

THE RELATIONSHIP BETWEEN THEORY OF MIND AND EXECUTIVE FUNCTIONS IN 4 AND 5 YEAR OLD CHILDREN

Gyltene SELIMI^{*}, Mevlyde SYLA, Merita BAJRAMI KAMBERI

*LSS "Musa Zajmi", Gjilan, Kosovo
Faculty of Education, University "Kadri Zeka" Gjilan
LSS "Thimi Mitko", Gjilan, Kosovo
^{*}Corresponding author e-mail: gyltena_namani@hotmail.com*

Abstract

The aim of the analysis is to see the relationship between Mind Theory (ToM) and Executive Function (FE) in children aged 4 and 5 and aged (preschool) and whether there are gender differences in the performance of Mind Theory tasks. The subjects in the study were 61 students aged 5 and 6, who were assessed through two tasks for Theory of Mind and two tasks for Executive Functions, in the kindergarten "Hello" in Gjilan.

The correlated results confirm that there is a significant positive correlation between Mind Theory and Executive Functions, while t-test analysis shows that there are significant gender differences between the results of ToM's tasks. These results also find support from other research. Based on our findings and the literature referred to in the study, we recommend that more research be done in the Kosovo context regarding ToM and FE, and the factors that drive their development.

Keywords: theory of mind, executive functions, gender differences

1. The context of the analysis

The most important thing during the socio-cognitive development of early childhood is the development of Theory of Mind (Flavell & Miller, 1998; Harris, 2006). During this period, children make significant progress in both aspects of understanding their own thoughts and perspectives, as well as those of other people (or Theory of Mind [ToM]) and awareness to control the actions and thoughts of their (or executive function [EF]) (Carpendale & Lewis, 2006). Many studies have shown that executive function is related to the theory of mind during its emergence in early childhood (Carlson & Moses, 2001; Carlson, Mandell, & Williams, 2004; Frye et al, 1995; Hughes & Ensor, 2007; Oh & Lewis 2008). Then, many of them find that despite the different characteristics of these two skills, ToM and FE have a similar developmental progression and share a stable relationship during the preschool years (Carlson et al, 2002).

According to Astington (2003), understanding mental states is a fundamental cognitive achievement that enables children to mark or understand two facts: that the world is represented by the mind and the way we represent the world around us determines what a person says or does. It consists of two components: the social cognitive component and the social one of perception. The term "theory of mind" was first mentioned by Premack in 1978 in his research on the intentions of primates. Mind theory is probably the most frequently researched issue in the last 25 years. From the evidence of experimental studies children develop this theory around the age of 3 or 4 years.

2. Purpose and objectives of the study

Based on the literature we know that theoretically the executive function and the theory of mind have connections during their appearance in early childhood. Therefore, the aim and two main objectives of this study are to measure whether there is a correlation between Theory of Mind (ToM) and Executive Function (FE) in children aged 4 and 5 (preschool) and whether there are gender differences in task performance. of Theory of Mind. Thus, referring to the relevant literature and numerous studies, we present two research questions for this study:

1. Is there a connection between Theory of Mind and Executive Functions?
2. Are there gender differences in the results of Mind Theory tasks?

Hypothesis:

H1: There is a positive correlation between Theory of Mind and Executive Functions.

H2: Women have higher scores on Mind Theory tasks than men

3. Theoretical context

The most controversial propositions regarding the emergence of the Theory of Mind and Executive Functions are two prominent theories.

Perner's Metare Presentation Report (1998), and Russell Executive Report (1996, 1997) both share the idea of functional connectivity between Tom and FE. Most importantly, theories differ regarding predictions regarding the causal direction of the Tom-FE relationship in typical development and in Autism.

Perner's Metapresentative Report (1998) states that the ability to represent the mental state at a meta-level is necessary for the development of executive function, which according to Tom increases EF, emphasizing the theory of mind as a prerequisite for the development of executive functions. . In other words, this meta-representation claims because children need to have a sufficiently developed understanding of their mind before they are able to engage in executive controls.

Russell's executive report (1996, 1997) presented a direct opposite view: specifying that the FE is a prerequisite for Tom. According to this view, Executive Functions are necessary to distance oneself from reality and to move towards the abstract state of mind (Tom).

However, there is empirical support for both theories mentioned. For example, a study longitudinal involving three time points (time intervals ranging from 9 to 12.5 months), has found evidence that FE initially initially predicted Tom at 2, 3, and 4 years of age (Hughes & Ensor, 2007). Also, a study by Farrant et al. (2012) in children aged 5 years found that FE later predicted Tom, supporting the theory of Russell (1996). Thus by replicating the general findings of longitudinal studies in young children, they have found similar results (Jahromi & Stifter, 2008; Müller et al, 2012.). However, a 1-year longitudinal study with 5-year-old children showed that FE had not predicted Tom later (Raza and Blair, 2009).

A further study by McAlister and Peterson (2013), with 4-year-olds also found the opposite, that Tom initially predicts FE later, thus, the results were consistent with PERNER's theory (Perner, 1998).

On the other hand, Executive Functions (FEs) refer to the capabilities of higher level cognitive functions that include three main functions such as working memory, inhibition, and flexibility that help develop goal-building behaviors (Hill 2004; Zelazo et al. 2004). Working memory is the ability to store and manipulate information in the service of another task (Baddeley & Hitch, 1974).

4. Methodology/Participants

In this study, using the quantitative method, the purposeful sample, the participants were selected in the kindergarten "Hello" in Gjilan where the participants of preschool classes were selected. In total there were 61 respondents, 32 males (52.5%) and 29 females (47.5%), 4 years old were 25 children or (41%) and (59%) or 36 children were 5 years old. All participants are Republic of Kosova.

Procedures

For the data collection process and the application of the tasks, approval was obtained for their realization by the director of the kindergarten "Hello" from the class educators and the parents of the participants, then the research objectives were presented with instructions on the issues raised in the questionnaire, and were assured of confidentiality stating that their data would remain anonymous. All children were tested individually in a separate classroom, away from noise and possible obstacles from students or other persons. Their assessment was done during the lessons and lasted 20-30 minutes for a child.

First we had a promise from the director of the school and also from the parents of all the children which were tested.

Designs/Instruments

Two standard false belief tasks have been administered to measure Tom, one being the Change of Location (Baron-Cohen, 1985), the other, Unexpected Content (Perner, 1999). These are chosen because they test children's understanding that the mind represents reality, rather than direct reflection (Wellman et al., 2001). Tasks for FE measurements were used Pencil Knock by Diamond and Taylor (1996) and Dimensional Change and Card Order (DCCS) by Frye (1995).

For the first task, two dolls (Sara and Ana) were presented to the children as materials for this task. Ana places a chocolate in a designated place (above the red box) and leaves the room. When Ana was not in the room, Sara took the chocolate and moved it to another place (inside the black box). Children were asked (1) the real question (Where is the chocolate now?) and (2) the false belief question (After Ana comes back she wants to eat the chocolate, where will she look for her chocolate?). The children's responses to this task were considered correct only if they answered the memory and reality check question correctly. For the second task, Unexpected Content (Perner, 1999), children were shown a box of chocolate they knew that actually had pencils inside, and children were asked what they thought was inside. After they were shown that there were pencils inside, the children were asked (1) the real question (What is actually inside the box?), (2) the false belief question about themselves (When did you see the box in the first place, before that you open it what did you think was inside it?) This question is necessary for children to remember the state of previous knowledge but that has been changed by the state of current knowledge (Watson et al., 1999), (3) the false belief question about others (If your friend comes, what will he/she think is inside the box? Children are scored one point for each correct answer (scores from 0 to 3).

Tasks for measuring FE used the Pencil Tapping by Diamond and Taylor (1996) and the Dimensional Change and Card Order (DCCS) by Frye (1995). Initially, pencil tapping was administered (Diamond & Taylor, 1996), and this task is for the assessment of working memory and inhibitory control, where children were asked that when the experimenter taps twice, he/she should tap once and vice versa, when the experimenter taps the pencil once he/she must tap twice. This task is repeated ten times in a row, and is evaluated for each correct answer with one point, (points from 0 to 10). Then, the dimensional change and card order task (DCCS) (Frye, 1995) was done, which is for assessing working memory, inhibitory control and shifting ability (variability). The task was done by first showing the child two cards, a red apple and a

blue car, then he/she was asked to sort them according to their shape, this was asked six times in a row. Then, the child is asked to weight the cards according to color, thus giving the following cards, a blue apple and a red car. This task has also been repeated six times. Respondents are assessed with one point for each correct answer (scores 0 to 12).

Validity and consistency are concerned with whether the statements used in the scale measure what we seek to measure. Alpha Cronbach, through the coefficient it gives us, shows how much an instrument measures what it is supposed to measure, how reliable an instrument is for the data we are interested in collecting and how valid it is. The tasks used to measure Tom have internal consistency alpha cronbach= .62., while the tasks for measuring FE alpha cronbach= .68. This result is an acceptable value for a research instrument.

5. Results

Demographic data

A total of 61 respondents / children participated in the research, of which 32 were male or 52.5% and the other 29 were female or 47.5%.

Gender	N	%
Male	32	52.5%
Female	29	47.5%

The ratio between 4 years old and 5 years old is that 25 of them or 41% were 4 years old and 59% or 36 were 5 years old.

Ages	N	%
4 year olds	25	41 %
5 year olds	36	59 %

H1: *There is a positive correlation between Theory of Mind and Executive Functions.*

The following analysis was performed through the Pearson Correlation method, in order to see the correlation between mind theory and executive functions. First we look at the descriptive data where the average level of mind theory is 1.68 with a high standard deviation of 0.50, while the average value of executive functions is 6.04 and a low deviation of 1.28.

Table 1. Correlation between Tom and FE

Descriptive Statistics			
	Mean	Std. Deviation	N
Theory of Mind - SallyAnne & Smarties	1.6803	.50853	61
Exekutive Functions - Pen, Tapping & DCCS	6.0437	1.28881	61
Correlations			
		Theory of Mind - SallyAnne & Smarties	-Executive Functions - Pen, Tapping & DCCS
Theory of Mind- SallyAnne & Smarties	Pearson Correlation	1	.484**
	Sig. (2-tailed)		.000
	Sum of Squares and Cross-products	15.516	19.019

Executive Functions - Pen, Tapping & DCCS	Covariance	.259	.317
	N	61	61
	Pearson Correlation	.484**	1
	Sig. (2-tailed)	.000	
	Sum of Squares and Cross-products	19.019	99.661
	Covariance	.317	1.661
	N	61	61

From the results above we see that we have a high positive correlation of .484 ** between the Theory of Mind - SallyAnne & Smarties and the Executive Functions-Pen, Tapping & DCCS, statistically significant at 1% of the confidence level with p-value .000 .

H2: *Women have higher score scores of Mind Theory tasks than men.*

Table 2. Statistical grouping on Gender and performance in Tom tasks

Independent Samples Test										
		Levene's Equality Variances	Test for of t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	(2-Mean Difference	Std. Difference	95% Interval Difference	Confidence of the Upper
Theory of Mind-SallyAnne Smarties	Equal variances assumed	.044	.835	.115	59	.909	.01509	.13147	-.24798	.27815
	Equal variances not assumed			.115	57.934	.909	.01509	.13170	-.24855	.27872

Therefore we reject the hypothesis that Women have higher scores of Mind Theory task scores than men, and we accept the hypothesis that women do not have higher scores of Mind Theory task scores than men

6. Discussion

The purpose of this study was to measure whether there is a correlation between Mind Theory ToM and Executive Functions FE in children aged 4 and 5 years preschool and whether there are gender differences in the performance of Mind Theory tasks, where according to the data found based on the correlation analysis we get a high positive correlation .484 ** and p-value .000 at 1% of the level of reliability, so the higher the level of Theory of Mind, the more high is the level of Executive Functions, there is a significant positive correlation between Tom and EF in preschool children, and thus supports our first hypothesis, where many studies have shown that the executive function is related to the theory of mind during its onset in early childhood (Carlson & Moses, 2001; Carlson, Mandell, and Williams, 2004; Frye et al, 1995; Hughes & Ensor, 2007; Oh & Lewis 2008; similar developmental progression and share a stable relationship during the preschool years. Even similar studies found results that there is a strong association between Tom and EF in preschoolers, such as research done by Carlson, Claxton & Moses et.al (2004).

References

- [1]. Astington, (2005). Why language matters for theory of mind. New York: Oxford University Press.
- [2]. Baddeley, A. D., & Hitch, G. J. L (1974). Working memory. In G.A. Bower (Ed.), The psychology of learning and motivation: Advances in research and theory (Vol. 8, pp. 47–89), New York: Academic Press.
- [3]. Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development*, 72, 1032–1053.
- [4]. Carlson, S. M., Mandell, D. J., & Williams, L. (2004). Executive function and theory of mind: Stability and prediction from ages 2 to 3. *Developmental Psychology*, 40, 1105–1122.
- [5]. Carlson, S. M., Moses, L. J., & Breton, C. (2002). How specific is the relation between executive function and theory of mind? Contributions of inhibitory control and working memory. *Infant and Child Development*, 11, 73–92.
- [6]. Carlson, S. M., Moses, L. J., & Claxton, L. J. (2004). Individual differences in executive functioning and theory of mind: An investigation of inhibitory control and planning ability. *Journal of Experimental Child Psychology*, 87, 299–319.
- [7]. Carpendale, J. I. M., & Lewis, C. (2006). How children develop social understanding. Oxford, UK: Blackwell.
- [8]. Flavell, J. H., & Miller, P. H. (1998). Social cognition. In E. Damon (Series Ed.), D. Kuhn & R. S. Siegler (Eds.), *Handbook of child psychology: Vol. 2. Cognition, perception, and language* (5th ed., pp. 851–898). New York: Wiley.
- [9]. Farrant B. M., Maybery M. T., & Fletcher J. (2012). Language, cognitive flexibility, and explicit false belief understanding: longitudinal analysis in typical development and specific language impairment *Child Development*. 83 223–235 10.1111/j.1467-8624.2011.01681.x.
- [10]. Harris PL. Social cognition. In: Kuhn D, Siegler RS, eds. *Cognition, perception, and language*. 6th ed. Hoboken, NJ: Wiley; 2006: 811-858. Damon W, Lerner RM, eds. *Handbook of child psychology*; vol. 2.
- [11]. Hill, E. L. (2004). Evaluating the theory of executive dysfunction in autism. *Developmental Review*, 24, 189–233.
- [12]. Hughes, C., & Ensor, R. (2007). Executive function and theory of mind: Predictive relations from ages 2 to 4. *Developmental Psychology*, 43, 1447–1459.
- [13]. Müller U., Liebermann-Finestone D. P., Carpendale J. I. M., Hammond S. I., Bibok M. B. (2012). Knowing minds, controlling actions: the developmental relations between theory of mind and executive function from 2 to 4 years of age. *J. Exp. Child Psychol.* 111 331–348 10.1016/j.jecp.2011.08.014.
- [14]. Oh, S., & Lewis, C. (2008). Korean preschoolers' advanced inhibitory control and its relation to other executive skills and mental state understanding. *Child Development*, 79, 80-99.
- [15]. Perner J. (1998). "The meta-intentional nature of executive functions and theory of mind," in *Language and Thought: Interdisciplinary Themes* eds Carruthers P., Boucher J., editors. (Cambridge: Cambridge University Press;) 270–283.

- [16]. Premack, D. G., & Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *Behavioral and Brain Sciences*, 1, 515–526. doi: 10.1017/S0140525X00076512.
- [17]. Razza R. A., Blair C. (2009). Associations among false-belief understanding, executive function, and social competence: a longitudinal analysis. *J. Appl. Dev. Psychol.* 30 332–343 10.1016/j.appdev.2008.12.020.
- [18]. Russell J. (1996). *Agency: Its Role in Mental Development*. Hove: Lawrence Erlbaum Associates.
- [19]. Russell J. (1997). "How executive disorders can bring about an adequate theory of mind," in *Autism as an Executive Disorder* ed Russell J., editor. (Oxford: Oxford University Press;) 256–304.
- [20]. Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development*, 72, 655–684.
- [21]. Zelazo, P. D., Craik, F. I. M., & Booth, L. (2004). Executive functions across the life spans.
- [22]. *Acta Psychologica*, 115, 167–18.

Questionnaire

This inventory is applied with preschool students in the "Hello" kindergarten in Gjilan. The information you provide will remain confidential and anonymous. The research is being carried out within the framework of the Master's topic, by the student of the Department of Psychology, University of Pristina. You are not obliged to answer questions that you deem inappropriate on the site. Thank you for agreeing to participate!

1. Your age? (insert age) _____

2. Your gender? (circle the gender) a) Female b) Male

The following statements are intended to measure Theory of Mind.

1. Location - unexpected (SallyAne task)	Failed (0)	Pased (1)
Where is the box of chocolates now?		
After the friend comes back, he/she wants to get chocolates, where will he/she look for chocolates?		
Content - unexpected (Smarties test)	Failed (0)	Pased (1)
What's really inside?		
When you first saw the box, what did you think was inside?		
If the friend comes, he/she has not seen what is inside the box, what would he/she think is inside?		

The following statements are intended to measure Executive Functions.

Note: 0- Incorrect, 1- self-improvement; 2- correct; 3- if it knocks without stopping.

	I	II	III	IV	V	VI	VII	VIII	IX	X	Total:
5.Tapping with a Pencil											Total Score:
6. Color							Total Score:				
7.Form											