

**‘Specialization in ICTs and Special Education: Psychopedagogy  
of Integration’ Postgraduate Program**  
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**INTERVENTION PROGRAMS USING THE INFORMATION AND  
COMMUNICATION TECHNOLOGIES (ICT) AND ROBOTS FOR CHILDREN  
WITH AUTISM SPECTRUM DISORDER**

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## **ABSTRACT**

Children with autism face significant difficulties in their social interaction. The deficiency on social behavior is the main indication of autism. They usually present repetition in their behavior with fixation to certain activities, non-socially acceptable behaviors, limited interests and obsession to a restricted number of activities. It seems to be a large diversity on the symptoms, their importance and in the different types of deficiencies they face. In addition they face often difficulties in developing social relationships with other people. Therefore, considering the above difficulties in socialization is a common theme in children with autism spectrum disorder.

The first part of this paper is an introduction in autism focused in the history of it and the basic characteristics, which people in autism spectrum disorder presents. In the second part the existing scientific information about are presented about the different kinds of educational intervention for children with autism. Furthermore, there is reference about the importance of the new technologies, ICTs, video modelling and educational robots. In the end, a case study is included, which the main objective is to determine if there is any difference in an educational intervention with a teacher or with a robot about improving social skills in children is autism (ASD).

Participants in this case study was 4 boys students aged 7 to 14 years old, who attended a public elementary special needs school and in a an inclusion classroom in a public secondary school in Xanthi, northern Greece. The method followed was the actualization of one on one and group session, according to the initial plan and the application of some specific educational activities with the aid of a teacher and an educational robot. The purpose of this study was to determine if educational robots can aid children with autism to practice their social skills and social interaction, to follow instructions for completing an activity and, in general, to be able to accommodate better the various stimuli, which they have to face in their everyday life.

The results were optimistic. The educational scenarios showed that the presence of an educational robot has positive effects in children. There was improvement helping them to learn the correct social behaviors and lessening the deficiencies they face in social life. There was some progress and improvement in the acquisition of social rules, which regulates these educational activities. During these educational scenarios repeating the activities and with the guidance of the teacher or the educational robot, the children practiced on a day to day basis their social skills. In every session they participated, the children seemed very eager to cooperate and to follow with attention the robot's guidance. Considering the above, there was considerate improvement in their social interaction and communicating with other people.

## References

- Αντωνιάδου – Χίτογλου, Μ. (2003). *Ο κοινωνικός εγκέφαλος: Διαταραχές της επικοινωνίας και της εξέλιξης του λόγου στο παιδί*. Θεσσαλονίκη: University Studio Press
- Βογινδρούκας, Ι., & Sherratt, D. (2005). *Οδηγός εκπαίδευσης παιδιών με διάχυτες αναπτυξιακές διαταραχές*. Αθήνα: Ταξιδευτής.
- Γεννά, Α. (2002). *Αυτισμός και Διάχυτες Αναπτυξιακές Διαταραχές: Αξιολόγηση – Διάγνωση – Αντιμετώπιση*. Αθήνα: Leaders books
- Δαλακούρας Ν. (2011). *Κοινωνικές Ιστορίες, βασικές αρχές και χρήση στην εκπαίδευση ατόμων με Αυτισμό*. Θεσσαλονίκη
- Ζωγόπουλος, Στ. (2001). *Νέες Τεχνολογίες και Μέσα Επικοινωνίας στην Εκπαιδευτική Διαδικασία*. Αθήνα: Κλειδάριθμος
- Harpe, F. (2003). *Αυτισμός- Σύγχρονη Ψυχολογική Θεώρηση*. Αθήνα: Gutenberg
- Κακούρος, Ε., Μανιαδάκη Κ. (2006). *Ψυχοπαθολογία Παιδιών και Εφήβων: Αναπτυξιακή Προσέγγιση*. Αθήνα: Τυπωθήτω – Γ. Δάρδανος
- Καμπούρογλου, Μ. (2003). *Ανάπτυξη στις διαταραχές επικοινωνίας και του Λόγου στον Αυτισμό*. Δοκίμια Αναδόμησης. Ίδρυμα για το παιδί «Η Παμμακάριστος».
- Καμπούρογλου, Μ. (2006). *Γλωσσικό Πρόγραμμα ΜΑΚΑΤΟΝ*. Αθήνα.
- Καλύβα Ευφροσύνη (2005). *Αυτισμός: Εκπαιδευτικές και θεραπευτικές προσεγγίσεις*. Θεσσαλονίκη: Εκδόσεις Παπαζήση.
- Κυπριωτάκης, Α. (2003). *Τα αυτιστικά παιδιά και η αγωγή τους*. Ηράκλειο: Εκδόσεις Κυπριωτάκη
- Μαυροπούλου, Σ. (2007). *Η κοινωνική ένταξη σε σχολείο και η μετάβαση σε χώρο εργασίας για τα άτομα στο φάσμα του Αυτισμού: θεωρητικά ζητήματα και εκπαιδευτικές παρεμβάσεις*. Θεσσαλονίκη: Γράφημα
- Μαυροπούλου, Σ. (2006). *Αυτισμός, διάχυτες αναπτυξιακές διαταραχές. Ολιστική διεπιστημονική προσέγγιση*, Βήτα.
- Πολυχρονοπούλου, Σ. (2013). *Παιδιά και έφηβοι με ειδικές ανάγκες και δυνατότητες*. Αθήνα: Λυχνία.
- Quill, K.A. (2000). *Διδάσκοντας Αυτιστικά Παιδιά*. Μετάφραση: Παγίδα Ρ. Αθήνα: Εκδόσεις ΕΛΛΗΝ
- Ράπτης, Α. & Ράπτη, Α. (1999). *Πληροφορική και Εκπαίδευση*. Αθήνα: Εκδόσεις Ράπτη
- Sadock, J.B. & Sadock, A.V. (2009). *Επίτομη Ψυχιατρική Παιδιών και Εφήβων*. Μετάφραση: Αμβρόσιος Ν. & Στασινοπούλου Σ. Αθήνα: Ιατρικές Εκδόσεις Λίτσας
- Σηφάκη, Α. (2015). *Η αξιοποίηση των ΤΠΕ στην εκπαίδευση ενηλίκων με αυτισμό*. Πάτρα: ΕΑΠ

Τζαναβάρη, Α. Αντωνιάδης, Δ. Μπαμίδης, Π. & Χίτογλου-Αντωνιάδου Μ. (2008). *ΕΚΠΑΙΔΕΥΣΗ ΑΥΤΙΣΤΙΚΩΝ ΑΤΟΜΩΝ ΜΕ ΧΡΗΣΗ ΝΕΩΝ ΤΕΧΝΟΛΟΓΙΩΝ*. Αριστοτέλειο Πανεπιστήμιο Θεσσαλονίκης

Frith, U. (1999). *Αυτισμός*. 3η έκδοση. Αθήνα: Εκδόσεις Ελληνικά Γράμματα

Adesola, S. A. (2011). *Using information and communication technology in a collaborative classroom to improve student achievement*. Proceedings of the 1st International Technology, Education and Environment Conference African Society for Scientific Research (ASSR). Human Resource Management Academic Research Society. Omoku, Nigeria.

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

Apple, A. L., Billingsley, F., & Schwartz, I. S. (2005). Effects of video modeling alone and with self-management on compliment giving behaviors of children with high-functioning ASD. *Journal of Positive Behavior Interventions*, 7(1), 33–46.

Asperger, H. (1944). *“Autistic psychopathy” in childhood*. Frith U. Autism and Asperger syndrome. Cambridge University Press

Bellini, S. & Akoullian, J. (2007). A Meta-Analysis of Video Modeling and Video Self-Modeling Interventions for Children and Adolescents with Autism Spectrum Disorders. *Exceptional Children*, 73(3).

Berge, Z. & Collins, M. (eds.) (1995). *Computer-mediated communication and the online classroom*. Cresskill, NJ: Hampton Press.

Bharatharaj, J., et al. 2017. Robot-assisted therapy for learning and social interaction of children with autism spectrum disorder. *Robotics*, 6(1), 4.

Bondy, A., & Frost, L. (1994). The Pictures Exchange Communication System. *Focus on Autistic Behaviour*, 9, 1-19.

Bondy, A., & Frost, L. (2001). The Picture Exchange Communication System. *Behavior Modification*, 25, 725-744.

Boucher, J. 2009. *The autistic spectrum. Characteristics, causes and practical issues*. London: SAGE Publications Ltd.

Bruce, B. (2008), Learning at the Border: How Young People Use New Media for Community Action and Personal Growth. In Ch. Angeli & N. Valanides (eds.), *Proceedings of the 6th Panhellenic Conference with International Participation: ICT in Education*. 25-28 September, Cyprus, pp.3-10.

Cabibihan, J.J., Javed, H., Ang, M., & Aljunied, S.M. (2013). Why Robots? A Survey on the Roles and Benefits of Social Robots in the Therapy of Children with Autism. *Int. J. Soc. Robot.*, vol. 5, no. 4, pp. 593–618

Charlop-Christy MH, Le L, Freeman KA. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *J. Autism Dev. Disord.* 30: 537–552.

- Chen, P. & McGrath, D. (2003). Knowledge Construction and Knowledge Representation in High School Students' Design of Hypermedia Documents. *Journal of Educational Multimedia and Hypermedia*, 12(1), 33-61. Norfolk, VA: Association for the Advancement of Computing in Education (AACE).
- Cobb S, Kerr S, Glover T. (2001). *The AS Interactive Project: Developing virtual environments for social skills training in users with Asperger syndrome*. In: Dautenhahn K. ed. *Robotic and virtual interactive systems in autism therapy* (Communications of the Adaptive Systems Research Group, University of Hertfordshire, Report No. 364). Hatfield, UK: University of Hertfordshire
- Corbett, B.A. (2003). Video Modeling: A Window into the World of Autism. *The Behavior Analysis Today*, 4(3).
- Cordes H., & Dzikowski S. (1991). *Fruforderung autistischer Kinder*. Hilfe fur das autistische Kind Bremen, e.V.
- Dautenhahn, K. & Werry, I. 2004. "Towards interactive robots in autism therapy: background, motivation and challenges." *Pragmatics and Cognition*.
- Davis, P., Florian, L., Ainscow, M., Dyson, A., Farrell, P., Hick, P., Humphrey, N., Jenkins, P., Kaplan, I., Palmer, S., Parkinson, G., Polat, F., Reason, R., Byers, R., Dee, L., Kershner, R. & Rouse, M. (2004). *Teaching Strategies and Approaches for Pupils with Special Educational Needs: A Scoping Study*. Research Report 516, ISBN 184478 183 6.
- Diehl, J.J., Schmitt, L.M., Villano, M., & Crowell, C.R. (2012). The Clinical Use of Robots for Individuals with Autism Spectrum Disorders: A Critical Review. *Res. Autism Spectr. Disord.*, vol. 6, no. 1, pp. 249–262
- Diorio, R. (2015). Using Video Self-Modeling to Increase Compliance to Classroom Requests in Students with Autism Spectrum Disorder. *Doctoral Dissertations*. Paper 732.
- Drigas, A. S., & Ioannidou R-E. (2013b, May). Special Education and ICTs. *International Journal of Emerging Technologies in Learning (iJET)*, Vol. 8(2), 41-47.
- Fairweather, P., Trewin, S., (2009). Cognitive impairments and Web 2.0. *Universal Access in the Information Society*, June 2010, Volume 9, Issue 2, pp 137–146
- Falco, M. (2014). Autism rates now in 1 in 68 U.S. children: CDC.
- Gillberg, C., & Coleman, M. (2000). *The biology of autistic syndromes*. London: MacKeith Press
- Gray, C.A. (1994). *The new social story book*. Arlington, TX: Future
- Gresham, F. M., & Elliott, S. N. (1990). *The Social Skills Rating System*. Circle Pines, MN: American Guidance Service
- Gwilliam, A. (2011). Effects of Video Modeling on Socialization in Children and Adolescents with Autism Spectrum Disorder. *PediatricsCATs*, 15.
- Heimann, M., Nelson, K. E., Tjus, T., & Gillberg, C. (1995). Increasing reading and communication skills in children with autism through an interactive multimedia computer program. *Journal of Autism and Developmental Disorders*, 25(5), 459–480.

- Horizons. Gray, C. (1995). Teaching children diagnosed with autism to “read” social situations. In K. Quill (Ed.), *Teaching children with autism: Strategies to enhance communication and socialization* (pp.219-241). New York: Delmar.
- Gray, C. (1998). The advanced Social Story workbook. *The Morning News*, 10(2), 1–21.
- Gray, C. (2010). Social Stories 10.1 Definition, Criteria & Sample Stories.
- Iacono, I. Lehmann, H. Marti, P. Robins, B. & Dautenhahn, K. 2011. Robots as social mediators for children with Autism - A preliminary analysis comparing two different robotic platforms. *IEEE International Conference on Development and Learning (ICDL)*. doi: 10.1109/DEVLRN.2011.6037322.
- Kanner L., (1943). *Autistic disturbances of affective contact*. *Nervous Child*.
- Kim, E. S., et al. 2013. Social robots as embedded reinforcers of social behavior in children with autism. *Journal of Autism and Developmental Disorders*, 43, 1038–1049.
- Kirinić, V., Vidaček-Hainš, V., & Kovačić, A. (2010). Computers in Education of Children with Intellectual and Related Developmental Disorders. *International Journal of Emerging Technologies in Learning*, Vol. 5(2), 12-16. DOI: 10.3991/ijet.v5s2.1246
- Koegel, R. L., & Koegel, L.K. (1995). *Teaching children with autism*. Baltimore, MD: Paul H. Broke.
- Kozima, H., et al. 2007. Children-robot interaction: A pilot study in autism therapy. *Progress in Brain Research*, 164, 385–400.
- Lovaas, O.I. (1987). Behavioural treatment and normal educational and intellectual functioning in your autistic children. *Journal of Consulting and clinical Psychology*, 5, 3-9.
- Lovaas, O.I., Smith, T., & McEachin, J.J. (1989). Clarifying comments on the young autism study: reply to Schopler, Short & Meisbov. *Journal of Consulting and Clinical Psychology*, 57, 165-167.
- Magiati, I. & Howlin, P. (2003). A pilot evaluation study of the Picture Exchange Communication System (PECS) for children with autistic spectrum disorders. *The International Journal of Autism*, 7, 3, 297-320.
- Maione, L., & Miranda, P. (2006). Effects of video modeling and video feedback on peer-directed social language skills of a child with autism. *Journal of Positive Behavior Interventions*, 8(2), 106–118.
- Marcus, A. & Wilder, D. (2009). A comparison of peer video modeling and self-video Modelling to teach textual responses in children with autism. *Journal of applied behavior analysis*, 42(2).
- Matson, J. (2009). *Applied Behavior Analysis for Children with Autism Spectrum Disorders*. New York: Springer
- Maurice, C., Green, G. & Luce, S. (1996). *Behavioral intervention for young children with autism*. Austin, TX: Pro-Ed.

- McEachin, C., Smith, T. & Lovaas, O.I. (1993). Long term outcome for children with autism who received early intensive behavioral treatment. *American Journal of Mental Retardation*, 4, 359-372.
- Mesibov, G.B. (1995). A comprehensive program for serving people with autism and their families: The TEACCH model. In: J.L. Matson (Ed.), *Autism in children and adults: Etiology, assessment and intervention* (pp. 85-97). Belmont, CA: Brooks/Cole.
- Mesibov, G.B., Shea, V., & Schopler, E. (2005). *The TEACCH Approach To Autism Spectrum Disorders*. Kluwer Academic/Plenum Publishers.
- Newman, L. (2005). *Family Involvement in the Educational Development of Youth With Disabilities*. Menlo Park, CA. SRI International.
- Newson, E. (2001). *Making sense of autism*. London: National Autistic Society.
- Nikopoulos CK, Keenan M. (2007). Using video modeling to teach complex social sequences to children with autism. *J. Autism Dev. Disord.* 37: 678–693.
- Ntaountaki, P., Lorentzou, G., Lykothanasi, A., Anagnostopoulou, P., Alexandropoulou, V., & Drigas, A. (2019). Robotics in Autism Intervention. *International Journal of Recent Contributions from Engineering Science & IT (IJES)*, 7. 4-17. DOI:10.3991/ijes.v7i4.11448.
- Passerini, K. & Granger, J. (2000). A developmental model for distance learning using the Internet. *Computers & Education*, 34(1), pp.1-15.
- Peca, A., Simut, R., Pintea, S., Costescu, C., & Vanderborght, B. (2014). How do typically developing children and children with autism perceive different social robots? . *Comput. Human Behav.*, vol. 41, pp. 268–277
- Pierce, K.C., & Schreibman, L. (1994). Teaching daily living skills to children with autism in unsupervised settings through pictorial self-management. *Journal of Applied Behavior Analysis*, 27, 471-481.
- Pivetti, M., Di Battista, S., Agatolio, F., Simaku, B., Moro, M., & Menegatti, E., 2020. Educational Robotics for children with neurodevelopmental disorders: A systematic review. in *Heliyon*. vol. 6, 10.
- Plavnick, J.B., Kaid, T. & MacFarland, M.C. (2015). Effects of a School-Based Social Skills Training Program for Adolescents with Autism Spectrum Disorder and Intellectual Disability. *Journal of Autism and Developmental Disorders*, 45, 267-2690.
- Pop, C. A., et al. 2014. Enhancing play skills, engagement and social skills in a play task in ASD children by using robot-based interventions. A pilot study. *Interaction Studies*, 15(2), 292–320.
- Ricks, D.J. & Colton, M. B. 2010. "Trends and considerations in robot assisted autism therapy". *IEEE Int Conf Robotics and Automation*
- Saatcioglu, K. T., & Boru, B. 2015. *Using educational robotics for students with learning difficulties*. Conference ISITES papers. Spain: Valencia. pp. 2152- 2160.

- Saerbeck, M., Schut, T., Bartneck, C., & Janse, M. D. 2010. Expressive robots in education. in: *Proceedings of the 28th International Conference on Human Factors in Computing Systems—CHI '10* (pp. 1613–1622). Atlanta, GA: ACM Press.
- Scattone, D., Wilczynski, S., & Edwards, R. (2002). Decreasing Disruptive Behaviors of Children with Autism Using Social Stories. *Journal of Autism and Developmental Disorders*, 32,6, 535-543.
- Schopler, E., Mesibov, G. & Kunce, L. (1998). *Asperger Syndrome or high-functioning autism?*. New York: Plenum Press
- Schreibman, L., Whalen, C., & Stahmer, A. C. (2000). The use of video priming to reduce disruptive transition behavior in children with autism. *Journal of Positive Behavior Interventions*, 2(1), 3–11.
- Shamir, A., & Margalit, M. (2011). Technology and students with special educational needs: new opportunities and future directions. *European Journal of Special Needs Education*, Vol. 26(3), 279-282.
- Simut, R. Vanderfaellie, J. Vanderborght, B. Pop, C. Pinte, S. Rusu, A. David, D. & Saldien, J. (2012). *Is the social robot Probo an added value for Social Story Intervention for children with ASD?*. Paper presented at the 7th ACM/IEEE International Conference on Human-Robot Interaction (HRI), Boston. (pp 235-236).
- Singhal, K. Neeraj and Garg, S. (2019). *Technology Based Intervention to Improve Social Skills in Students on Autism Spectrum*. Paper presented at the “2019 3rd International Conference on Recent Developments in Control, Automation & Power Engineering”. (pp. 242-246).
- Skinner, B.F. (1957). *Verbal Behavior*. New York: Appleton – Century – Crofts
- Slomins, V. (2002). ABA: A balancing fact. *Bulletin*, 8-10.
- Srebnicki, T., Bryńska, A., (2016) The application of computer assisted technologies (CAT) in the rehabilitation of cognitive functions in psychiatric disorders of childhood and adolescence, *Psychiatr. Pol.* 50(3).
- Standen, P., Brown, D., Roscoe, J., Hedgecock, J., Stewart, D., Trigo, M. J. G., & Elgajji, E. 2014. Engaging students with profound and multiple disabilities using humanoid robots. In C. Stephanidis & M. Antona (Eds.), *Universal access in human-computer interaction. Universal access to information and knowledge* (pp. 419–430). Heraklion: Springer International Publishing.
- Stanton, C. M., et al. 2008. Robotic animals might aid in the social development of children with autism. In *HRI 2008 – Proceedings of the 3rd ACM/IEEE International Conference on Human-Robot Interaction: Living with Robots*. (pp. 271–278).
- Starcic, A. I., & Bagon, S. (2014). ICT-supported learning for inclusion of people with special needs: Review of seven educational technology journals, 1970–2011. *British Journal of Educational Technology*, Vol 45(2), 202-230.



- Tapus, A., et al. 2012. Children with autism social engagement in interaction with Nao, an imitative robot: A series of single case experiments. *Interaction Studies*, 13(3), 315–347.
- Tutt, R., Powell, S., & Thornton, M. (2006). Educational Approaches in Autism: what we know about what we do. *Educational Psychology in Practice*, 22, 1, 69-81.
- Villaronga, E.F., & Albo-Canals, J. (2019). "I'll take care of you," said the robot. Reflecting up on the legal and ethical aspects of the use and development of social robots for therapy," *Paladyn. Journal of behavioral robotics*, vol.10, no. 1, pp. 77-93,
- Walker, M. (1978). The Makaton Vocabulary. In T. Tebbs (Ed.) *Ways and Means* (pp. 172-183). Basingstoke: Globe Education
- Walker, M. (1986). *Understanding Makaton*. *Special Children*, 1, 6, 22-23
- Walker, M., & Park, K. (1987). *The Makaton Vocabulary Progress Record Sheets*. Available from the Makaton Vocabulary Development Project, 31 Firwood Drive, Camberley, Surrey.
- Werry, I. Dautenhahn, K. & Harwin, W. 2001. "Evaluating the response of children with autism to a robot" in: Simpson, R. (Eds.). USA: Resna Press. Arlington.
- Wing, L. (1988). The continuum of autistic characteristics. In E. Schopler & G. B. Mesibow (Eds.), *Diagnosis and assessment in autism* (pp.91-110). New York Plenum Press.
- Yun, S. S., Kim, H., Choi, J. and Park, S. K. 2016. A robot-assisted behavioral intervention system for children with autism spectrum disorders. *Journal of Robotics and Autonomous Systems*, 76, 58–67.
- Zheng, Z. Zhang, L. Bekele, E. Swanson, A. Crittendon, J. Warren, Z. & Sarkar N. (2013). *Impact of robot-mediated interaction system on joint attention skills for children with autism*. Paper presented at the IEEE Int Conf Rehabil Robot.