

Affective and Cognitive Theory of Mind in Children With Intellectual Disabilities: How to Train Them to Foster Social Adjustment and Emotion Regulation?

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Abstract

Affective and cognitive Theory of Mind (ToM) is known to be deficit or delayed in children with intellectual disabilities (IDs), when compared with typically developing children matched for developmental age. Yet, little is known about causal contribution of affective and cognitive ToM on emotion regulation or social adjustment in these children. Studies that aimed to answer this problematic, implemented training focusing on the nine mental states – mainly on beliefs and emotions – and in toddlers and adolescents' samples, rarely compared to control group. The present study aims at testing whether training ToM abilities notably affective and cognitive mental states in children with IDs could foster ToM, but also their emotion regulation and social adjustment. 30 children with mild or moderate IDs functioning at preschool developmental age, took part in a pre-test session involving measures on cognition and ToM. Teachers and/or parents completed questionnaires evaluating children's emotion regulation and social adjustment. Secondly, children were allocated to control or experimental group which benefits from the specific "ToM program for children". It was delivered in eight sessions, by an experimented searcher to sub-groups of three children. Finally, all children took part in a post-test session. Results showed significant improvement of affective and cognitive ToM abilities in children with IDs in experimental groups. After ToM training, they displayed a better understanding of cognitive mental states and of consequences of emotions. In post-tests, they are perceived as more socially adjusted by teachers.

Keywords: theory of mind, training, intellectual disabilities, emotion regulation, social adjustment

1. Introduction

Children with intellectual disabilities are known to have limitations in emotional and social competence (American Association on Intellectual and Developmental Disabilities; AAIDD, 2011). Due to these difficulties, they are more likely to have deficits in emotion regulation, of displaying social maladjustment or behavioral disorders, frequently reported by parents, teachers, specialized educators and psychologists (Baurain & Nader-Grosbois, 2013; Charman & Campbell, 2002; Dekker & Koot, 2003; Fiasse & Nader-Grosbois, 2012; Giaouri, Alevriadou, & Tsakiridou, 2010; Leffert & Siperstein, 2002). In order to foster their social inclusion, it is essential to prevent these difficulties as much as possible.

To explore their emotional and social profile, we could explore the potential causal role of their specific Theory of mind (ToM) abilities. ToM corresponds to abilities to understand one's own and other people's mental states, including beliefs, emotions, intentions, desires, false beliefs, pretense, knowledge, thinking, visual perception, and attention (Flavell, 1999). The ability to infer other's mental states leads to understanding and predicting social behavior and to respond in socially adaptive ways (Barisnikov, Van der Linden, & Detraux, 2002; Deneault & Ricard, 2013; Denham et al., 2003). ToM competences therefore help to foster positive social interactions with peers or adults, and adjustment in daily life. Recently, there has been an interest in differentiating "affective" and "cognitive" ToM (Hynes, Baird, & Grafton, 2006; Shamay-Tsoory et al., 2007). Affective ToM is associated with the understanding of desire and emotions while cognitive ToM is related to understanding of the other mental states. To evaluate the affective and cognitive dimensions, several authors (e.g., Hutchins, Bonazinga et al., 2008; Hutchins, Prelock et al., 2012) have created new measures, namely the ToM task Battery and the Theory of Mind Inventory, to assess a broader range of mental states. There are several prerequisites to developing ToM abilities, such as joint attention (Charman et al., 2000; Turrette, Recordon, Barbe, & Soares-Boucaud, 2000), imitation (Meltzoff, 2002), pretend play (Barthélémy & Tartas, 2009; Rakoczy, 2008) or empathy (Astington, 2003)

are needed. According to a Vygotskian perspective, children develop ToM abilities through language acquisition and social interactions, most notably during conversations in the family, social and cultural environment (Ricard, Cossette, & Gouin Décarie, 1999). Children with intellectual disabilities (IDs) display difficulties in these prerequisite factors and in ToM abilities themselves. Two kind of hypotheses have emerged regarding ToM abilities in these children. Empirical studies have observed either a delay or a deficit: (1) In comparison to typically developing children matched for developmental age, children with IDs present a delay in their understanding of causes and consequences of emotions (Baurain & Nader-Grosbois, 2013; Fiasse & Nader-Grosbois, 2012; Garitte, 2003; Thirion-Marissiaux & Nader-Grosbois, 2008c). (2) Results support either a delay (Fiasse & Nader-Grosbois, 2012; Giaouri et al., 2010), or a deficit (Charman & Campbell, 2002; Thirion-Marissiaux & Nader-Grosbois, 2008c) in these children's understanding of beliefs, depending on the measure used. Notably, children with borderline IDs have displayed difficulties in distancing themselves from their own perspective, wherein they do not differentiate their knowledge from the knowledge of others (Baglio et al., 2016).

A number of ToM trainings have been created and tested with children with (1) autistic spectrum disorders (e.g. Gevers, Clifford, Mager, & Boer, 2006; Hadwin, Baron-Cohen, Howlin, & Hill, 1996; Howlin, Baron-Cohen, & Hadwin, 2011; McGregor, Whiten, & Blackburn, 1998; Paynter & Peterson, 2013; Ratcliffe, Wong, Dossetor, & Hayes, 2014; Serret et al., 2014; Swettenham, 1996; Wellman et al., 2002; Williams, Gray, & Tonge, 2012), (2) externalizing behavior (e.g. Houssa, Jacobs, & Nader-Grosbois, 2016; Houssa & Nader-Grosbois, 2016; Shure, 1993; Webster-Stratton & Hammond, 1997), or (3) IDs (e.g. Jacobs, Léonard, Nader-Grosbois, Houssa, & Mazzone, 2016; Lachavanne & Barisnikov, 2013; Stewart & Singh, 1995). Several issues emerged from these studies among samples of participants with IDs or autism spectrum disorders (see appendixes A and B). It can be seen that very few samples consisted of children functioning at a preschool developmental age. Quasi-experimental studies have rarely included a control group. Training targets and measures focused on emotions and beliefs and not on all the cognitive and affective mental states. They generally used visual material supports such as photographs, pictures, mirror, stories or videos. Techniques implemented were corrective feedback, repetition, discussions, role-play, questions, key concepts, narratives, and storytelling (e.g. Lachavanne & Barisnikov, 2013; Paynter & Peterson, 2013; Ratcliffe et al., 2014; Serret et al., 2014; Stewart & Singh, 1995; Wellman et al., 2002). Most of these trainings have resulted in positive effects on ToM abilities. Children improved most in terms of their understanding of beliefs, false beliefs and emotions. Several studies indicated a better recognition of facial emotion expression, which is the first step of understanding the cause and consequences of emotions. Some trainings have also demonstrated positive effects on social problem-solving skills, emotion regulation or behavioral problems. In their meta-analysis, Hofmann and colleagues (2016) demonstrated that this kind of training in ASD and typically developing population is working well in a range of contexts (with a large effect size). Although these results are encouraging, they give little information about the potential causal contributions of affective and cognitive ToM abilities on emotion regulation and social adjustment, especially in children with IDs functioning at a preschool developmental age. Therefore, the goal of the present study is to test this causal contribution of affective and cognitive ToM abilities on emotion regulation and social adjustment. To do so, a new ToM training will be implemented in children with mild to moderate IDs. To assess its effectiveness, performance-based measures and questionnaires evaluating ToM and socio-emotional abilities will be administrated before and after training.

2. Method

2.1 Participants

Children included 23 boys and 7 girls with mild to moderate non-specific IDs. Recruitment was done with special education primary schools, from French speaking areas of Belgium. They have a mean age of 106.87 months ($SD = 19.85$), between 56 and 145 months. Children's IQ levels range from 50 and 75 and they have been previously diagnosed as having intellectual disabilities, according to AAIDD and DSM-V criteria. These children display limitations in intellectual functioning and in adaptive behavior. Children present a global developmental age (GDA) ranging from between 40 and 88 months ($M = 62.57$, $SD = 14.26$). Moreover, a verbal GDA is estimated between 37 and 86 months ($M = 61.43$; $SD = 14.38$). The recruitment and the sample were restricted due to very strict inclusion criteria – the children's developmental age corresponds to preschool age; consent given by schools, teachers and parents, notably to record videos of each training session; parents and teachers invest time to complete each questionnaire at pre-tests and –post-tests. Based on the exclusion criteria, children with Williams's syndrome or Autism spectrum disorder could not be included, as well as children who are not able to express sentences of three to four words. Moreover, 10 participants left the research program, leading to a mortality rate in the sample.

2.2 Measures

2.2.1 Wechsler Preschool and Primary Scales (WPPSI-III; Wechsler, 2004)

This measure gives information about the cognitive functioning and the child's GDA. It was used only in pretesting because it allowed screening for the inclusion criteria (i.e., mild to moderate intellectual disability and a GDA between 3 and 7

years). Four subtests were administered. Two verbal (“information” and “vocabulary”) and two non-verbal (“block design” and “matrix reasoning”) subscales, that strongly correlated with total WPPSI-III scores, were used.

2.2.2 Tom-Emotions Tasks (Thirion-Marissiaux & Nader-Grosbois, 2008b)

Computerized ToM-emotions tasks (E-prime) evaluate the comprehension of emotions, and particularly their causes and consequences. Each child completed three tasks. (1) The first one was a preliminary task of facial emotional expression (FEE) recognition, in which the child is required to recognize joy, sadness, anger, and fear in pictures. (2) The second task evaluated the comprehension of the causes of emotions. Four stories, with the same beginning, were presented to the child who had to predict the protagonist’s emotion according to the end of the script and justify his or her response. The correct emotion is scored 1 point and a coherent justification is scored 0.5, with a maximum score of 6. (3) The third task estimated the understanding of consequences of emotions. Four scripts, eliciting joy, anger, sadness and fear, were presented to the child. After listening to the beginning of each story, the child had to infer the protagonist’s behavior. He or she chooses from among three responses, illustrating a socially adjusted, a maladjusted or a neutral behavior, and justified his or her choice. The choice of socially adjusted cards scored 1, whereas the maladjusted or neutral score 0. A coherent justification scored 0.5, with a maximum of 6. ToM-emotions tasks are summed for a possible maximum score of 12.

Concerning validation data, factor analysis revealed two subscales (causes and consequences). Cronbach’s alpha was .57, and the test-retest stability was significant for the two subscales (between .56 and .68). The validation is good and it has been tested in typically developing children and children with IDs.

2.2.3 ToM-Beliefs Tasks (Thirion-Marissiaux & Nader-Grosbois, 2008a)

The ToM-beliefs tasks assesses the understanding of beliefs, through five tasks: (1) Deception skills task (Oswald & Ollendick, 1989); (2) Change of representation task (Flavell, Everett, Croft, & Flavell, 1981); (3) Appearance-Reality task (Flavell, 1986); (4) Unexpected content task (Perner, Leekam, & Wimmer, 1987); (5) Change of location task (Wimmer & Perner, 1983). Each task scores 1 point, with a possible maximum score of 5. During the task validation process, the inter-judge agreement was very high (between 99% and 100%; Cohen’s kappa between .98 and .99; Pearson correlation coefficient between .99 and 1). No difference between the test and retest session was obtained. These ToM-beliefs tasks were validated with children with IDs.

2.2.4 ToM-Task Battery-French Version (Hutchins, Bonazinga, Prelock, & Taylor, 2008; Nader-Grosbois & Houssa, 2016)

This battery estimates children’s ToM abilities about differentiated mental states. Nine tasks evaluate: (1) Emotion recognition; (2) Perspective taking; (3) Inference of desire-based emotion; (4) Inference of perception-based belief; (5) Inference of perception-based action; (6) False belief; (7) Inference of Belief- and Reality-Based Emotion and Second Order Emotion Task; (8) Message-Desire Discrepant; (9) Second-Order False Belief. The child is asked different questions: control, test and prompt questions. Each correct test question is scored 1, with a maximum total score of 15. This measure also provides sub-scores relating to affective, cognitive or mixed mental states. Concerning validation, the Cronbach’s alpha demonstrated good reliability ($\alpha = .91$), which has been validated with children with atypical development.

2.2.5 Theory Of Mind Inventory - French-Version (Tomi-Vf; Houssa, Mazzone, & Nader-Grosbois, 2014; Hutchins, Prelock, & Bonazinga, 2012)

This questionnaire assesses parents’ perceptions of their child’s ToM abilities used in daily life. On 39 items, parents evaluate the child’s comprehension of nine mental states: desires, emotions, beliefs, intentions, attention, perception, thinking, pretense, knowledge. Each item is scored out of 20 and a maximum total score of 20 is obtained by averaging item scores. The 3 sub-scores relate to cognitive mental states, socio-emotional mental states and intentions and beliefs. Validation data of the french version match those of the original version (Hutchins et al., 2012), demonstrating good internal consistency ($\alpha = .94$) and test-retest reliability ($r = .86$).

2.2.6 Emotion Regulation Checklist - French Version (ERC, Shields & Cicchetti, 1997; ERC-Vf, Nader-Grosbois & Mazzone, 2015)

This questionnaire assesses the parents’ perception about their child’s emotional regulation ability. This measure is applicable for children aged from 3 to 12 years old with or without development disorder. Using a 4-point Likert scale, ranging from never to usually, parents evaluate the occurrence of specific behaviors. Parents completed the questionnaire, estimating the child’s emotion regulation with 8 items and emotion dysregulation with 16 items. Emotion regulation relates to appropriate empathy, affective displays, emotional and frustration control while emotion dysregulation is linked to mood lability, angry reactivity and dysregulated negative affect. Emotional regulation and dysregulation scores were summed to provide a composite emotional regulation score. Factor analysis for the french version of this questionnaire identified two factors, namely “emotional regulation” and “emotional dysregulation”. During a validation process, the

inter-judge agreement was carried out and was high for the two scales (88% for emotional regulation and 86% for emotional dysregulation). Regarding reliability, analyses revealed a good intern consistency ($\alpha = .70$).

2.2.7 Social Adjustment Scales for Children (EASE; Hughes, Soares-Boucaud Hochman & Frith, 1997)

This questionnaire measures social adjustment with 50 items completed by parents, which estimate their child's socio-emotional adjustment, by rating the frequency of daily interaction related behavior on a 2-point Likert scale. One-half of items assess behavior relating to politeness, discipline or civility and gives an "EASE - Social skills" score. The other half evaluate social skills relating to Theory of Mind competencies, considering others' emotions, desires or beliefs, and provides an "EASE - ToM" score. The maximum score is 100. The "EASE - Social skills" and "EASE - ToM" scores demonstrate good reliability (respectively $\alpha = .77$ and $\alpha = .79$; Hughes, Soares-Boucaud, Hochmann, & Frith, 1997).

2.2.8 Child Behavior Checklist (CBCL; Achenbach, 1991)

This measure assesses children's behavioral and emotional problems, and includes 79 items. For each item, parents indicate the frequency of children's behavior on a 3-point Likert scale – from "not at all present" to "often present". Two scores are obtained: one relating to internalizing behavior and the other externalizing behavior. "Attention problems" and "aggressive behavior" subscales are summed to obtain the externalizing behavior score (clinical cutoff > 24) and "anxious/depressed", "emotionally reactive", "withdrawn" and 'somatic complaints' subscales are summed to obtain the internalizing behavior score (clinical cutoff > 17). Using clinical cutoffs, profiles in terms of behavioral and emotional problems are identified in the present sample at baseline. Cronbach's alphas for the different subscales are between .63 and .86.

2.3 Procedure

This study was approved by an ethical committee and the consent of parents and their child were obtained before proceeding. All of the measures described above were administered in the pretest session. Children were then randomly assigned to an experimental or a control group. No difference was found between these two groups on pretest measurement scores (see Table 1). Children from the experimental group took part in the "ToM program for children" while the control group benefited from the same program after post-test. This post-test session took place after implementing the 8 sessions with children in the experimental group and included all of the measures, except for the Wechsler preschool and primary scales and the Child Behavior Checklist.

Table 1. Demographic and individual characteristics: Mean scores and standard deviations for each group in pre-test and between-group comparisons

Variables		Control group	Experimental group	χ^2/t
		(<i>n</i> = 15)	(<i>n</i> = 15)	
		<i>M</i> (SD)	<i>M</i> (SD)	
Sex (% boys)		86%	66%	1.68
CA (in months)		109.6 (12.51)	104.13 (25.37)	.75
GDA		63.47 (16.18)	61.67 (12.57)	.34
VDA		62.1 (15.85)	60.77 (13.27)	.25
Family measures	Family income	3.20 (1.15)	3.64 (.81)	.71
	Mothers' education (max = 7)	2.45 (1.44)	2.63 (1.6)	-.24
	Fathers' education (max = 7)	3.33 (1.22)	3.83 (1.6)	-.65
Explicit ToM measures	ToM Task Battery total (max = 15)	8.07 (2.52)	8.33 (3.15)	-.26
	Affective ToM Task Battery	4.8 (1.15)	4.93 (1.38)	-.27
	Cognitive ToM Task Battery	2.64 (1.15)	2.86 (1.46)	-.43
	Mixed ToM Task Battery	.92 (.95)	.64 (1.08)	.71
	ToM emotions (max= 12)	6.9 (1.63)	7.33 (2.77)	-.52
	ToM emotions – causes (max= 6)	3.87 (.85)	4.3 (1.88)	-1.13
	ToM emotions – consequences (max= 6)	3.5 (1.59)	4.23 (1.93)	-.81
	ToM beliefs (max= 5)	2.53 (1.26)	3.13 (1.42)	-1.22
Applied ToM measures	ToM Inventory (max = 20)	14.23 (3.18)	12.5 (3.43)	1.31
	ToM Inventory – Factor 1	13.03 (4.56)	10.88 (3.65)	1.3
	ToM Inventory – Factor 2	15.05 (2.58)	14.61 (3.34)	.37
	ToM Inventory – Factor 3	15.86 (2.45)	13.65 (4.7)	1.49
Social (mal)adjustment	EASE total	59.07 (18.66)	57.38 (19.35)	.23
	EASE ToM	28.93 (9.8)	27.85 (10.51)	.28
	EASE social skills	30.14 (9.44)	29.38 (9.17)	.21
	Externalizing problems	65 (13.58)	75.05 (18.25)	-1.65
	Internalizing problems	73.36 (18.08)	74.78 (11.27)	-.25
	Social competences	106 (23.48)	118.87 (29.95)	-1.27
	General adjustment	244.36 (40.49)	268.71 (48.76)	-1.44
	CBCL EB	16.47 (10.44)	19.25 (11.91)	-.65
	CBCL IB	17.53 (9.03)	18.42 (10.04)	-.24
	Emotion Regulation	3.01 (.33)	2.91 (.4)	.71
Emotion Dysregulation	2.01 (.35)	1.99 (.52)	.1	

Note. CA = Chronological Age; GDA = Global Developmental Age; IQ = Intellectual Quotient; CBCL = Child Behavior Checklist; EB = Externalizing Behavior; IB = Internalizing Behavior; EASE = Social Adjustment Scale for Children

2.3.1 ToM Program for Children (Jacobs & Nader-Grosbois, 2018)

The ToM program for children consisted of eight 45-minute sessions that took place two times a week and were implemented in groups of three children with IDs by two trainers. The program is modeled after a literature review and the program of Howlin et al. (2011) that described developmental stages of acquisition. For example, the understanding of belief is trained before that of false belief and emotional facial expression is trained first on photographs and then on schematic faces. The sessions' complexity increased over time, considering each child's zone of proximal development. The program was aimed at fostering comprehension of the nine mental states described by Flavell (1999). Each session focused either on affective or cognitive mental states. It was only during the seventh session that trainers began discussing the link between emotion, desire and belief. Materials such as games, videos, pictorial books were chosen considering

which mental states each elicits (see Appendix B). Sessions started with a reminder, then trainers implemented 3-4 activities and closed the session by reading a pictorial book. Techniques used throughout sessions matched both general and specific objectives (see Appendix C). For example, the experimenter asked questions related to affective or cognitive mental states and explained the correct answer using key concepts (e.g., “You feel happiness when something pleasant occurs or when you received a present”). Repetition of these key questions and concepts fostered a cognitive routine that ensures generalization of knowledge. Similarly, knowing the key role of language and conversations in ToM abilities’ development (Vygotsky, 1978), it was essential to support discussions between trainers and peers, and between peers themselves. In fact, children helped each other to find the correct answer, gave alternative justifications or interpretations which emphasized the possibility to share diverse perspectives on the same situations. The selection of these techniques was based on proof of their potential effectiveness in young children with developmental disorders.

3. Results

3.1 Training Effects on Theory of Mind Abilities

To evaluate training effect, we firstly used t tests to compare means and identified time effect. Secondly, we look for group by time interaction using repeated measure ANOVAS. As can be seen in Table 2, the control group did not significantly improve in their cognitive or affective ToM skills at the post-test, whereas the experimental group’s ToM abilities improved after training. Compared with the pre-test, significant improvements were observed on ToM abilities, notably on the total ToM Task Battery ($t = -3.97$; $p = .001$; $d = 1.02$). Nevertheless, improvements differ considering affective or cognitive ToM.

Regarding affective ToM, children of the experimental group improve their performance in the affective score ($t = -2.28$; $p \leq .05$; $d = .60$) of ToM Task Battery and in ToM-emotions ($t = -2.61$; $p \leq .05$; $d = .58$), in comparison with the pretest. Concerning ToM-emotions, repeated measures ANOVAs show group by time interaction effects, but only for the subscale evaluating the comprehension of consequences of emotions ($F = 5.58$; $p \leq .05$; $\eta^2 = .17$).

Concerning cognitive ToM, improvements noticed are greater. Compared with the pre-test, children of the experimental group improve their abilities in the cognitive score ($t = -3.55$; $p \leq .01$; $d = 1.17$) of ToM task battery and in ToM-beliefs ($t = -5.05$; $p = .000$; $d = 1.33$). Repeated measures ANOVAs show significant interaction effects group by time for the cognitive score of ToM task Battery ($F = 4.26$; $p \leq .05$; $\eta^2 = .15$) and for the ToM-beliefs task ($F = 13.41$; $p \leq .001$; $\eta^2 = .32$). Simultaneously, a significant interaction effect group by time is obtained for the score corresponding with the third factor of the ToMI ($F = 6.9$; $p \leq .05$; $\eta^2 = .33$). Parents perceived a significant improvement of the comprehension of cognitive mental states in their children. Moreover, thanks to a One-way ANOVA, we compare children that display better ToM abilities at post-test to those improving moderately and to the control group. Results show that children which improve the most, are those which display a lower level of understanding of cognitive mental states, at the pretest ($F = 5.79$; $p = .009$; $\eta^2 = .43$).

Table 2. Within and between group comparisons: Means and standard deviations on pre-test and post-test in ToM, emotion regulation and social adjustment measures

Variables	Control group			Experimental group			Analysis (F)	Group by time interaction	Partial Eta ²	
	Pre-test	Post-test	△	Pre-test	Post-test	△				
	M (SD)	M (SD)	t	M (SD)	M (SD)	t				
Explicit ToM measures	ToM Task Battery total (max= 15)	8.07 (2.52)	7.87 (2.33)	.37	8.33 (3.15)	11.2 (2.4)	-3.97***	11.47**	.29	
	Affective ToM Task Battery (max= 6)	4.8 (1.15)	4.8 (1.21)	.00	4.93 (1.38)	5.62 (.87)	-2.28*	3.24		
	Cognitive ToM Task Battery (max= 6)	2.64 (1.15)	2.87 (1.64)	-.67	2.86 (1.46)	4.3 (.95)	-3.55**	4.26*	.15	
	Mixed ToM Task Battery (max= 3)	.92 (.95)	.33 (.62)	1.67	.64 (1.08)	1.42 (1.38)	-2.42*	8.2**	.26	
	ToM emotions (max= 12)	6.9 (1.63)	6.5 (1.36)	1.03	7.33 (2.77)	8.93 (2.76)	-2.61*	7.82**	.22	
	ToM emotions – causes (max= 6)	3.87 (.85)	3.90 (1.27)	-.13	4.3 (1.88)	5.18 (1.96)	-1.87	2.69		
	ToM emotions – consequences (max= 6)	3.5 (1.59)	3.57 (1.73)	-.16	4.23 (1.93)	5.82 (2.62)	-3.29**	5.58*	.17	
	ToM beliefs (max= 5)	2.53 (1.26)	2.73 (.99)	-1.06	3.13 (1.42)	4.6 (.66)	-5.05****	13.41***	.32	
	Applied ToM measures	ToM Inventory (max = 20)	14.23 (3.18)	13.78 (7.31)	.11	12.5 (3.43)	14.57 (4.15)	-1.35	.79	
		ToM Inventory – Factor 1	13.03 (4.56)	12.91 (11.07)	-.05	10.88 (3.65)	13.06 (5.61)	-.91	.23	
ToM Inventory – Factor 2		15.05 (2.58)	15.55 (5.31)	-.51	14.61 (3.34)	15.86 (2.81)	-.96	.04		
ToM Inventory – Factor 3		15.86 (2.45)	13.28 (4.49)	2.21 ^a	13.65 (4.7)	16.03 (3.75)	-1.54	6.9*	.33	

Note. △ = post-test/pre-test difference. ToM = Theory of Mind; * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, **** $p = .000$, ^a $p = .055$.

3.2 Training Effects on Social (mal)Adjustment

As can be seen in Table 3, parents estimated that neither children in the experimental group nor children in the control group had better social adjustment skills at the post-test. Nevertheless, teachers evaluated children in the experimental group as displaying better abilities in social adjustment after the ToM program for children. According to a repeated measures ANOVA, a significant group x time effect was found for scores in EASE completed by teachers ($F = 7.9$; $p = .01$; $\eta^2 = .27$). The improvement was assessed by teachers as greater for items relating to the use of ToM abilities ($F = 8.78$; $p = .007$; $\eta^2 = .29$) than of social skills ($F = 4.8$; $p = .04$; $\eta^2 = .19$).

Table 3. Within and between group comparisons: Means and standard deviations on pre-test and post-test in social adjustment and emotion regulation measures

Variables	Control group			Experimental group			Analysis (<i>F</i>)		
	Pre-test	Post-test	Δ	Pre-test	Post-test	Δ	Group by time interaction	Partial Eta ²	
	<i>M</i> (SD)	<i>M</i> (SD)	<i>t</i>	<i>M</i> (SD)	<i>M</i> (SD)	<i>t</i>			
Social adjustment	EASE Total (max= 98)	59.07 (18.6)	61 (17.35)	-.33	57.38 (19.3)	72 (17.72)	-.6	.85	
	EASE ToM (max= 52)	28.93 (9.8)	29.42 (8.71)	.26	27.85 (10.5)	36.25 (7.27)	-.77	1.68	
	EASE Social Skills (max= 46)	30.14 (9.44)	31.58 (9.2)	-.95	29.38 (9.17)	35.75 (10.7)	-.45	.31	
	EASE Total_Teachers (max= 98)	48.30 (17.1)	46.90 (16.1)	1.54	54.08 (17.9)	59.31 (16.8)	-2.69*	7.9*	.27
	EASE ToM_Teachers (max= 52)	25 (8.55)	24.20 (7.76)	.83	26.92 (9.23)	32.08 (8.87)	-3.24**	8.78**	.29
	EASE Social Skills_Teachers (max= 46)	23.30 (8.93)	22.70 (9.08)	1.41	27.15 (9.38)	29.23 (8.15)	-2.04	4.8*	.19
Emotion regulation	ERC Regulation (max= 4)	3.01 (.33)	3.07 (.43)	-1.51	2.91 (.4)	3.28 (.67)	-1.93	.08	
	ERC Dysregulation (max= 4)	2.01 (.35)	2.07 (.37)	1.15	1.99 (.52)	2.11 (.55)	-.67	.12	

Note. Δ = post-test/pre-test difference. ToM = Theory of Mind; ERC = Emotion Regulation Checklist; EASE = Social Adjustment Scales; * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$, **** $p = .000$, ^a $p = .055$.

The results concerning social competences and behavior were different according to context. Parents noticed no improvement in children, whereas teachers evaluated children in the experimental group as displaying less externalizing and internalizing behavior after the training sessions. A repeated measures ANOVA showed a significant group by time interaction effect in scores on the CBCL measure for externalizing ($F = 14.15$; $p = .001$; $\eta^2 = .37$) and internalizing ($F = 12.69$; $p = .002$; $\eta^2 = .35$) behavior (see Table 2). After the ToM program for children, children were not perceived by their parents as better at regulating their emotions (see Table 2).

4. Discussion

The present study aimed to test the effectiveness of a new “ToM program for children” among children with IDs. Its unique contribution is that it considers affective and cognitive mental states and is in line with the strengths and impairments of children with IDs. We looked at the performance in ToM, social adjustment and emotion regulation of children who participated in this program in comparison to a control group. Results showed that this program fosters ToM abilities and social adjustment. Nevertheless, positive effects varied depending on affective or cognitive mental states.

As demonstrated by other studies (e.g. Jacobs et al., 2016; Lachavanne & Barisnikov, 2013; Stewart & Singh, 1995), an adapted training focusing on affective ToM supports the understanding of desires and emotions (notably the causes of emotions) despite the inter- and intra-variability among children. In fact, some children in the present sample displayed different levels of intensity and progression, which influences the improvement of ToM abilities in various ways. Additionally, enhancements in emotion abilities were seen primarily in the comprehension of consequences of emotions. This ability is acquired at approximately 6 years old (Wellman & Liu, 2004; Westby & Robinson, 2014). Yet, some children in the present sample presented a GDA of 5 and had already acquired the understanding of desire and causes of emotions. Therefore, they were more likely to acquire the comprehension of consequences of emotions, by training understanding of affective mental states. This result reflects that one of factors explaining the effectiveness of this program corresponds to respecting the zone of proximal development (Vygotsky, 1978) of each subgroup of children. The most significant results concerned cognitive ToM. After training, the experimental group showed a better comprehension of cognitive mental states, such as belief or perspective taking, than the control group. Moreover, children with low cognitive

ToM benefited the most from the ToM program for children. This could be explained by the fact that children with IDs display deficits in the understanding of cognitive mental states (Barisnikov et al., 2002; Fiasse & Nader-Grosbois, 2012; Thirion-Marissiaux & Nader-Grosbois, 2008a) while affective ToM is delayed (Baurain & Nader-Grosbois, 2012; Nader-Grosbois, Houssa, & Mazzone, 2013; Thirion-Marissiaux & Nader-Grosbois, 2008c). A lot of studies attest to the effectiveness of training focusing on cognitive ToM, particularly for beliefs comprehension. For example, “Thought bubbles” training has been proven effective with children with autistic spectrum disorder and IDs (Paynter & Peterson, 2013; Wellman et al., 2002). Nevertheless, the present study indicates that it is possible to support the comprehension of other cognitive mental states, beyond beliefs. This learning seemed to generalize to diverse contexts and particularly at home. Parents perceived that their child used better their understanding of beliefs and intentions in daily life, after participating in our program.

Given the results for social adjustment and emotion regulation, it is possible to better understand the causal contribution of ToM abilities on these social skills. Nevertheless, these effects were noticed only in a school setting. Teachers perceived children with IDs as more socially adjusted after the program, suggesting that these children were more polite, disciplined and responsive to others in a social situation with peers. This finding is in line with those of Nader-Grosbois et al. (2013) suggesting that children with IDs who are more tolerant, prosocial and integrated display a better understanding of emotion. Parents did not identify similar improvements suggesting that generalization occurs only at school or that parents did not have the opportunity to observe their child in diverse social interactions with multiple partners. Parents perceived no significant effect in terms of emotion regulation. It could be explained by the fact that although the emotion regulation checklist was completed by parents while, as with social adjustment skills, emotion regulation may be observed more easily at school. Furthermore, Thirion-Marissiaux and Nader-Grosbois (2008c) highlighted that parents may underestimate social abilities in their children with IDs because they refer to their child’s chronological age rather to their developmental age. Although ToM competencies relate to emotion regulation when it is assessed in observational studies with children with IDs (Baurain & Nader-Grosbois, 2013), children with IDs have greater difficulty handling situations where emotions are aroused (Baurain & Nader-Grosbois, 2013), which could limit the effectiveness of the ToM training. Other deficient factors such as social information processing (Jacobs & Nader-Grosbois, Submitted) or executive function (e.g., inhibition; (Gligorović & Buha, 2012) should be supported in addition to the present training in order to reinforce emotion regulation in children with IDs.

Some limitations have to be considered. Statistical power was limited due to the quite small sample size. Recruitment was limited by strict inclusion criteria and the necessity to obtain consent from all participating children, parents, and teachers. Two children missed one session and after their absence, they participated in a 10-minute feedback session focusing on what had been done during the missed session. An additional measure of language or executive functions might have been useful, as language (Hippolyte, Iglesias, Van der Linden, & Barisnikov, 2010; Lohmann & Tomasello, 2003; Westby & Robinson, 2014) and executive functions, most notably working memory (Dennis, Agostino, Roncadin, & Levin, 2009; Lecce & Bianco, 2018) and inhibition (Josef Perner, Lang, & Kloo, 2002), could be underlying mechanisms of ToM development. In the future, it would be interesting to implement the ToM program for children along with an executive function training, such as inhibition training. It could reinforce children’s control of socially adjusted behavior and emotion regulation skills. Another limitation is that the children did not take part in a follow-up session.

To conclude, the ToM program for children seems effective with children with IDs. The material and techniques of the present program can be seen as adaptive since it respects objective and specific affective and cognitive ToM profiles of these children. Despite verbal difficulties, techniques of discussion and feedback seemed beneficial for children with IDs, just as they are for typically developing children (Gola, 2012; Lecce, Bianco, Devine, Hughes, & Banerjee, 2014). Considering the developmental period and the nature of difficulties, namely those stemming from the deficit or delay hypothesis, in children with IDs has crucial consequences for professionals and families (Reilly, 2012). The present study suggests that the preliminary analysis of the affective and cognitive ToM profile is a necessary first step of intervention. According to a qualitative observation, the group training design allows for socio-cognitive debate between children, which contributes to the effectiveness of our program. But, in an individual setting, implementation of ToM program for children is possible – considering the child’s socio-emotional profile. Current results emphasized the importance of parents’ involvement in the intervention process in order to generalize learning to the everyday context. Generalization could be reinforced by homework based on the materials and techniques used by the professional trainers, but adapted to a home setting. Parents could also benefit from support concerning their emotion socialization behavior, since parental impact on ToM abilities and emotion regulation skills is well-known (Jacobs, Mazzone, Simon, & Nader-Grosbois, 2019). Other actors of prevention, change and learning stability could be specialized teachers. They could implement activities inspired by ToM programs for children in their classroom. Beyond its effectiveness in this experimental study, our adapted training for children with IDs, the ToM program for children, highlights guidelines for professionals, parents and teachers to foster both affective and cognitive ToM in order to prevent social maladjustment and encourage social inclusion.

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Appendix A. Table of ToM training studies in children with Intellectual Disabilities

Authors		Stewart & Singh (1995)	Lachavanne & Barisnikov (2013)	Jacobs, Nader-Grosbois, Houssa et al. (2016)
Sample		Children with IDs (mild to moderate) ($n = 3$) - IQ: $M = 54$ (between 44 to 64) - CA: $M = 12$ (between 12 to 13)	Adolescent with IDs (mild to moderate) ($n = 17$) - IQ: $M = 60$ - CA: $M = 23$ (between 18 to 42)	Children with IDs (mild to moderate) ($n = 6$) - CA: $M = 9.5$ (6 to 12) - DGA: $M = 4.5$
Training	Control group			X ($n = 6$)
	Target	- Emotions (joy, anger, fear, sadness, surprise, disgust)	- Emotions - Social Problem Solving	- Theory of Mind - Social problem-solving
	Timing sessions	- 30 sessions - 8 to 12 weeks follow up	- 9 sessions (90 min) - 1 x / week	- 1 session (45min.)
	Individual or group?	Individual	Group (4 to 5)	Group (3)
Variables/ Measures	Relating to ToM	- Facial emotions recognition (based on FACS)	- Emotions recognition - Emotional attribution task	- Theory of Mind (ToM-Emotions; ToM-Beliefs; ToM Tasks Battery-vf)
	Relating to other variables		- Social problem-solving task - Social behavior (Development-al Behavior Checklist)	- Social adjustment (EASE; SCBE) - Social problem-solving competence (RES) - Emotion Regulation (ERC-vf)
Material	Eliciting mental states	Photographs (6/session) ; Stories; Mirror	Pictures; Photographs; Stories; Mirror; Interactive game; Imitation; Discussions	Pictures; Games; Videos; Books
Techniques	Repetition	X		
	Corrective feedback	X	X	X
	Asking justification			X
	Link with child's experience		X	X
Results	Effects on ToM	X	X	X
	Effects on other variables	(+ Facial emotion expression recognition)	X (- Behavior problems + Social Problem Solving)	X (Social problem solving)

Appendix B. Table of ToM training studies in children with Autistic Spectrum Disorder

Authors		Wellman et al. (2002)	Williams, Gray, Tonge (2012)	Ratcliffe et al. (2014)	Serret et al (2014)
Sample		ASD Children & Adolescents with/without IDs (mild to moderate) ($n = 7$) - MA: $M = 5.6$ (between 4 to 6.5) - CA: $M = 11.2$ (between 8 to 18)	ASD Children with/without IDs (mild to moderate) ($n = 28$) - IQ: $M = 76$ (between 42 to 107) - CA: $M = 5$ (between 4.1 to 7.3)	ASD Children without IDs ($n = 106$) - CA: $M = 9$	ASD Children & Adolescents with/without ID (mild to moderate) ($n = 33$) IQ: $M = 70.5$ (between 35 to 129) CA: $M = 11.4$ (between 6 to 17)
Training	Control group		X ($n = 27$)	X ($n = 111$)	
	Target	- Beliefs	- Emotions	- Emotion- Based Social Skills Training (EBSST) - Emotional skills - Emotional problem solving - ToM - Emotion regulation	- Emotions
	Timing sessions	- 6 sessions (30 min) - 2 to 3 x / week	- 15 min. / day - During 1 month - Home - 3 months follow up	- 16 sessions (90 min) - 3 x / week - During 5 weeks - 6 months follow up	- 8 sessions - 3 x / week - 1 level / session
	Individual or group?	Individual	Individual	Group of 3 to 8	Individual
Variables/ Measures	Relating to ToM	- Cognitive ToM (“Sally & Anne” & “Smarties” tasks)	- Emotion identification & matching tasks (Based on FACS) - Emotion recognition & ToM (NEPSY-II) - Emotion & desire relating to ToM (Mindreading task)	- Emotional skills (including ToM; Emotions Development Questionnaire)	- Je StiMule
	Relating to other variables		- QI (WPPSI-III) - Social adjustment (Vineland-II) - ASD Diagnosis (ADOS)	- ASD Diagnosis (SRS) - Social skills (Social Skills Improvement System- Rating Scale) - Mental health difficulties (Strengths and Difficulties Questionnaire)	

Appendix C. “ToM program for children” – Material

Material		Mental states		
			Own	Others
How I feel? (<i>Affective ToM</i>)	“Faces’ game”	Emotions – expression	X	X
	Mirror	Emotions – expression, cause	X	
	Smileys Recognition	Emotions – expression		X
	Puzzle	Emotions – expression, cause		X
	Pictorial Book – “The color of emotions”	Emotions – expression, cause, intensity		X
What do I believe? (<i>Cognitive ToM</i>)	Hidden objects (deceptive task)	Perspective taking Belief Attention	X	
	Prototypical boxes with unexpected content – e.g. Smarties box with pencil inside	Perspective taking Belief False belief Attention Knowledge	X	
	“Mirror images”	Visual perspective taking Perspective taking Attention	X	
	Cartoons: Extract of “Snow White” – e.g. Snow White thinks she sees crocodiles while it is a wood.	Perspective taking Belief False belief Intentions Knowledge		X
	Pictorial Book – “The wolf may be here”	Belief False belief	X	X
Why this feeling? (I)? (<i>Affective ToM</i>)	Level 3 of Howlin et al. program	Emotions – Causes		X
	Game – “Marion, Simon and their emotions”	Emotions – Expression, Causes		X
	Cartoons: Extract of “The Jungle Book” – e.g. A girl seeks Moogly and feels fear when she saw an animal.	Emotions – Expression, Causes		X
	Pictorial Book – “Happy, Angry”	Emotions – Expression, Causes		X
Why this feeling? (II)? (<i>Affective ToM</i>)	Game – Tintin and the four emotions	Emotions – Expression, Causes		X
	Game – Guess why?	Emotions – Expression, Causes		X
	Pictures – Feelings	Emotions – Expression, Causes, Consequences		X
	Pictorial Book – “Huge Angry”	Emotions – Expression, Causes, Consequences		X
My beliefs and me? (I) (<i>Cognitive ToM</i>)	Game – Mental Simil	Perspective taking Belief False belief Intentions Knowledge Pretend Attention		X
	Cartoons: Extract of “The little red riding hood”. – She thinks that she will see a grandmother while it is the wolf.	Perspective taking Belief False belief Knowledge Attention Visual perception		X

	Game: Acting the change of location task	Perspective taking Belief False belief Knowledge Attention Visual perception Intention		X
	Pictorial Book – “Giant are you here?”	Perspective taking Belief False belief	X	X
How to react after? <i>(Affective ToM)</i>	Game – Guess why ?	Emotions – Causes and Consequences		
	Level 4 of Howlin et al. (2011) program	Emotions – Causes and consequences Desire		
	Pictorial Book – “The wolf who domesticates his emotions”	Emotions – Causes and Consequences		
My beliefs and me? (II) <i>(Cognitive ToM)</i>	Level 5 of Howlin et al. (2011) program	Emotions – Causes and consequences Desire Belief Intentions		X
	Game: “Mental Simil”	Perspective taking Belief False belief Intentions Knowledge Pretend Attention		X
	Game: “Statue”	Visual perception Perspective taking Attention Knowledge	X	
	Pictorial Book – “The hand of the witch”	Perspective taking Belief False belief		X
	Booster and integrative session <i>(Affective and Cognitive ToM)</i>	Thermometer of emotions	Emotions – Expression, Causes, Consequences	X
Table of concepts		All mental states	X	
Craft – Mask of emotions		Emotions – Expression	X	

Appendix D: “ToM program for children” - Objectives and techniques

	Objectives	Techniques
General	<ul style="list-style-type: none"> • Support the child’s socio-emotional development (understanding and regulation of emotions) • Understanding mental states of child or of various protagonists • Understand the combination of affective and cognitive mental states 	<ul style="list-style-type: none"> • Use of key questions • Asking children’s justification • Immediate feedback, differentiated according to child’s responses and the specific mental state • Explanation of the correct response and of the general principle • Repetition of tasks • Discussions about affective and cognitive mental states • Use of various terms related to mental states • Connections with child’s own experience, notably by asking, “Did this happen to you?” • Reading of narrative and pictorial stories • Subgroups training to enhance their learning by hearing or correcting the other children of their group
Relating to affective and/or cognitive ToM	<p>Affective ToM</p> <ul style="list-style-type: none"> • Understanding desires • Recognition of own and other’s facial emotions (sadness, joy, fear, anger) following developmental order: photographic facial recognition; schematic facial recognition; situation-based emotions; desire-based emotions; belief-based emotions • Understanding of causes and consequences of own and other’s emotions. <p>Cognitive ToM</p> <ul style="list-style-type: none"> • Understanding perspective taking following developmental acquisition: simple perspective taking; complex perspective taking; seeing leads to knowing; true belief prediction; false belief. • Understanding own and other’s beliefs and false beliefs • Understanding intentions, knowledge, pretend, thinking, attention, and visual perception. <p>Combination of mental states</p> <ul style="list-style-type: none"> • Understanding Desire-Based Emotion, Perception-Based Belief, Perception-Based Action Task Standard False Belief, Belief- and Reality-Based Emotion and Second Order Emotion 	<ul style="list-style-type: none"> • Semi-open key questions: <ul style="list-style-type: none"> • “How does he feel?” • “Why does he feel?” • “What will he do?” • Identification of desires • Identification of emotions • Identification of causes of emotions • Identification of consequences of emotions • Judgement about emotional reaction • Identification of appropriate reaction to emotional situations <ul style="list-style-type: none"> • Denomination of deceptive objects and experimenter’s demonstration of the distinction between appearance and reality • Role-play inducing change of location games or deception • Demonstration of mirror pictures • Semi-open questions: <ul style="list-style-type: none"> • “What does he believe?” • “What is it really?” • “What does it look like?” • Identification of beliefs and false beliefs <ul style="list-style-type: none"> • Identification of the difference between desires, intentions and beliefs • Identification of consequences of several mental states

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