for each skill with a scenario. Children are trained during the first three lessons in "encoding". This enables them to identify and describe his / her inner feelings and the social / external cues will be introduced. During these lessons, children enjoy meeting the faces of some pets; their favourite cats/dogs/bears. At the beginning of each lesson, the researcher tells the children that they will meet with some cats/dogs/bears.

Scenario: "Look at me. Listen to me carefully. Yes, it may appear to you that I am angry or crazy, or sad all the time. You are right, but I don't know why I always feel this way. It is people who make me angry. You understand me, I know. Sometimes, take my things from me, and shout at me, and this may make me crazy. My classmates do not like to play with me. They may fear me ". Children are allowed to use body language or their faces to show the feelings of each cat.

During interpretation of cues, a child will recognise many of our responses to social cues. Once he/she attends to or perceives the information from the social and internal systems , he/she must interpret the meaning of those cues. Children are given scraps of paper containing a story labelled "My days in colour". The researchers reads using body language and the children follow.

Once he/she has interpreted the social and personal cues in the event, another procedure will take place. It is clarification of goals and the child will set many goals, which he/she will use when dealing with any given social situation. The most we can talk about is the child's feelings, temperament and adult instruction influence these goals. The child will learn behave positively as well as regulate their emotions. The researcher informs his children "well, what we can say about goals is that it can come from the inside of you: internal (as you maintain or regulate your emotion) or from outside of you: external (as for example when you set social relational goals in such a way that you like getting another to play with you.When you are in a positive moods you may choose goals that maintain your pleasant mood.

During the fourth stage, the child is searching for possible and appropriate behavioural responses to the way he/she encodes and interprets the social information and to what goal he/she is working toward. A child's past experiences play a role. The researcher tries to expose the child to a novel situation where responses may be constructed to respond to these social cues. The child will be able to evaluate multiple choices, choose the right action and provide justification for the choices. The child will be able to identify confidence and name the skill of solving problems that he is adept at and should be used in the problematic social situation. The child will be able to select and predict the response.

During the fifth stage the child chooses a response to the social situation. This is done carefully as a child's responses involve specific behavioural capabilities that concern his/her ability to carry out the decision. Here again past experiences play a role. The researcher reiterates that in order for the student to be confident in the act, he must believe in the importance of the act (it will help them to achieve their goals). The researcher provides some simple examples such as (modelling):

- I know I can get the teacher to hear me if I wake up in class. But I am not sure that shouting will make me some time on the computer. It will not be useful. The researcher asks children: What's the problem? What needs to be changed? What are some possible goals? What is the

best goal? What steps might you take?

The researcher explains to the children that sometimes the action will not be beneficial because it will not help to change the situation. For example, just wanting to be invited by the teacher will not change the situation. At other times, actions may not work because they do not fit the situation. For example, if you can yell in the classroom, the teacher might hear you, but it won't bring you what you want because yelling does not fit the classroom.

The sixth and final step of social information processing occurs when the response is enacted. We call it the culmination of the process. The child will be able to respond to choice, fiction, poetry, and drama using evaluative, interpretative, and critical processes with conclusions on personalities, events and topics. The child will be able to evaluate multiple options, choose the appropriate action and provide justification for the choices. The child will be able to evaluate the success achieved. The child employs verbal and motor skills that have been developed through rehearsal, feedback, and practice in order to act out the chosen response.

The researcher gives the children a copy of the worksheet: I am really good at ..... and asks them to draw a picture of a particular emotion performed well. Children may return to problem solving in the method of making choices and choosing a step. This skill should be one of the skills they feel confident in and perform well. Each child asks for a particular emotion (self-questioning), thinks aloud with his classmates (thinking out loud), and children exercise self-assessment (enacting).

The experimental group received ten sessions, each of which lasted for 25-30 minutes. All data was entered in an SPSS file.

Results

To test the first hypothesis the researchers used the two-way ANOVA analysis for the differences in post-test mean scores between the experimental and control groups in WM. The abbreviated analysis of variance output is shown in Table 2. T- test results for the differences in post-test mean scores experimental and control groups in WM are shown in Table 3. The results of the two-way ANOVA Table1. reported that $F\ (1,\ 27) = 447.839$, $p < .0005$. Furthermore, Table 2. shows the T-test results for the differences in post-test mean scores between the experimental and control groups in WM. As shown, $T = 21.21$, $p < 0.01$ (See figure 3. for the differences in mean scores on WM).

Tests of Between-Subjects Effects

Table 2. Dependent Variable: WM (post-test)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	78.883	1	78.883	67.211	.000
WM pre	.578	1	.578	.492	.489
Group	525.609	1	525.609	447.839	.000
Error	31.689	27	1.174		
Total	3848.000	30			
Corrected Total	561.467	29			

a. R Squared = .944 (Adjusted R Squared = .939)

Table 3. T-test results for the differences in post- test mean scores between experimental and control groups in WM

Variables	Group	N	Mean	Std. deviation	T	Sig.
WM	Exp.	15	6.266	1.45	21.21	.000
	Cont.	15	14.666	1.44		

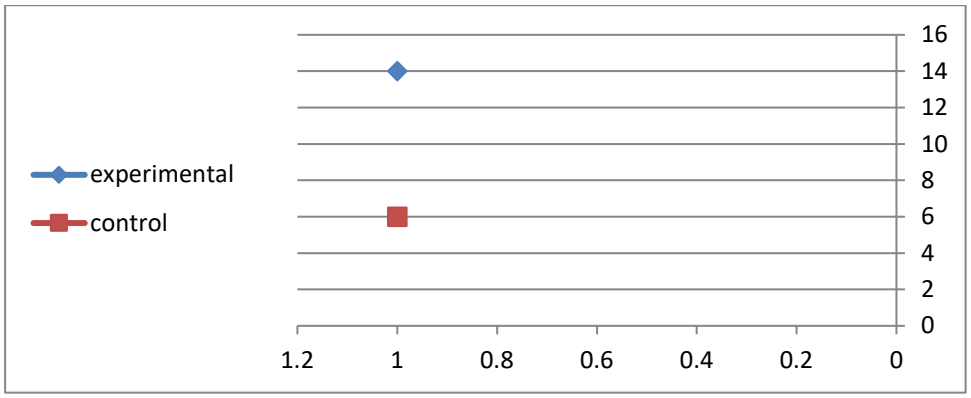


Figure 3. Post- test mean scores between the experimental and control groups in WM

As for the second hypothesis, the researchers used the two-way ANOVA analysis for the differences in post-test mean scores between the experimental and control groups in inhibition. The abbreviated analysis of variance output is shown in Table 4. T-test results for the differences in post-test mean scores of the experimental and control groups in inhibition are shown in Table 5. The results of the two-way ANOVA in Table 1 reported that $F(1, 27) = 240.760$, $p < .0005$. Furthermore, Table 5. shows T-test results for the differences in post-test mean scores between experimental and control groups in inhibition. As shown, $T = 15.18$, $p < 0.01$ (See figure 4. for the differences in mean scores on inhibition).

Tests of Between-Subjects Effects

Table 4. Dependent Variable: Inhibition(post-test)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	6.725	1	6.725	.890	.354
Inhpre	19.444	1	19.444	2.573	.120
Group	1819.279	1	1819.279	240.760	.000
Error	204.023	27	7.556		
Total	14919.000	30			
Corrected Total	2064.300	29			

a. R Squared = .901 (Adjusted R Squared = .894)

Table 5. T-test results for the differences in post-test mean scores between experimental and control groups in inhibition

Variables	Group	N	Mean	Std. deviation	T	Sig.
WM	Exp.	15	12.866	1.40	15.18	.000
	Cont.	15	28.533	3.16		

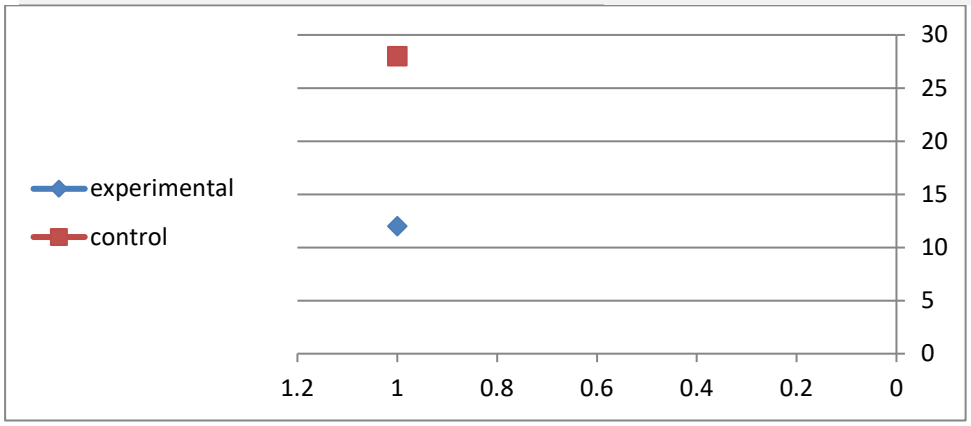


Figure 4. Post-test mean scores between the experimental and control groups in inhibition

As for the third hypothesis, the researchers used the two-way ANOVA analysis for the differences in post-test mean scores between experimental and control groups in cognitive flexibility. The abbreviated analysis of variance output is shown in Table 6. T-test results for the differences in post-test mean scores of the experimental and control groups in cognitive flexibility are shown in Table 7. The results of the two-way ANOVA in Table 6. reported that $F(1, 27) = 163.533$, $p < .0005$. Furthermore, Table 5. shows T-test results for the differences in post-test mean scores between the experimental and control groups in cognitive flexibility. As shown, $T = 12.67$, $p < 0.01$ (See figure 5. for the differences in mean scores in cognitive flexibility).

Tests of Between-Subjects Effects

Table 6. Dependent Variable: Cognitive flexibility (post-test)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	19.312	1	19.312	2.309	.140
CFhpre	11.231	1	11.231	1.343	.257
Group	1367.837	1	1367.837	163.533	.000
Error	225.835	27	8.364		
Total	14082.000	30			
Corrected Total	1597.200	29			

a. R Squared = .859 (Adjusted R Squared = .848)

Table 7. T-test results for the differences in post- test mean scores between the experimental and control groups in cognitive flexibility

Variables	Group	N	Mean	Std. deviation	T	Sig.
WM	Exp.	15	13.666	1.87	12.67	.000
	Cont.	15	27.133	3.43		

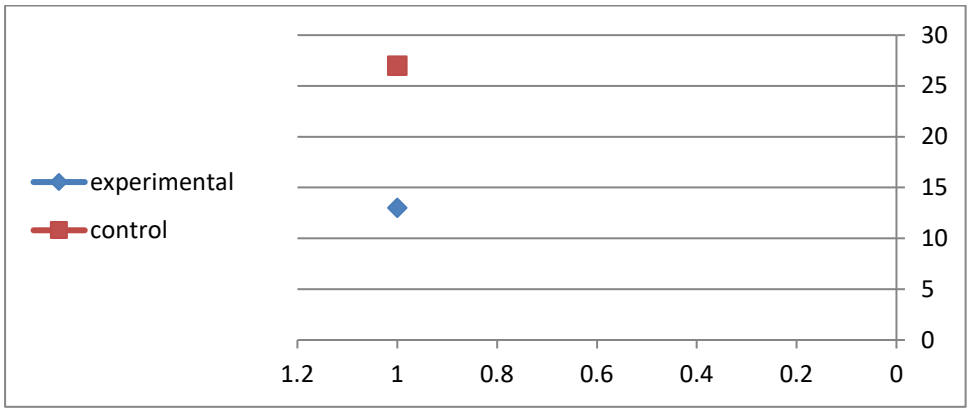


Figure 5. Post-test mean scores between the experimental and control groups in CF.

Discussion

It is now established that working memory, inhibition and cognitive flexibility can be improved through training in Dodge and Crick's Social Information-Processing Model, although ASD subjects present difficulty across a range of EFs, including cognitive flexibility, inhibition and working memory (Blijd-Hoogewys et al., 2014; Mostert-Kerckhoffs, Staal, Houben, & De Jonge, 2015; Van Eylen, Boets, Steyaert, Wagemans, & Noens, 2015). To our knowledge, there is no data in the literature concerning the potential benefit of Dodge and Crick's Social Information-Processing Model on developing working memory, inhibition and cognitive flexibility among primary school children with autism spectrum disorder. Therefore, the innovation of the present study was to develop an intervention program based on Dodge and Crick's Social Information-Processing Model aiming to develop working memory, inhibition and cognitive flexibility among primary school children with autism spectrum disorder. But also, to implement it in the school setting and to evaluate its direct impact on working memory, inhibition and cognitive flexibility among primary school children with autism spectrum disorder. At this time, teachers need to have at their disposal pedagogical activities in a coherent and efficient model, such as that of Crick's Social Information-Processing Model that can easily be applied in their primary school classroom. Therefore, this study responds to a growing demand in primary classes.

As expected there were positive effects of Dodge and Crick's Social Information-Processing Model on developing working memory, inhibition and cognitive flexibility among primary school children with autism spectrum disorder and this goes in the same line with other research studies (e.g. Röthlisberger et al., 2012; Houssa et al., 2013; Tamm et al., 2013; Houssa and Nader-Grosbois, 2015; Volckaert and Noël, 2015, 2016). Our results showed that Dodge and Crick's Social Information-Processing Model was effective, as children were able to identify and describe his / her inner feelings in "encoding". Training in SIP, beside improving working memory, inhibition and cognitive flexibility among primary school children with autism spectrum disorder, also improved different processes such as the encoding of cues, the interpretation of the intent and emotions of self and others, clarification of social goals, generation and evaluation of responses, and finally, a behavioural response was selected and enacted. Intact working memory, inhibition and cognitive flexibility are crucial for adequate SIP, as impaired focused attention may affect the encoding of relevant cues and, as a result, the interpretation of the problem situation. Impaired working memory may affect the encoding of cues and their interpretation, as these mechanisms involve assembling multiple pieces of potentially contradicting information (Maaike et al.,2018).

Without the essential executive skills included in Crick's Social Information-Processing Model (1994), a child may struggle to meet the demands of a given social scenario necessary for successful social interaction. These executive functions (EF) which can be described as cognitive capacities, are responsible for a child's ability to use purposeful, organised, strategic, self-regulated, goal-directed processing of emotions, thoughts, and actions necessary to cue mental operations such as language and reasoning.

To conclude, by training children with autism spectrum disorder how to encode social cues, that is, attend to appropriate cues; chunking/storing information; mentally represent and interpret the cues; integrate cues with past experiences; arrive at a meaningful understanding; consider one's own and others' perspectives on situations; clarify social goals; join a group game; maintain ongoing conversation; search for possible social responses; make a response decision after evaluating various response consequences and estimate the probability of favourable outcomes; and act out a selected response while monitoring its effects on the environment and regulating behaviour accordingly, it is possible to develop their EF processes (i.e. working memory, inhibition and cognitive flexibility).

Theoretical Implications

The findings of this study contribute to social information processing research in two major ways. First of all, they reinforce the utility of this approach in developing some executive functions (working memory, inhibition, and cognitive flexibility) which are impaired or atypical in these populations. Knowledge of the social information processing model is helpful for anyone seeking to develop executive functions (i.e. working memory, inhibition, and

cognitive flexibility) among children with autism spectrum disorder. Understanding of the order of the steps will help by allowing those who are interested and concerned to identify interventions that can happen early.

Limitations

The limitations of the study should be addressed. First, the control did not receive any intervention, which may have biased our results. Second, although the intervention was effective, the shorty period of training (i.e. 10 sessions only) was not enough to achieve a better outcome for children with ASD. Finally, children were of convenient sample, and this will affect the generalisation of our results.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

REFERENCES

Abdullah, A. (2014).The Effectiveness of a Social Story Intervention in Decreasing Problem Behaviour in Children With Autism Spectrum Disorder. *Psycho-Educational Research Reviews* , 3(3),27-33.

Ahmed, H. (2014). The Effect Of Social Stories Intervention On Social Skills Of Children With Autism Spectrum Disorder. *Psycho-Educational Research Reviews* , 3(2),32-40.

Albeheri, A. (2017)*Wechsler Intelligence scales for children.* Egyptian Anglo.

Amanda C, Katherine T, Victoria S, Brooke K, Rachel G & Susan F.(2020). Inhibition in developmental disorders: A comparison of inhibition profiles between children with autism spectrum disorder, attention-deficit/hyperactivity disorder, and comorbid symptom presentation. *Autism* 1 –17

American Psychiatric Association(2013*). Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing

Baddeley, A. (2012).Working memory: theories, models, and controversies. *Annual Review of Psychology,* 63, 1–29. doi:10.1146/annurev-psych-120710-100422

Baron-Cohen S, Leslie AM& Frith U. (1985).Does the autistic child have a "theory of mind"? *Cognition*, 21(1):37–46. doi: 10.1016/0010-0277(85)90022-8

Blackwell, K. a, Chatham, C. H., Wiseheart, M., & Munakata, Y. (2014). A developmental window into trade-offs in executive function: the case of task switching versus response inhibition in 6-year-olds. *Neuropsychologia,* 62, 356–64. doi:10.1016/j.neuropsychologia.2014.04.016

Blijd-Hoogewys, E. M. A., Bezemer, M. L., & Van Geert, P. L. C. (2014). Executive functioning in children with ASD: An analysis of the BRIEF. *Journal of Autism and Developmental Disorders*, 2014 ,44, 3089–3100. doi:10.1007/s10803-014-2176-9

Colombi, C., & Ghaziuddin, M. (2017). Neuropsychological characteristics of children with mixed autism and ADHD. *Autism Research and Treatment*, Article 5781781. https://doi.org/10.1155/2017/5781781

Corsi, P. M. (1972)*Human memory and the medial temporal region of the brain*. Dissertation Abstracts International, 34 (02), 891B. (University Microfilms No. AAI05–77717).

Crick, N. R., & Dodge, K. A. (1994).A review and reformulation of social information: Processing mechanisms in children's social adjustment. *Psychological Bulletin*, 115, 74–101.

Demetriou, E. DeMayo, M & Guastella, A (2019) Executive Function in Autism Spectrum Disorder: History, Theoretical Models, Empirical Findings, and Potential as an Endophenotype. *Front Psychiatry*. 10: 753. doi: 10.3389/fpsyt.2019.00753

Ebrahim, M. (2019).Effectiveness of a Pivotal Response Training Programme in Joint attention and Social Interaction of Kindergarten Children with Autism Spectrum Disorder. *Psycho-Educational Research Reviews* , 8 (2), 48-56.

Ellefson, M. R., Shapiro, L. R., & Chater, N. (2006).Asymmetrical switch costs in children. Cognitive Development, 21(2), 108–130. doi:10.1016/j.cogdev.2006.01.002

Embregts, P., & Van Nieuwenhuijzen, M. (2009).Social information processing in boys with autistic spectrum disorder and mild to borderline intellectual disabilities. *Journal of Intellectual Disability Research*, 53, 922–931.

Evelien M , Marc H, Jacobus FA , Walter H, Paul AM ,Geert T, Roy PC &Albert P . (2013).Working memory deficits in high-functioning adolescents with autism spectrum disorders: neuropsychological and neuroimaging correlates. *Journal of Neurodevelopmental Disorders*, 5:14

Flood, A. M., Hare, D. G., & Wallis, P. (2011)An investigation into social information processing in young people with Asperger syndrome. *Autism*, 15, 601–624.

Geurts, H. M., Corbett, B., & Solomon, M. (2009).The paradox of cognitive flexibility in autism. *Trends in Cognitive Sciences*, 13, 74–82.

Happé F&Frith U. (2006).The weak coherence account: detail-focused cognitive style in autism spectrum disorders. *J Autism Dev Disord* , 36(1):5–25. doi: 10.1007/s10803-005-0039-0

Hill E. (2004).Evaluating the theory of executive dysfunction in autism. *Dev Rev* , 24(2):189–233. doi: 10.1016/j.dr.2004.01.001

Honoré N, Houssa M, Volckaert A, Noël M-P and Nader-Grosbois N.(2020).Training Inhibition and Social Cognition in the Classrooms. *Front. Psychol*. 11:1974. doi: 10.3389/fpsyg.2020.01974

Houssa M., Nader-Grosbois N. (2015). Experimental study of middle-term training in social cognition in preschoolers. *J. Educ. Train. Stud.* 4 61–73.

Houssa M., Nader-Grosbois N., Jacobs E. (2013).Experimental study of short-term training in social cognition in pre-schoolers. *J. Educ. Train. Stud*. 2 139–154.

Leung, R. C., Vogan, V. M., Powell, T. L., Anagnostou, E., & Taylor, M. J. (2016).The role of executive functions in social impairment in Autism Spectrum Disorder. Child Neuropsychology: *A Journal on Normal and Abnormal Development in Childhood and Adolescence,* 22, 336–344. doi:10.1080/09297049.2015.1005066

Luna B, Doll SK, Hegedus SJ, Minshew NJ &Sweeney JA. (2007).Maturation of executive function in autism. *Biol Psychiatry*, 61:474–481.

Mahmoud , F. (2015).The Effectiveness of Picture Exchange Communication System in Improving the Functional Communication Skills of Individuals with Autism Spectrum Disorders . *Psycho-Educational Research Reviews* , 4(1), 31-37.

Mahmoud , M. (2015).The Effectiveness of a Training Program Based on Dodge's Social Information Processing Model on Improving Social Skills of Children with Autism Disorder. *Psycho-Educational Research Reviews* , 4(2), 22-28.

Gómez-Pérez, M.& Dolores, C.(2020). Differential analysis of executive functions in children from disadvantaged families vs. children with autistic spectrum disorder . *Anales de Psicología,* 36(1):102-110.

Mohammed, A. (2006).*Autism Spectrum Disorder Evaluation Inventory*. Cairo: Dar Al Rashad.

Mohammed, A. & Mostafa, A. (2012).Effectiveness of a Phonological Awareness Training Intervention on Word Recognition Ability of Children with Autism Spectrum Disorder. *Psycho-Educational Research Reviews* , 1(1), 2-10.

Mohammed M. (2016).Implementing a Joint Attention Intervention by Siblings: Effects on Children with Autism Spectrum Disorder . *Psycho-Educational Research Reviews* , 5 (1), 10-16.

Mohammed, S. (2016).The Effect of Graphic Organizers on Improving Reading Comprehension of Children with Autism Disorder . *Psycho-Educational Research Reviews* , 5 (1), 33-37.

Mortada, A. (2017).The Effect of Peer-Mediated Picture Exchange Communication System Intervention in Improving Vocabulary Knowledge in Children with

Autism Spectrum Disorders. *Psycho-Educational Research Reviews* , 6 (2), 23-29.

Mostafa , A. (2018).Investigating the Effect of Multisensory Approach on Improving Emergent Literacy Skills in Children with Autism Disorder . *Psycho-Educational Research Reviews* ,7(1), 94-99.

Mostert-Kerckhoffs, M. A. L., Staal, W. G., Houben, R. H., & De Jonge, M. V. (2015).Stop and Change: Inhibition and Flexibility Skills Are Related to Repetitive Behaviour in Children and Young Adults with Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders,* 45, 3148–3158. doi:10.1007/s10803-015-2473-y

Mourad, A. (2015).The Effectiveness of a Joint Attention Training Program on Improving Communication Skills of Children With Autism Spectrum Disorder . *Psycho-Educational Research Reviews* , 4(3), 3-12.

Mourad, A.(2016). The Effectiveness of Social Stories among Children and Adolescents with Autism Spectrum Disorders: Meta- Analysis . *Psycho-Educational Research Reviews* , 5(2), 51-60.

Mourad A. (2017a).A Systematic Review of Autism Spectrum Disorder in Children and Adolescents :Social Deficits and Intervention. *Psycho-Educational Research Reviews* , 6 (2), 12-22.

Mourad A. (2017b).Are Phonological Awareness Intervention Programs Effective for Children with Disabilities? A Systematic Review. *Psycho-Educational Research Reviews* , 6 (3), 11-20.

Mourad, A. (2018 a). The Effectiveness of a Life Skills Training Based on the Response to Intervention Model on Improving Functional Communication Skills in Children with Autism. *Psycho-Educational Research Reviews* ,7 (3), 56-61.

Mourad, A. (2018 b). Issues Related to Identification of Children with Autism Spectrum Disorders (ASDs) Insights from DSM-5 . *Psycho-Educational Research Reviews* ,7 (3), 62-66.

Mourad A.& Borowska-Beszta, B. (2019). Disability in the Arab World: A Comparative Analysis Within Culture . *Psycho-Educational Research Reviews* 8 (2):29-47.

Nirit B, Mor A, Alit B, Hani S, Tzuriel D, Gila T&Michal A. (2019).Social Information Processing Among Children With ASD, SLD, and Typical Development: The

Mediational Role of Language Capacities. *The Journal of Special Education,* 53(3):153 –165

Olde L.&Geurts H. (2017).Planning skills in autism spectrum disorder across the lifespan: a meta-analysis and meta-regression. *J Autism Dev Disord* ,47(4):1148–65. doi: 10.1007/s10803-016-3013-0

Peterson, R., Noggle, C. , Thompson, J. & Davis, J. (2015).Everyday executive functioning influences adaptive skills in autism spectrum disorders. *Neuropsychological Trends,* 18, 31–37. doi:10.7358/neur-2015-018-pete

Röthlisberger M., Neuenschwander R., Cimeli P., Michel E., Roebers C. M. (2012).Improving executive functions in 5-and 6-year-olds: evaluation of a small group intervention in prekindergarten and kindergarten children. *Infant Child Dev.* , 21 411–429.

Servera, M., & Cardo, E. (2006).Children sustained attention task (CSAT): Normative, reliability, and validity data. *International Journal of Clinical and Health,*6, 697–707.Retrieved from http://www.redalyc.org/articulo.oa?id=33760311

Steele SD, Minshew NJ, Luna B, Sweeney JA. (2007). Spatial working memory deficits in autism. *J Autism Dev Disord ,* 37:605–612.

Tamm L., Epstein J. N., Peugh J. L., Nakonezny P. A., Hughes C. W. (2013).Preliminary data suggesting the efficacy of attention training for school-aged children with ADHD. *Dev. Cogn. Neurosci. ,*4 16–28.

Turda ES, Crisan C, Albulescu I . (2019).The Development of Executive Functions among Children with Autism Spectrum Disorder. *Autism Open Access*,9: 243. doi: 10.35248/2165-7890.19.09.243.

Van Eylen, L., Boets, B., Steyaert, J., Wagemans, J., & Noens, I. (2015).Executive functioning in autism spectrum disorders: influence of task and sample characteristics and relation to symptom severity. *European Child & Adolescent Psychiatry,* 24, 1399–1417. doi:10.1007/s00787-015-0689-1

Van Nieuwenhuijzen M., Van Rest M., Embregts P., Vriens A., Oostermeijer S., Van Bokhoven I., et al. (2015).Executive functions and social information processing in adolescents with severe behaviour problems. *Child Neuropsychol.* ,23 228–241

Volckaert A. M. S., Noël M.-P. (2015).Training executive function in preschoolers reduce externalizing behaviours. *Trends Neurosci. Educ.* , 4 37–47.

Volckaert A. M. S., Noël M.-P. (2016).Externalizing behaviour problems in preschoolers: impact of an inhibition training. *J. Psychol. Abnorm*., 5:154.

Waite, (2013).*Executive Functions and Social Interactions: Developing Social Scenarios* . Master's Theses. 154

Williams DL, Goldstein G &Minshew NJ. (2006).The profile of memory function in children with autism. *Neuropsychology*, 20:21–29.

Williams DL, Goldstein G, Carpenter PA &Minshew NJ(2006).Verbal and spatial working memory in autism. *J Autism Dev Disord* , 35:747–756.

Yair Z. , Bat S.& Yasmine K . (2014).Social Information Processing in Preschool Children Diagnosed with Autism Spectrum Disorder. *J Autism Dev Disord* ,44:846–859 DOI 10.1007/s10803-013-1935-3

Yerys, B. E., Wallace, G. L., Sokoloff, J. L., Shook, D. A., James, J. D., & Kenworthy, L.(2009). Attention deficit/hyperactivity disorder symptoms moderate cognition and behaviour in children with autism spectrum disorders. *Autism Research,* 2(6), 322–333. https://doi.org/10.1002/aur.103.

Yerys, B. E., Wallace, G. L., Harrison, B., Celano, M. J., Giedd, J. N., & Kenworthy, L. E. (2009).Set-shifting in children with autism spectrum disorders. *Autism,* 13, 523– 538.