

**‘Specialization in ICTs and Special Education: Psychopedagogy of Integration’
Postgraduate Program Studies
DEMOKRITUS UNIVERSITY OF THRACE Department of Hellenic Philology
in collaboration with
NCSR DEMOKRITOS Informatics and Telecommunications Institute**

**EXECUTIVE FUNCTIONS AND THEORY OF MIND IN CHILDREN WITH
AUTISM**

LIMNEOU ELEFThERIA

POSTGRADUATE
THESIS

SUPERVISOR – COMMITTEE

1. ΖΩΗ ΚΑΡΑΜΠΑΤΖΑΚΗ
ΣΥΝΕΡΓΑΖΟΜΕΝΗ ΕΡΕΥΝΗΤΡΙΑ Τ.Ε.Φ. ΔΠΘ
2. ΣΥΡΙΟΠΟΥΛΟΥ ΧΡΙΣΤΙΝΑ
ΚΑΘΗΓΗΤΡΙΑ ΠΑΝΕΠΙΣΤΗΜΙΟ ΜΑΚΕΔΟΝΙΑΣ
3. ΔΟΣΗ ΙΦΙΓΕΝΕΙΑ
ΜΕΤΑΔΙΔΑΚΤΟΡΙΚΗ ΕΡΕΥΝΗΤΡΙΑ Τ.Ε.Φ. ΔΠΘ

KOMOTINI / ATHENS 2018

ABSTRACT:

Children in the autism spectrum, according to research, seem to be impaired in the Executive Functions of programming, inhibition, cognitive flexibility, working memory and the Theory of Mind. These researches, despite the fact that all the children included in the sample met the same criteria failed to reach the same conclusions. The purpose of this research is to investigate whether or not there are deficiencies in executive functions and in Theory of Mind in Autistic through a bibliographic review of quantitative researches. The researches, which were included in this work, used as a sample typical developing children, who were chosen to have the same chronological age, the same IQ, and the same verbal and non-verbal mental age as the clinical group. The results showed that autistic children show impairments in both Executive Functions and Theory of Mind. These impairments become apparent when compared to typical developing children of the same chronological age, same IQ and of same verbal and non-verbal mental age.

10. References

American Psychiatric Association. (2013). The Diagnostic and statistical manual of mental disorders, text revision. Washington, D.C.: American Psychiatric Association.

Αποστολοπούλου, Μ. (2011). *Παιδιά με ειδικές ανάγκες. Μια εισαγωγή στην Ειδική Εκπαίδευση*. Αθήνα: Εκδόσεις Τόπος.

Baron-Cohen, S. (2000). Theory of mind and autism: A review. *International Review of Research in Mental Retardation*, 23, 169-184. doi: 10.1016/S0074-7750(00)80010-5.

Baron-Cohen, S., O’Riordan, M., Stone, V., Jones, R., & Plaisted, K. (1999). Recognition of Faux Pas by Normally Developing Children and Children with Asperger Syndrome or High-Functioning Autism. *Journal of Autism and Developmental Disorders*, 29(5), 407-418. doi: 10.1023/A:1023035012436.

Baron-Cohen, S. (1989). The Autistic Child's Theory of Mind: a Case of Specific Developmental Delay. *The Journal of Child Psychology and Psychiatry*, 30(2), 285-297. doi: 10.1111/j.1469-7610.1989.tb00241.x.

Baron-Cohen, S., Leslie, A. M., & 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.

Bowler, D.M. (1992). "Theory of Mind" in Asperger's Syndrome. *Journal of Child Psychology and Psychiatry*, 33(5), 877-893. Ανακτήθηκε στις 11/3/2018 από <https://www.ncbi.nlm.nih.gov/pubmed/1378848>.

Burack, J. A., Charman, T., Yurmiya, N., & Zelazo, P. R. (2001). *The Development of Autism: Perspectives from Theory and Research*. New Jersey: Lawrence Erlbaum Associates, Inc Publishers.

Chan, A. S., Cheung, M. C., Han, Y. M. Y., Sze, S. L., Leung, W. W., Man, H. S., et al. (2009). Executive function deficits and neural discordance in children with Autism Spectrum Disorder. *Clinical Neuropsychology*, 120(6), 1107-1115. doi: 10.1016/j.clinph.2009.04.002.

Chen, S.-F., Chien, Y.-L., Wu, C.-T., Shang, C.-Y., Wu, Y.-Y., & Gau, S.S. (2016). Deficits in executive functions among youths with autism spectrum disorders: an age-stratified analysis. *Psychological Medicine*, 46(8).1625-1638. doi: 10.1017/S0033291715002238.

Corbett, B.A., Constantine, L. J. Hendren, R., Rocke, D., & Ozonoff, S. (2009). Examining executive functioning in children with autism spectrum disorder, attention deficit hyperactivity disorder and typical development. *Psychiatry Research*, 166(2), 210-222. doi: 10.1016/j.psychres.2008.02.005

Czermainski, F. R., Riesgo, R. d. S., Guimarães, L. S. P., Salles, J. F. d., & Bosa, C. A. (2014). Executive Functions in Children and Adolescents With Autism Spectrum Disorder. *Paidéia (Ribeirão Preto)*, 24(57), 85-94. doi: 10.1590/1982-43272457201411

De Vries, M., Prins, P.J.M., Schmand, B.A., & Geurts, H.M. (2015). Working memory and cognitive flexibility-training for children with an autism spectrum disorder: A randomized controlled trial. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 56(5), 566-576. doi: 10.1111/jcpp.12324.

Diamond, A. (2013). Executive Functions. *Annual Review of Psychology*, 64, 135-168. doi: 10.1146/annurev-psych-113011-143750

Dichter, G.S., Radonovich, K. J., Turner-Brown, L.M., Lam, K.S., Holtzclaw, T. N., & Bodfish, J. W. (2010). Performance of Children with Autism Spectrum Disorders on the Dimension-Change Card Sort Task. *J Autism Dev Disord*, 40(4), 448-456. doi: 10.1007/s10803-009-0886-1.

Edgin, J. O., Pennington, B. F. (2005). Spatial Cognition in Autism Spectrum Disorders: Superior, Impaired, or Just Intact?. *Journal of Autism and Developmental Disorders*, 35(6), 729—745. doi: 10.1007/s10803-005-0020-y.

Elliot, R. (2003). Executive functions and their disorders. *British Medical Bulletin*, 65, 49-59. doi: 10.1093/bmb/ldg65.049

Fadda, R., Parisi, M., Ferretti, L., Saba, G., Foscoliano, M., Salvago, A., et al. (2016). Exploring the role of theory of mind in moral judgment: The case of children with autism spectrum disorder. *Frontiers in Psychology*, 7 (APR). doi: 10.3389/fpsyg.2016.00523

Faja, S., & Dawson, G. (2014). Performance on the dimensional change card sort and backward digit span by young children with autism without intellectual disability. *Child Neuropsychology: A Journal on Normal and Abnormal Development in Childhood and Adolescence*, 20(6), 692-699. doi: 10.1080/09297049.2013.856395.

Frith, U. (1992). *Autism: Explaining the enigma*. Oxford Uk. & Cambridge USA: Basil Blackwell.

Gallagher, H.L., Happé, F., Brunswick, N., Fletcher, P.C., Frith, U., & Frith, C.D. (2000). Reading the mind in cartoons and stories: an fMRI study of “theory of mind” in verbal and nonverbal tasks. *Neuropsychologia*, 38(1), 11-21. Ανακτήθηκε στις 12/5/2018 από <https://www.ncbi.nlm.nih.gov/pubmed/10617288>.

Gardener, H., Spiegelman, D., & Buka, S.L. (2011). Perinatal and Neonatal Risk Factors for Autism: A Comprehensive Meta-Analysis. *Pediatrics*, 128, 344-355. doi: 10.1542/peds.2010-1036.

Garon, N., Bryson, S. E., & Smith, I.M. (2008). Executive Function in PreschoolersQ A Review Using an Integrative Framework. *Psychological Bulletin*, 134(1), 31-60. doi: 10.1037/0033-2909.134.1.31.

Goldberg, M. C., Mostofsky, S. H., Cutting, L. E., Mahone, E. M., Astor, B. C., Denckla, M.B., et al. (2005). Subtle Executive Impairment in Children with Autism and Children with ADHD. *Journal of Autism and Developmental Disorders*, 35(3), 279-293. doi: 10.1007/s10803-005-3291-4.

Gupta, B. (2015). Theory of Mind in Autism: A Case Study. *Psychological Studies*, 60(3), 339-345. doi: 10.1007/s12646-015-0316-8.

Happé, F. G. (1994). An Advanced Test of Theory of Mind: Understanding of Story Characters' Thoughts and Feelings by Able Autistic, Mentally Handicapped, and Normal Children and Adults. *J Autism Dev Disord*, 24(2), 129-154. doi: 10.1007/BF02172093.

Happé, F., Booth, R., Charlton, R., & Hughes, C. (2006). Executive function deficits in autism spectrum disorders and attention-deficit/hyperactivity disorder: Examining profiles across domains and ages. *Brain and Cognition*, 61(1), 25-39. doi: 10.1016/j.bandc.2006.03.004.

Hill, E. (2004). Executive dysfunction in autism. *TRENDS in Cognitive Sciences*, 8(1), 26-32. Ανακτήθηκε στις 22/3/2018 από <https://www.ncbi.nlm.nih.gov/pubmed/14697400>

Hoddenbach, E., Koot, H.M., Clifford, P., Gevers, C., Clauser, C., Boer, F., et al. (2012). Individual differences in the efficacy of a short theory of mind intervention for children with autism spectrum disorder: A randomized controlled trial. *Trials*, 13. doi: 10.1186/1745-6215-13-206.

Hughes, C. (1996), Control of Action and Thought: Normal Development and Dysfunction in Autism: A Research Note. *J Child Psychol Psychiat*, 37(2), 229-236. doi: 10.1111/j.1469-7610.1996.tb01396.x.

Hughes, C., Russell, J., & Robbins, T. W. (1994). Evidence for Executive Dysfunction in Autism. *Neuropsychologia*, 32(4), 477-492. doi: 10.1016/0028-3932(94)90092-2.

Isquith, P.K., Roth, R.M., & Gioia, G. (2013). Contribution of Rating Scales to the Assessment of Executive Functions. *Applied Neuropsychology: Child*, 2(2), 125-132. doi: 10.1080/21622965.2013.748389.

Jiang, Y. V., Capistrano, C.G., & Palm, B.E. (2014). Spatial working memory in children with high-functioning autism: Intact configural processing but impaired capacity. *Journal of Abnormal Psychology*, 123(1), 248-257. doi: 10.1037/a0035420.

Kimhi, Y., Shoam-Kugelmas, D., Ben-Artzi, g. a., Ben-Moshe, I., & Bauminger-Zviely, N. (2014). Theory of Mind Abilities and Deficits in Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 34(4), 329-343. doi: 10.1097/TLD.0000000000000033

Korkmaz, B. (2011). Theory of Mind and Neurodevelopmental Disorders of Childhood. *Pediatric Research*, 69(5), 101R-108R. doi: 10.1203/PDR.0b013e318212c177

Kouklari, E.-C., Thompson, T., Monks, C.P., & Tsermentseli, S. (2017a). Hot and Cool Executive Function and its Relation to Theory of Mind in Children with and without Autism Spectrum Disorder. *Journal of Cognition and Development*, 18(4), 399-418. doi: 10.1080/15248372.2017.1339708

Kouklari, E.-C., Tsermentseli, S., & Monks, C.P. (2017b). Hot and Cool executive function in children and adolescents with autism spectrum disorder: Cross-

sectional developmental trajectories. *Child Neuropsychology*. doi: 10.1080/09297049.2017.1391190.

Kretschmer, A., Lampmann, S.-A., Altgassen, M. (2014). Relations between moral reasoning, theory of mind and executive functions in children with autistic spectrum disorder. *International Journal of Developmental Disabilities*, 60(3), 174-183. doi: 10.1179/2047387714Y.0000000045.

Loukusa, S., Mäkinen, L., Kuusikko-Gauffin, S., Ebeling, H., & Moilanen, I. (2014). Theory of mind and emotion recognition skills in children with specific language impairment, autism spectrum disorder and typical development: group differences and connection to knowledge of grammatical morphology, word-finding abilities and verbal working memory. *International journal of language & communication disorders / Royal College of Speech & Language Therapists*, 49(4), 498-507. doi: 10.1111/1460-6984.12091

Macizo, P., Soriano, M.F., & Paredes, N. (2016). Phonological and Visuospatial Working Memory in Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 46(9), 2956-2967. doi: 10.1007/s10803-016-2835-0.

Mazza, M., Mariano, M., Peretti, S., Masedu, F., Pino, M.C., & Valenti, M. (2017). The Role of Theory of Mind on Social Information Processing in Children With Autism Spectrum Disorders: A Mediation Analysis. *Journal of Autism and Developmental Disorders*, 47(5), 1369-1379. doi: 10.1007/s10803-017-3069-5.

Nydén, A., Gillberg, C., Hjelmquist, E., & Heiman, M. (1999). Executive function/attention deficits in boys with Asperger syndrome, attention disorder

and reading/writing disorder. *Autism*, 3(3), 213-228. doi: 10.1177/1362361399003003002

Ozonoff, S., & Jensen, J. (1999). Brief Report: Specific executive function profiles in three neurodevelopmental disorders. *J Autism Dev Disord*, 29(2), 171-177. doi: 10.1023/A:1023052913110.

Ozonoff, S., & Strayer, D. L. (1997). Inhibitory function in non retarded children with autism. *J Autism Dev Disord*, 27(1), 59-77. doi: 10.1023/A:1025821222046.

Panerai, S., Tasca, D., Ferri, R., Genitori D' Arrigo, V., & Elia, M. (2014). Executive Functions and Adaptive Behaviour in Autism Spectrum Disorders with and without Intellectual Disability. *Psychiatry Journal*, 2014. doi: 10.1155/2014/941809.

Paynter, J. & Peterson, C.C. (2013). Further evidence of benefits of thought-bubble training for theory of mind development in children with autism spectrum disorders. *Research in Autism Spectrum Disorders*, 7(2), 344-348. doi: 10.1016/j.rasd.2012.10.001.

Pellicano, E. (2010). The Development of Core Cognitive Skills in Autism: A 3-Year Prospective Study. *Child Development*, 81(5), 1400-1416. doi: 10.1111/j.1467-8624.2010.01481.x.

Pellicano, E., Kenny, L., Brede, J., Klaric, E., Lichwa, H., & McMillin, R. (2017). Executive function predicts school readiness in autistic and typical preschool children. *Cognitive Development*, 43, 1-13. doi: 10.1016/j.cogdev.2017.02.003

Pellicano, E., Maybery, M., Durkin, K., & Maley, A. (2006). Multiple cognitive capabilities0deficits in children with an autism spectrum disorder: "Weak" central

- coherence and its relationship to theory of mind and executive control. *Development and Psychopathology*, 18(1), 77-98. doi: 10.1017/S0954579406060056.
- Pino, M.C., Mazza, M., Mariano, M., Peretti, S., Dimitriou, D., Masedu, F., et al. (2017). Simple Mindreading Abilities Predict Complex Theory of Mind: Developmental Delay in Autism Spectrum Disorders. *Journal of Autism and Developmental Disorders*, 47(9), 2743-2756. doi: 10.1007/s10803-017-3194-1.
- Πολυχρονοπούλου, Σ. (2012). *Παιδιά και Έφηβοι με ειδικές ανάγκες και δυνατότητες*. Αθήνα: Εκδόσεις Άτραπος.
- Pooragha, F., Kafi, S.-M., & Sotodeh, S.-O. (2013). Comparing Response Inhibition and Flexibility for Two Components of Executive Functioning in Children with Autism Spectrum Disorder and Normal Children. *Iranian Journal of Pediatrics*, 23(3), 309–314. Ανακτήθηκε στις 11/3/2018 από <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3684476/>
- Prior, M. & Hoffmann, W. (1990). Brief report: Neuropsychological testing of autistic children through an exploration with frontal lobe tests. *Journal of Autism and Developmental Disorders*, 20(4), 581-590. doi: 10.1007/BF02216063.
- Robinson, S., Goddard, L., Dritschel, B., Wisley, M., & Howlin, P. (2009). Executive functions in children with Autism Spectrum Disorders. *Brain and Cognition*, 71(3), 362-368. doi: 10.1016/J.BANDC.2009.06.007.

Russell, J., Mauthner, N., Sharpe, S., & Tidswell, T. (1991). The 'windows task' as a measure of strategic deception in preschoolers and autistic subjects. *British Journal of Developmental Psychology*, 9(2), 331-349. doi: 10.1111/j.2044-835X.1991.tb00881.x.

Scheeren, A. M., De Rosnay, M., Koot, H.M., & Begeer, S. (2013). Rethink theory of mind in high-functioning autism spectrum disorder. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 54(6), 628-635. doi: 10.1111/jcpp.12007.

Semrud-Clikeman, M., Goldenring Fine, J., & Bledsoe, J. (2013). Comparison among children with children with autism spectrum disorder, nonverbal learning disorder and typically developing children on measures of executive functioning. *J Autism Dev Disord*, 44(2), 331-42. doi: 10.1007/s10803-013-1871-2.

Shu, B. C., Tien, A. Y., & Chen, B.C. (2001). Executive Function Deficits in Non-Retarded Autistic Children. *Autism*, 5(2), 165-174. doi: 10.1177/1362361301005002006.

Sinzig, J., Vinzelberg, I., Evers, D., & Lehmkuhl, G. (2014). Executive function and attention profiles in preschool and elementary schoolchildren with autism spectrum disorder or ADHD. *International Journal of Developmental Disabilities*, 60(3), 144-154. doi: 10.1179/2047387714Y.0000000040.

Syriopoulou Delli, C.K., Varveris, A., & Geronta, A. (2017). Application of the Theory of Mind, Theory of Executive Functions and Weak Central Coherence Theory to Individuals with ASD. *Journal of Educational and Developmental Psychology*, 7(1). doi: 10.5539/jedp.v7n1p102.

- Tachibana, Y., Hwang, Y., Abe, Y., Goto, S., Sugai, K., & Kawashima, R. (2013). Reading aloud improves executive function of children with autism spectrum disorder: A pilot randomized controlled trial. *International Journal on Disability and Human Development*, 12(1), 91-101. doi: 10.1515/ijdhhd-2012-0128.
- Theoharides, T.C. (2013). Is a Subtype of Autism an Allergy of the Brain?. *Clinical Therapeutics*, 35(5), 584-591. doi: 10.1016/j.clinthera.2013.04.009.
- Tin, L.N.W., Lui, S.S.Y., Ho, K.K.Y., Hung, K.S.Y., Wang, Y., Yeung, H.K.H., et al. (2017). High-functioning autism patients share similar but more severe impairments in verbal theory of mind than schizophrenia patients. *Psychological Medicine*, 1-12. doi: 10.1017/S0033291717002690
- Van Herwegen, J., Smith, T. J., & Dimitriou, D. (2015). Exploring different explanations for performance on a theory of mind task in Williams syndrome and autism using eye movements. *Research in Developmental Disabilities*, 45-46, 202-209. doi: 10.1016/j.ridd.2015.07.024.
- Velloso, R. L., Duarte, C.P., & Schwartzman, J.S. (2013). Evaluation of the theory of mind in autism spectrum disorders with the Strange Stories test. *Arquivos de Neuro-Psiquiatria*, 71(11), 871-876. doi: 10.1590/0004-282X20130171.
- Verte, S., Geurts, H. M., Roeyers, H., Oosterlaan, J., & Sergeant, J. A. (2006). Executive Functioning in Children with an Autism Spectrum Disorder: Can We Differentiate Within the Spectrum?. *J Autism Dev Disord*, 36(3), 351-372. doi: 10.1007/s10803-006-0074-5.

- Whyte, E.M., Nelson, K.E., & Scherf, K.S. (2014). Idiom, syntax, and advanced theory of mind abilities in children with autism spectrum disorders. *Journal of Speech, Language, and Hearing Research*, 57(1), 120-130. doi: 10.1044/1092-4388(2013/12-0308)
- Williams, J.M.G., Mathews, A., & MacLeod, C. (1996). The Emotional Stroop Task and Psychopathology. *Psychological Bulletin*, 120(1), 3-24. Ανακτήθηκε στις 12/5/2018 από <https://www.ncbi.nlm.nih.gov/pubmed/8711015>.
- World Health Organization. (1992). International classification of mental and behavioral disorders. Diagnostic criteria for research, 10th ed. Geneva: WHO.
- 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: Reversal shifting deficits on the Intradimensional/Extradimensional Shift Test correlate with repetitive behaviors. *Autism: The International Journal of Research and Practice*, 13(5), 523-538. doi: 10.1177/1362361309335716.
- Yi, L., Fan, Y., Joseph, L., Huang, D., Wang, X., Li, J., et al. (2014). Event-based prospective memory in children with autism spectrum disorder : The role of executive function. *Research in Autism Spectrum Disorders*, 8(6), 654-660. doi: 10.1016/j.rasd.2014.03.005.
- Zafeiriou, D.I., Ververi, A., & Vargiami, E. (2009). The Serotonergic System: Its Role in Pathogenesis and Early Developmental Treatment of Autism. *Current Neuropharmacology*, 7, 150-157. doi: 10.2174/157015909788848848

Zafeiriou, D.I., Ververi, A., & Vargiami, E. (2007). Childhood autism and associated comorbidities. *Brain & Development*, 29(5), 257-272. doi: 10.1016/j.braindev.2006.09.003.

Zelazo, P. D. (2006). The Dimensional Change Card Sort (DCCS): a method of assessing executive function in children. *Nature Protocols*, 1, 297-301. doi: 10.1038/nprot.2006.46.

Zinke, K., Fries, E., Altgassen, M., Kirschbaum, C., Dettenborn, L., & Kliegel, M. (2010). Visuospatial short-term memory explains deficits in tower task planning in high-functioning children with autism spectrum disorder. *Child Neuropsychology*, 16(3), 229-241. doi: 10.1080/09297040903559648.