

BÖLÜM 15

ÖZGÜL ÖĞRENME BOZUKLUĞU VE OTİZM SPEKTRUM BOZUKLUKLARI

Özge METİN

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Otizm Spektrum Bozukluğu Nedir?

Otizm spektrum bozukluğu (OSB) yaşamın ilk yıllarında başlayan karşılıklı sosyal etkileşim ve iletişimde yetersizlikler, sınırlı ve yineleyici ilgi, davranış ve etkinlikler ile kendini gösteren nörogelişimsel bir bozukluktur. Günümüzde dünya çapında yaygınlık oranı %1 olarak kabul edilmekte, erkeklerde kızlara göre 3-4 kat daha fazla görülmektedir (1). Genellikle 18-24 aylar arasındaki çocuklarda semptomlar gözlenir hale gelmektedir. Küçük çocuklar sıklıkla konuşma ve/veya diğer gelişimsel alanlardaki gecikme veya gerileme, yaşa uygun olmayan oyun ve davranışlar nedeniyle, büyük çocuklar ise; akademik ve sosyal hayattaki güçlükler, aile hayatını bozan davranışlar nedeniyle hekime başvurmaktadır (2). OSB ile ilişkili semptomların çeşitliliği ve şiddeti çocuktan çocuğa değişir (3). DSM-5'e (psikiyatri tanı ölçütleri kitabı) göre OSB tanısı için bir çocukta sosyal etkileşim/iletişim grubu için 3 kriterin tamamı, kısıtlayıcı ve tekrarlayan ilgiler grubunda belirtilen 4 kriterden en az ikisinin karşılanması gerekir (Tablo 1) (4).

Özgül Öğrenme Bozukluğu (ÖÖB) eş tanımlı OSB'li çocukları anlamak ve yardımcı olmak için öncelikle OSB'yi anlamak önemlidir. Böylelikle eğitim ortamlarında karşılaşacakları zorlukları anlamlandırmak ve onlara yardımcı olabilmek mümkün hale gelecektir. OSB'de karşılıklı sosyal etkileşimle ilgili vurgulanan nokta sosyal davranışların tam bir yokluğu olmayıp niteliksel bir bozulmanın olmasıdır. Niteliksel bozulmayla anlatılmak istenen sosyal alanla ilgili semptomlarda, diğer insanlara dair farkındalığının tamamen olmamasından, bağlama uygun olmayan sosyal davranışlara varan çeşitli varyasyonların gözlenebilmesidir (5). Genellikle tek başına olmayı yeğler, ilişki kurmaya isteksiz gibi görünürler. Ebeveynlerinin ilişki kurma taleplerini karşılamaz, jestlerle veya sesler çıkarak ötekilerin dikkatini çekme çabaları göstermezler (6). Sosyal gülümsemenin yokluğu, seçiciliği ya da tutarsızlığı dikkati çeker. Göz teması, yüz ifadesi ve beden dili gibi verbal olmayan davranışların yokluğu ya da yetersizliği gözlenir (2). Kısa süreli de olsa göz teması kurabilenlerde bu göz temasının nesne ya da ilgilendikleri olaya dikkati yönlendirmek amaçlı olmadığı, bazılarında ise başkasının gözlerine bakmak için onun kafasını çevirdikleri veya gözlerini karşıdakinin yüzüne dikme gibi uygun olmayan bir şekilde göz teması kurdukları gözlenir (5).

yazma işlevlerine olumlu katkıda bulunmaktadır (172-175). El yazısı sırasında yaşanan eksikliklerin giderilmesi ve çalışmaların düzenlenmesinde teknoloji araçlarının kullanılmasıyla SRSD'nin daha da geliştirilebileceği düşünülmüştür. SSRD yazma müdahalelerinin etkinliğini güçlendirmek için teknoloji kullanılan kısıtlı sayıda çalışmada olumlu etkiler bildirilmiştir (176-178). İpad ve akran aracılı öğretim (PMI; peer-mediated instruction) kullanan teknoloji destekli SRSD odeli; yazılan kelime sayısının yanı sıra yazma kalitesinin artması yoluyla disgrafi eşlik eden OSB'li çocuklara fayda sağlamıştır (164). Kelime işlemci ve konuşma tanıma yazılımının kullanılması, yazılı iş miktarının ve kopyalama talebinin azaltılması; öğrencilerin yalnızca kendi notlarını almaya güvenmelerine gerek kalmaması için sınıf notları, taslaklar ve çalışma kılavuzları sağlamak; testleri ve ödevleri değiştirmek testler ve yazılı ödevler için konuşma tanıma yazılımının kullanımına izin vermek; yazının görünüşüne göre değil içeriğe göre değerlendirmek gibi disgrafiye yönelik akademik uyumu arttırıcı düzenlemeler ve yaklaşımlar OSB+ disgrafi varlığında da benzer şekilde kullanılabilir (107,108,164,179-182). ÖÖB'de yazma performansı üzerinde olumlu etkili olduğu gösterilen klavye kullanımı, konuşma tanıma yazılımı, kelime işlemci programlarının (179,183) OSB'li çocuklarda disgrafinin tedavisindeki etkisi daha çok incelenmelidir. Bazı araştırmacılar OSB'li çocuklarda el yazısı iyileştirmesinin okuma becerilerini de ele alması gerektiğine işaret etmektedir (162).

OSB ve Metematik bozukluğu

OSB'li çocuklarda AB'ye ilişkin kısıtlı sayıda çalışma mevcuttur. Sosyal ve iletişim sorunları olan çocuklarda; sosyoekonomik durum, yürütücü işlev sorunları, yetersiz öğrenme ortamları ve olumsuz stereotipler AB'ye katkıda bulunabilen olası faktörlerdir (53,93,109). Matematiksel yetenek için gerekli olan yanıt inhibisyonu, çalışma belleği ve dikkati değiştirme ile ilişkili bilişsel beceriler OSB'li çocuklar için zor olabilmektedir (93). Otizmi aşırı erkek beyni kapsamında üstün bir sistemleştirme becerisi

kapsamında ele alınması bazı OSB'lilerde matematik ve bilim gibi kural temelli alanlardaki üstün başarıyı açıklayabilir. Bu bağlamda OSB'li bireylerin genel nüfustan daha büyük bir oranının aritmetik yetenek konusunda 'zirve' bir beceri gösterebileceği beklenebilir. Öte yandan genel aritmetik yetenek ile belli bir aritmetik beceride görülen performans birbiriyle tutarlı olmayabilmektedir (56,184,185).

OSB'de bilişsel yeteneğe göre matematiksel problem çözme becerisinde gözlenen beklenenden düşük performansın dikkatsizlik, soyut kavramları anlama güçlüğü ve işitsel bilgiyi işlemedeki zorluktan kaynaklanabileceği düşünülmüştür (186). Benzer şekilde AS'de özellikle problem çözme görevlerinde zorluk yaşandığı, sayısal işlemler alt test puanlarının en düşük alt test puanları arasında yer aldığı bildirilmiştir. AS ve YFO olgularının çoğunun popülasyon normlarına göre ortalama matematiksel yetenek sergilemekte, klinik önemi küçük olmakla beraber matematiksel yetenekleri entelektüel yeteneklerinden nispeten daha düşük bildirilmektedir (30,187). Diskalkulide olumlu sonuçlar elde edilmesini sağlayan grafik düzenleyiciler, sanal manipülatifler, hafıza yardımcıları, doğrudan öğretim gibi görsel tekniklerin kullanımı ve teknoloji destekli öğretim (öğrenme, alıştırma ve uygulamalar için teknoloji uygulamaları kullanma) gibi stratejiler OSB+diskalkuli birlikteliğinde de yararlıdır (114,188,189).

KAYNAKLAR

1. Loomes R, Hull L, Mandy WPL. What is the male-to-female ratio in autism spectrum disorder? A systematic review and meta-analysis. *J Am Acad Child Adolesc Psychiatry*. 2017;56(6):466-74.
2. Mukherjee SB. Autism Spectrum Disorders - Diagnosis and Management. *Indian J Pediatr*. 2017;84(4):307-14.
3. Tarazi FI, Sahli ZT, Pleskow J, Mousa SA. Asperger's syndrome: diagnosis, comorbidity and therapy. *Expert Rev Neurother*. 2015;15(3):281-93.

4. American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 5th ed. Washington, DC: APA, 2013.
5. Van Engeland H, Buitelaar JK. Autism spectrum disorders. In: Rutter M, Bishop DVM, Pine DS, Scott S, Stevenson J, Taylor E, Thapar A, eds. *Rutter's child and adolescent psychiatry*. 5th ed. Massachusetts: Blackwell Publishing; 2008. p. 759-81.
6. Johnson CP, Myers SM. Identification and evaluation of children with autism spectrum disorders. *Pediatrics*. 2007;120(5):1183-215.
7. Ghaziuddin M. Mental health aspects of Autism and Asperger Syndrome. London: Jessica Kingsley Publishers; 2005.
8. Paul R. Communication and its development in autism spectrum disorders. In: Volkmar FR, ed. *Autism and pervasive developmental disorders*. 2nd ed. New York: Cambridge University Press; 2007. p. 129-56.
9. Jordan R. Managing autism and Asperger's syndrome in current educational provision. *Pediatr Rehabil*. 2005;8(2):104-12.
10. Klin A. Young autistic children's listening preferences in regard to speech: a possible characterization of the symptom of social withdrawal. *J Autism Dev Disord*. 1991;21(1):29-42.
11. Volkmar FR, Klin A. Pervasive developmental disorders. In: Sadock BJ, Sadock VA, eds. *Kaplan & Sadock's comprehensive textbook of psychiatry*. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2000. p. 2659-78.
12. Arik JR, Krug DA, Fullerton A, Loos L, Falco R. School-based programs. In: Volkmar FR, Paul R, Klin A, Cohen D, eds. *Handbook of autism and pervasive developmental disorders*. 3rd ed. Hoboken, NJ: John Wiley & Sons; 2005. p. 1003-28.
13. Baron-Cohen S. Is Asperger syndrome/high-functioning autism necessarily a disability? *Dev Psychopathol*. 2000;12(3):489-500.
14. Ghaziuddin M, Mountain-Kimchi K. Defining the intellectual profile of Asperger syndrome: comparison with high-functioning autism. *J Autism Dev Disord*. 2004;34(3):279-84.
15. McConachie H, Le Couteur A, Honey E. Can a diagnosis of Asperger syndrome be made in very young children with suspected autism spectrum disorder? *J Autism Dev Disord*. 2005;35(2):167-76.
16. Szatmari P, Bryson SE, Boyle MH, Streiner DL, Duku E. Predictors of outcome among high functioning children with autism and Asperger syndrome. *J Child Psychol Psychiatry*. 2003;44(4):520-8.
17. Ehlers S, Gillberg C. The epidemiology of Asperger syndrome. A total population study. *J Child Psychol Psychiatry*. 1993;34(8):1327-50.
18. Fombonne E. What is the prevalence of Asperger disorder? *J Autism Dev Disord*. 2001;31(3):363-4.
19. Fernandez-Jaen A, Martin Fernandez-Mayoralas D, Calleja-Perez B, Munoz-Jareno N. [Asperger syndrome: diagnosis and treatment]. *Rev Neurol*. 2007;44 (Suppl 2):S53-5.
20. Griffin HC, Griffin LW, Fitch CW, Albera V, Gingras H. Educational interventions for individuals with Asperger syndrome. *Intervention in School and Clinic*. 2006;41(3):150-5.
21. Mirkovic B, Gerardin P. Asperger's syndrome: what to consider? *Encephale*. 2019;45(2):169-74.
22. Hosseini SA, Molla M. Asperger Syndrome. [Updated 2021 Mar 6]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK557548/>
23. Szatmari P. Asperger's syndrome: diagnosis, treatment, and outcome. *Psychiatr Clin North Am*. 1991;14(1):81-93.
24. Bauminger N, Kasari C. Loneliness and friendship in high-functioning children with autism. *Child Dev*. 2000;71(2):447-56.
25. Boschi A, Planche P, Hemimou C, Demily C, Vaivre-Douret L. From high intellectual potential to Asperger syndrome: evidence for differences and a fundamental overlap—a systematic review. *Front Psychol*. 2016;7:1605.
26. Gonzalez-Gadea ML, Tripicchio P, Rattazzi A, Baez S, Marino J, Roca M, et al. Inter-individual cognitive variability in children with Asperger's syndrome. *Front Hum Neurosci*. 2014;8:575.
27. Smith Myles B, Hilgenfeld TD, Barnhill GP, Griswold DE, Hagiwara T, Simpson RL. Analysis of reading skills in individuals with Asperger syndrome. *Focus Autism Other Dev Disabl*. 2002;17(1):44-7.

28. Baghdadli A, Brisot J, Henry V, Michelon C, Soussana M, Rattaz C, et al. Social skills improvement in children with high-functioning autism: a pilot randomized controlled trial. *Eur Child Adolesc Psychiatry*. 2013;22(7):433-42.
29. Meyer JA, Minshew NJ. An update on neuro-cognitive profiles in Asperger syndrome and high-functioning autism. *Focus Autism Other Dev Disabl*. 2002;17(3):152-60.
30. Chiang H-M, Lin Y-H. Mathematical ability of students with Asperger syndrome and high-functioning autism: a review of literature. *Autism*. 2007;11(6):547-56.
31. Russell E, Sofronoff K. Anxiety and social worries in children with Asperger syndrome. *Aust N Z J Psychiatry*. 2005;39(7):633-8.
32. Fernell E, Eriksson MA, Gillberg C. Early diagnosis of autism and impact on prognosis: a narrative review. *Clin Epidemiol*. 2013;5:33-43.
33. Steinhausen HC, Mohr Jensen C, Lauritsen MB. A systematic review and meta-analysis of the long-term overall outcome of autism spectrum disorders in adolescence and adulthood. *Acta Psychiatr Scand*. 2016;133(6):445-52.
34. Callahan K, Shukla-Mehta S, Magee S, Wie M. ABA versus TEACCH: the case for defining and validating comprehensive treatment models in autism. *J Autism Dev Disord*. 2010;40(1):74-88.
35. Lai MC, Lombardo MV, Baron-Cohen S. Autism. *Lancet*. 2014;383(9920):896-910.
36. Harrower JK, Dunlap G. Including children with autism in general education classrooms: A review of effective strategies. *Behav Modif*. 2001;25(5):762-84.
37. Kurth JA, Mastergeorge AM. Academic and cognitive profiles of students with autism: implications for classroom practice and placement. *Int J Spec Educ*. 2010;25(2):8-14.
38. Segall MJ, Campbell JM. Factors relating to education professionals' classroom practices for the inclusion of students with autism spectrum disorders. *Res Autism Spectr Disord*. 2012;6(3):1156-67.
39. Odom SL, Strain PS. A comparison of peer-initiation and teacher-antecedent interventions for promoting reciprocal social interaction of autistic preschoolers. *J Appl Behav Anal*. 1986;19(1):59-71.
40. Chandler S, Christie P, Newson E, Prevezer W. Developing a diagnostic and intervention package for 2- to 3-year-olds with autism: outcomes of the frameworks for communication approach. *Autism*. 2002;6(1):47-69.
41. Williams K. Understanding the student with Asperger syndrome: Guidelines for teachers. *Focus on Autistic Behavior*. 1995;10(2):9-16.
42. Grandin T. How people with autism think. In: Schopler E, Mesibov G, eds. *Learning and cognition in autism*. New York: Plenum Press; 1995. p. 137-56.
43. Klin A, Jones W, Schultz R, Volkmar F, Cohen D. Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism. *Arch Gen Psychiatry*. 2002;59(9):809-16.
44. Altenmüller-Lewis U. Designing schools for students on the spectrum. *The Design Journal*. 2017;20(sup1):S2215-S29.
45. Mostafa M. Architecture for autism: autism ASPECTSS™ in school design. *ArchNet-IJAR*. 2014;8(1):143-58.
46. Matusiak M [Internet]. How to create an autism-friendly environment. Living Autism Ltd. [cited 2021 Jun 15]. Available from: <https://livingautism.com/create-autism-friendly-environment/>.
47. Mostafa M. An architecture for autism: concepts of design intervention for the autistic user. *ArchNet-IJAR*. 2008;2(1):189-211.
48. Xu W, Yao J, Liu W. Intervention effect of sensory integration training on the behaviors and quality of life of children with autism. *Psychiatr Danub*. 2019;31(3):340-6.
49. Nagib W, Williams A. Toward an autism-friendly home environment. *Housing Studies*. 2017;32(2):140-67.
50. Irlen H. Reading by the colors: overcoming dyslexia and other reading disabilities through the Irlen method. NY: Avery Pub. Group; 1991.
51. Bogdashina O. Sensory perceptual issues in autism and Asperger syndrome: different sensory experiences-different perceptual worlds. London: Jessica Kingsley Publishers; 2003.
52. Fong KN, Ma WY, Pang HK, Tang PP, Law LL. Immediate effects of coloured overlays on the

- reading performance of preschool children with an autism spectrum disorder using eye tracking. *Res Dev Disabil.* 2019;89:141-8.
53. Wei X, Christiano ER, Yu JW, Wagner M, Spiker D. Reading and math achievement profiles and longitudinal growth trajectories of children with an autism spectrum disorder. *Autism.* 2015;19(2):200-10.
 54. Turner LM, Stone WL, Pozdol SL, Coonrod EE. Follow-up of children with autism spectrum disorders from age 2 to age 9. *Autism.* 2006;10(3):243-65.
 55. Stevens MC, Fein DA, Dunn M, Allen D, Waterhouse LH, Feinstein C, et al. Subgroups of children with autism by cluster analysis: a longitudinal examination. *J Am Acad Child Adolesc Psychiatry.* 2000;39(3):346-52.
 56. Jones CR, Happé F, Golden H, Marsden AJ, Tregay J, Simonoff E, et al. Reading and arithmetic in adolescents with autism spectrum disorders: peaks and dips in attainment. *Neuropsychology.* 2009;23(6):718.
 57. Ashburner J, Ziviani J, Rodger S. Sensory processing and classroom emotional, behavioral, and educational outcomes in children with autism spectrum disorder. *Am J Occup Ther.* 2008;62(5):564-73.
 58. Eaves LC, Ho HH. School placement and academic achievement in children with autistic spectrum disorders. *J Dev Phys Disabil.* 1997;9(4):277-91.
 59. Venter A, Lord C, Schopler E. A follow-up study of high-functioning autistic children. *J Child Psychol Psychiatry.* 1992;33(3):489-507.
 60. Estes A, Rivera V, Bryan M, Cali P, Dawson G. Discrepancies between academic achievement and intellectual ability in higher-functioning school-aged children with autism spectrum disorder. *J Autism Dev Disord.* 2011;41(8):1044-52.
 61. Anderson DK, Lord C, Risi S, DiLavore PS, Shulman C, Thurm A, et al. Patterns of growth in verbal abilities among children with autism spectrum disorder. *J Consult Clin Psychol.* 2007;75(4):594-604.
 62. Assouline SG, Foley Nicpon M, Dockery L. Predicting the academic achievement of gifted students with autism spectrum disorder. *J Autism Dev Disord.* 2012;42(9):1781-9.
 63. Mayes SD, Calhoun SL. WISC-IV and WIAT-II profiles in children with high-functioning autism. *J Autism Dev Disord.* 2008;38(3):428-39.
 64. Tsermentseli S, O'Brien JM, Spencer JV. Comparison of form and motion coherence processing in autistic spectrum disorders and dyslexia. *J Autism Dev Disord.* 2008;38(7):1201-10.
 65. Rosen GD, Bai J, Wang Y, Fiondella CG, Threlkeld SW, LoTurco JJ, et al. Disruption of neuronal migration by RNAi of *Dyx1c1* results in neocortical and hippocampal malformations. *Cereb Cortex.* 2007;17(11):2562-72.
 66. Williams EL, El-Baz A, Nitzken M, Switala AE, Casanova MF. Spherical harmonic analysis of cortical complexity in autism and dyslexia. *Transl Neurosci.* 2012;3(1):36-40.
 67. Eicher JD, Gruen JR. Language impairment and dyslexia genes influence language skills in children with autism spectrum disorders. *Autism Res.* 2015;8(2):229-34.
 68. Noterdaeme M, Mildenberger K, Minow F, Amorosa H. Evaluation of neuromotor deficits in children with autism and children with a specific speech and language disorder. *Eur Child Adolesc Psychiatry.* 2002;11(5):219-25.
 69. White S, Frith U, Milne E, Rosen S, Swettenham J, Ramus F. A double dissociation between sensorimotor impairments and reading disability: A comparison of autistic and dyslexic children. *Cogn Neuropsychol.* 2006;23(5):748-61.
 70. Oram Cardy JE, Flagg EJ, Roberts W, Brian J, Roberts TP. Magnetoencephalography identifies rapid temporal processing deficit in autism and language impairment. *Neuroreport.* 2005;16(4):329-32.
 71. Facoetti A, Turatto M, Lorusso ML, Mascetti GG. Orienting of visual attention in dyslexia: evidence for asymmetric hemispheric control of attention. *Exp Brain Res.* 2001;138(1):46-53.
 72. Mann TA, Walker P. Autism and a deficit in broadening the spread of visual attention. *J Child Psychol Psychiatry.* 2003;44(2):274-84.
 73. Takarae Y, Minshew NJ, Luna B, Krisky CM, Sweeney JA. Pursuit eye movement deficits in autism. *Brain.* 2004;127(Pt 12):2584-94.

74. Biscaldi M, Fischer B, Hartnegg K. Voluntary saccadic control in dyslexia. *Perception*. 2000;29(5):509-21.
75. von Karolyi C, Winner E, Gray W, Sherman GF. Dyslexia linked to talent: global visual-spatial ability. *Brain Lang*. 2003;85(3):427-31.
76. Jolliffe T, Baron-Cohen S. Are people with autism and Asperger syndrome faster than normal on the Embedded Figures Test? *J Child Psychol Psychiatry*. 1997;38(5):527-34.
77. Rumsey JM, Hamburger SD. Neuropsychological divergence of high-level autism and severe dyslexia. *J Autism Dev Disord*. 1990;20(2):155-68.
78. Bishop DV. Overlaps between autism and language impairment: phenomimicry or shared etiology? *Behav Genet*. 2010;40(5):618-29.
79. Nash HM, Hulme C, Gooch D, Snowling MJ. Preschool language profiles of children at family risk of dyslexia: continuities with specific language impairment. *J Child Psychol Psychiatry*. 2013;54(9):958-68.
80. Locascio G, Mahone EM, Eason SH, Cutting LE. Executive dysfunction among children with reading comprehension deficits. *J Learn Disabil*. 2010;43(5):441-54.
81. Menghini D, Finzi A, Benassi M, Bolzani R, Facchetti A, Giovagnoli S, et al. Different underlying neurocognitive deficits in developmental dyslexia: a comparative study. *Neuropsychologia*. 2010;48(4):863-72.
82. Poljac E, Simon S, Ringlever L, Kalcik D, Groen WB, Buitelaar JK, et al. Impaired task switching performance in children with dyslexia but not in children with autism. *Q J Exp Psychol (Hove)*. 2010;63(2):401-16.
83. Van Eylen L, Boets B, Steyaert J, Wagemans J, Noens I. Executive functioning in autism spectrum disorders: influence of task and sample characteristics and relation to symptom severity. *Eur Child Adolesc Psychiatry*. 2015;24(11):1399-417.
84. Smith-Spark JH, Fisk JE. Working memory functioning in developmental dyslexia. *Memory*. 2007;15(1):34-56.
85. Barbosa T, Rodrigues CC, Mello CB, Silva M, Bueno OFA. Executive functions in children with dyslexia. *Arq Neuropsiquiatr*. 2019;77(4):254-9.
86. Huemer SV, Mann V. A comprehensive profile of decoding and comprehension in autism spectrum disorders. *J Autism Dev Disord*. 2010;40(4):485-93.
87. Kjelgaard MM, Tager-Flusberg H. An investigation of language impairment in autism: implications for genetic subgroups. *Lang Cogn Process*. 2001;16(2-3):287-308.
88. Mayes SD, Calhoun SL. Ability profiles in children with autism: influence of age and IQ. *Autism*. 2003;7(1):65-80.
89. O'Connor IM, Klein PD. Exploration of strategies for facilitating the reading comprehension of high-functioning students with autism spectrum disorders. *J Autism Dev Disord*. 2004;34(2):115-27.
90. Volden J, Coolican J, Garon N, White J, Bryson S. Brief report: pragmatic language in autism spectrum disorder: relationships to measures of ability and disability. *J Autism Dev Disord*. 2009;39(2):388-93.
91. Chung P, Patel DR. Dysgraphia. *Int J Child Adolesc health*. 2015;8(1):27-36.
92. Kushki A, Chau T, Anagnostou E. Handwriting difficulties in children with autism spectrum disorders: a scoping review. *J Autism Dev Disord*. 2011;41(12):1706-16.
93. May T, Rinehart NJ, Wilding J, Cornish K. Attention and basic literacy and numeracy in children with autism spectrum disorder: A one-year follow-up study. *Res Autism Spectr Disord*. 2015;9:193-201.
94. McIntyre NS, Solari EJ, Gonzales JE, Solomon M, Lerro LE, Novotny S, et al. The scope and nature of reading comprehension impairments in school-aged children with higher-functioning autism spectrum disorder. *J Autism Dev Disord*. 2017;47(9):2838-60.
95. Asberg J, Kopp S, Berg-Kelly K, Gillberg C. Reading comprehension, word decoding and spelling in girls with autism spectrum disorders (ASD) or attention-deficit/hyperactivity disorder (AD/HD): performance and predictors. *Int J Lang Commun Disord*. 2010;45(1):61-71.
96. Hendren RL, Haft SL, Black JM, White NC, Hoefft F. Recognizing psychiatric comorbidity with reading disorders. *Front Psychiatry*. 2018;9:101.
97. Ricketts J. Research review: reading comprehension in developmental disorders of

- language and communication. *J Child Psychol Psychiatry*. 2011;52(11):1111-23.
98. McGuinness PS, Cook NE, Bush H, Lind H, Vuijk PJ, Doyle AE, et al. 4.10 Children with autism spectrum disorder and comorbid specific learning disorder demonstrate cognitive weakness compared to autism spectrum disorder alone. *J Am Acad Child Adolesc Psychiatry*. 2017;56(10):S231-S.
 99. Brown HM, Oram-Cardy J, Johnson A. A meta-analysis of the reading comprehension skills of individuals on the autism spectrum. *J Autism Dev Disord*. 2013;43(4):932-55.
 100. Nally A, Healy O, Holloway J, Lydon H. An analysis of reading abilities in children with autism spectrum disorders. *Res Autism Spectr Disord*. 2018;47:14-25.
 101. Mayes SD, Calhoun SL. Frequency of reading, math, and writing disabilities in children with clinical disorders. *Learn Individ Differ*. 2006;16(2):145-57.
 102. Henderson LM, Clarke PJ, Snowling MJ. Reading comprehension impairments in autism spectrum disorders. *L'Année psychologique*. 2014;114(4):779-97.
 103. Lucas R, Norbury CF. Levels of text comprehension in children with autism spectrum disorders (ASD): the influence of language phenotype. *J Autism Dev Disord*. 2014;44(11):2756-68.
 104. McIntyre NS, Solari EJ, Grimm RP, Lerro LE, Gonzales JE, Mundy PC. A comprehensive examination of reading heterogeneity in students with high functioning autism: distinct reading profiles and their relation to autism symptom severity. *J Autism Dev Disord*. 2017;47(4):1086-101.
 105. Nation K, Clarke P, Wright B, Williams C. Patterns of reading ability in children with autism spectrum disorder. *J Autism Dev Disord*. 2006;36(7):911-9.
 106. Ricketts J, Jones CR, Happé F, Charman T. Reading comprehension in autism spectrum disorders: The role of oral language and social functioning. *J Autism Dev Disord*. 2013;43(4):807-16.
 107. Mayes SD, Frye SS, Breaux RP, Calhoun SL. Diagnostic, demographic, and neurocognitive correlates of dysgraphia in students with ADHD, autism, learning disabilities, and neurotypical development. *J Dev Phys Disabil*. 2018;30(4):489-507.
 108. Ibrahim I. Specific learning disorder in children with autism spectrum disorder: Current issues and future implications. *Adv Neurodev Disord*. 2020;4(2):103-12.
 109. Morsanyi K, van Bers B, McCormack T, McGourty J. The prevalence of specific learning disorder in mathematics and comorbidity with other developmental disorders in primary school-age children. *Br J Psychol*. 2018;109(4):917-40.
 110. Moll K, Kunze S, Neuhoﬀ N, Bruder J, Schulte-Körne G. Specific learning disorder: prevalence and gender differences. *PLoS One*. 2014;9(7):e103537.
 111. Costa LJC, Edwards CN, Hooper SR. Writing disabilities and reading disabilities in elementary school students: Rates of co-occurrence and cognitive burden. *Learning Disability Quarterly*. 2016;39(1):17-30.
 112. Hofvander B, Delorme R, Chaste P, Nyden A, Wentz E, Stahlberg O, et al. Psychiatric and psychosocial problems in adults with normal-intelligence autism spectrum disorders. *BMC Psychiatry*. 2009;9:35.
 113. Odom SL, Thompson JL, Hedges S, Boyd BA, Dykstra JR, Duda MA, et al. Technology-aided interventions and instruction for adolescents with autism spectrum disorder. *J Autism Dev Disord*. 2015;45(12):3805-19.
 114. Root JR, Stevenson BS, Davis LL, Geddes-Hall J, Test DW. Establishing computer-assisted instruction to teach academics to students with autism as an evidence-based practice. *J Autism Dev Disord*. 2017;47(2):275-84.
 115. Åsberg J. Literacy and comprehension in school-aged children: studies on autism and other developmental disabilities [doctoral dissertation in psychology]. University of Gothenburg, Sweden; 2009.
 116. Murray D. IT and autism: Therapy with computers. In: Powell S, Jordan R, editors. *Autism and learning: a guide to good practice*. London: David Fulton; 1997. p. 100-17.
 117. Arciuli J, Stevens K, Trembath D, Simpson IC. The relationship between parent report of adaptive behavior and direct assessment of reading ability in children with autism spectrum disorder. *J Speech Lang Hear Res*.

- 2013;56(6):1837-44.
118. Åsberg J, Dahlgren S, Sandberg AD. Basic reading skills in high-functioning Swedish children with autism spectrum disorders or attention disorder. *Res Autism Spectr Disord*. 2008;2(1):95-109.
 119. Miniscalco C, Dahlgren Sandberg A. Basic reading skills in Swedish children with late developing language and with or without autism spectrum disorder or ADHD. *Res Dev Disabil*. 2010;31(5):1054-61.
 120. Solari EJ, Grimm RP, McIntyre NS, Zajic M, Mundy PC. Longitudinal stability of reading profiles in individuals with higher functioning autism. *Autism*. 2019;23(8):1911-26.
 121. Åsberg J, Dahlgren Sandberg A. Dyslexic, delayed, precocious or just normal? Word reading skills of children with autism spectrum disorders. *J Res Read*. 2012;35(1):20-31.
 122. Frith U, Snowling M. Reading for meaning and reading for sound in autistic and dyslexic children. *Br J Dev Psychol*. 1983;1(4):329-42.
 123. Newman TM, Macomber D, Naples AJ, Barbitz T, Volkmar F, Grigorenko EL. Hyperlexia in children with autism spectrum disorders. *J Autism Dev Disord*. 2007;37(4):760-74.
 124. Saldana D, Carreiras M, Frith U. Orthographic and phonological pathways in hyperlexic readers with autism spectrum disorders. *Dev Neuropsychol*. 2009;34(3):240-53.
 125. Burd L, Kerbeshian J. Hyperlexia and a variant of hypergraphia. *Percept Mot Skills*. 1985;60(3):940-2.
 126. Grigorenko EL, Klin A, Volkmar F. Annotation: Hyperlexia: disability or superability? *J Child Psychol Psychiatry*. 2003;44(8):1079-91.
 127. Sesma HW, Mahone EM, Levine T, Eason SH, Cutting LE. The contribution of executive skills to reading comprehension. *Child Neuropsychol*. 2009;15(3):232-46.
 128. Swanson HL, Jerman O. The influence of working memory on reading growth in subgroups of children with reading disabilities. *J Exp Child Psychol*. 2007;96(4):249-83.
 129. Lindgren KA, Folstein SE, Tomblin JB, Tager-Flusberg H. Language and reading abilities of children with autism spectrum disorders and specific language impairment and their first-degree relatives. *Autism Res*. 2009;2(1):22-38.
 130. Randi J, Newman T, Grigorenko EL. Teaching children with autism to read for meaning: challenges and possibilities. *J Autism Dev Disord*. 2010;40(7):890-902.
 131. Norbury C, Nation K. Understanding variability in reading comprehension in adolescents with autism spectrum disorders: Interactions with language status and decoding skill. *Sci Stud Read*. 2011;15(3):191-210.
 132. Davidson MM, Ellis Weismer S. Reading comprehension of ambiguous sentences by schoolage children with autism spectrum disorder. *Autism Res*. 2017;10(12):2002-22.
 133. Jolliffe T, Baron-Cohen S. Linguistic processing in high-functioning adults with autism or Asperger's syndrome. Is global coherence impaired? *Psychol Med*. 2000;30(5):1169-87.
 134. Norbury CF, Bishop DV. Inferential processing and story recall in children with communication problems: a comparison of specific language impairment, pragmatic language impairment and high-functioning autism. *Int J Lang Commun Disord*. 2002;37(3):227-51.
 135. Lopez B, Leekam SR. Do children with autism fail to process information in context? *J Child Psychol Psychiatry*. 2003;44(2):285-300.
 136. St Clair MC, Durkin K, Conti-Ramsden G, Pickles A. Growth of reading skills in children with a history of specific language impairment: the role of autistic symptomatology and language-related abilities. *Br J Dev Psychol*. 2010;28(Pt 1):109-31.
 137. Fernandes FD, Amato CA, Cardoso C, Navas AL, Molini-Avejonas DR. Reading in autism spectrum disorders: a literature review. *Folia Phoniatr Logop*. 2015;67(4):169-77.
 138. El Zein F, Solis M, Vaughn S, McCulley L. Reading comprehension interventions for students with autism spectrum disorders: a synthesis of research. *J Autism Dev Disord*. 2014;44(6):1303-22.
 139. El Zein F, Gevarter C, Bryant B, Son S-H, Bryant D, Kim M, et al. A comparison between iPad-assisted and teacher-directed reading instruction for students with autism spectrum disorder (ASD). *J Dev Phys Disabil*. 2016;28(2):195-215.

140. Omar S, Bidin A. The impact of multimedia graphic and text with autistic learners in reading. *Universal Journal of Educational Research*. 2015;3(12):989-96.
141. Wilkins AJ, Evans BJ. Visual stress, its treatment with spectral filters, and its relationship to visually induced motion sickness. *Appl Ergon*. 2010;41(4):509-15.
142. DPHE Report. Albon E, Adi Y, Hyde C, West Midlands Health Technology Assessment Collaboration. The effectiveness and cost-effectiveness of coloured filters for reading disability: a systematic review. Studley: West Midlands Health Technology Assessment Collaboration, Dept. of Public Health and Epidemiology, University of Birmingham; 2008.
143. Ludlow AK, Wilkins AJ, Heaton P. The effect of coloured overlays on reading ability in children with autism. *J Autism Dev Disord*. 2006;36(4):507-16.
144. Ludlow A, Wilkins AJ, Heaton P. Colored overlays enhance visual perceptual performance in children with autism spectrum disorders. *Res Autism Spectr Disord*. 2008;2(3):498-515.
145. Bouldoukian J, Wilkins AJ, Evans BJ. Randomised controlled trial of the effect of coloured overlays on the rate of reading of people with specific learning difficulties. *Ophthalmic Physiol Opt*. 2002;22(1):55-60.
146. Cartmill L, Rodger S, Ziviani J. Handwriting of eight-year-old children with autistic spectrum disorder: An exploration. *J Occup Ther Sch Early Interv*. 2009;2(2):103-18.
147. Rosenblum S, Simhon HAB, Gal E. Unique handwriting performance characteristics of children with high-functioning autism spectrum disorder. *Res Autism Spectr Disord*. 2016;23:235-44.
148. Grace N, Johnson BP, Rinehart NJ, Enticott PG. Are motor control and regulation problems part of the asd motor profile? A handwriting study. *Dev Neuropsychol*. 2018;43(7):581-94.
149. Siegel DJ, Minshew NJ, Goldstein G. Wechsler IQ profiles in diagnosis of high-functioning autism. *J Autism Dev Disord*. 1996;26(4):389-406.
150. Fuentes CT, Mostofsky SH, Bastian AJ. Children with autism show specific handwriting impairments. *Neurology*. 2009;73(19):1532-7.
151. Fuentes CT, Mostofsky SH, Bastian AJ. Perceptual reasoning predicts handwriting impairments in adolescents with autism. *Neurology*. 2010;75(20):1825-9.
152. Myles BS, Huggins A, Rome-Lake M, Hagiwara T, Barnhill GP, Griswold DE. Written language profile of children and youth with Asperger syndrome: from research to practice. *Educ Train Dev Disabil*. 2003;38(4):362-9.
153. Asperger H. 'Autistic psychopathy' in childhood (U. Frith, Trans.). In: Frith U, ed. *Autism and Asperger syndrome*. Cambridge: Cambridge University Press; 1991. p.37-92.
154. Grace N, Enticott PG, Johnson BP, Rinehart NJ. Do handwriting difficulties correlate with core symptomology, motor proficiency and attentional behaviours? *J Autism Dev Disord*. 2017;47(4):1006-17.
155. Beversdorf DQ, Anderson JM, Manning SE, Anderson SL, Nordgren RE, Felopulos GJ, et al. Brief report: macrographia in high-functioning adults with autism spectrum disorder. *J Autism Dev Disord*. 2001;31(1):97-101.
156. Rinehart NJ, Bellgrove MA, Tonge BJ, Brereton AV, Howells-Rankin D, Bradshaw JL. An examination of movement kinematics in young people with high-functioning autism and Asperger's disorder: further evidence for a motor planning deficit. *J Autism Dev Disord*. 2006;36(6):757-67.
157. Rinehart NJ, Bradshaw JL, Brereton AV, Tonge BJ. Movement preparation in high-functioning autism and Asperger disorder: A serial choice reaction time task involving motor reprogramming. *J Autism Dev Disord*. 2001;31(1):79-88.
158. Tseng MH, Cermak SA. The influence of ergonomic factors and perceptual - motor abilities on handwriting performance. *Am J Occup Ther*. 1993;47(10):919-26.
159. David FJ, Baranek GT, Giuliani CA, Mercer VS, Poe MD, Thorpe DE. A pilot study: coordination of precision grip in children and adolescents with high functioning autism. *Pediatr Phys Ther*. 2009;21(2):205-11.
160. Alaniz ML, Galit E, Necesito CI, Rosario ER. Hand strength, handwriting, and functional skills in children with autism. *Am J Occup Ther*. 2015;69(4):6904220030p1-9.

161. Johnson BP, Papadopoulos N, Fielding J, Tonge B, Phillips JG, Rinehart NJ. A quantitative comparison of handwriting in children with high-functioning autism and attention deficit hyperactivity disorder. *Res Autism Spectr Disord*. 2013;7(12):1638-46.
162. Hellinckx T, Roeyers H, Van Waelvelde H. Predictors of handwriting in children with autism spectrum disorder. *Res Autism Spectr Disord*. 2013;7(1):176-86.
163. Dockrell JE, Ricketts J, Charman T, Lindsay G. Exploring writing products in students with language impairments and autism spectrum disorders. *Learning and Instruction*. 2014;32:81-90.
164. Almumen HA. Technologically Supported SRSD and PMI: The impact of an intervention package on the expository writing performance of students with autism spectrum disorder. PhD Thesis. State University of New York; 2017.
165. Constable S, Grossi B, Moniz A, Ryan L. Meeting the common core state standards for students with autism: the challenge for educators. *TEACHING Exceptional Children*. 2013;45(3):6-13.
166. Losh M, Capps L. Narrative ability in high-functioning children with autism or Asperger's syndrome. *J Autism Dev Disord*. 2003;33(3):239-51.
167. Brown HM, Johnson AM, Smyth RE, Cardy JO. Exploring the persuasive writing skills of students with high-functioning autism spectrum disorder. *Res Autism Spectr Disord*. 2014;8(11):1482-99.
168. Zajic MC, McIntyre N, Swain-Lerro L, Novotny S, Oswald T, Mundy P. Attention and written expression in school-age, high-functioning children with autism spectrum disorders. *Autism*. 2018;22(3):245-58.
169. Pennington RC, Collins BC, Stenhoff DM, Turner K, Gunselman K. Using simultaneous prompting and computer-assisted instruction to teach narrative writing skills to students with autism. *Educ Train Autism Dev Disabil*. 2014;396-414.
170. Harris KR. Cognitive-behavior modification: application with exceptional students. *Focus Except Child*. 1982;15(2):1-16.
171. Asaro-Saddler K. Writing instruction and self-regulation for students with autism spectrum disorders. *Top Lang Disord*. 2016;36(3):266-83.
172. Sugawara H, Yamamoto Ji. Computer based teaching of word construction and reading in two students with developmental disabilities. *Behav Interv*. 2007;22(4):263-77.
173. Bedrosian J, Lasker J, Speidel K, Politsch A. Enhancing the written narrative skills of an AAC student with autism: evidence-based research issues. *Top Lang Disord*. 2003;23(4):305-24.
174. Grossman M, Peskin J, San Juan V. Thinking about a reader's mind: fostering communicative clarity in the compositions of youth with autism spectrum disorders. *J Autism Dev Disord*. 2013;43(10):2376-92.
175. Yamamoto J-i, Miya T. Acquisition and transfer of sentence construction in autistic students: analysis by computer-based teaching. *Res Dev Disabil*. 1999;20(5):355-77.
176. Delano ME. Improving written language performance of adolescents with Asperger syndrome. *J Appl Behav Anal*. 2007;40(2):345-51.
177. Schneider AB, Coddling RS, Tryon GS. Comparing and combining accommodation and remediation interventions to improve the written-language performance of children with Asperger syndrome. *Focus Autism Other Dev Disabl*. 2013;28(2):101-14.
178. Asaro-Saddler K, Bak N. Persuasive writing and self-regulation training for writers with autism spectrum disorders. *The Journal of Special Education*. 2014;48(2):92-105.
179. Hetzroni OE, Shrieber B. Word processing as an assistive technology tool for enhancing academic outcomes of students with writing disabilities in the general classroom. *J Learn Disabil*. 2004;37(2):143-54.
180. Lane SE, Lewandowski L. Oral and written compositions of students with and without learning disabilities. *J Psychoeduc Assess*. 1994;12(2):142-53.
181. MacArthur CA. Using technology to enhance the writing processes of students with learning disabilities. *J Learn Disabil*. 1996;29(4):344-54.

182. MacArthur CA. New tools for writing: Assistive technology for students with writing difficulties. *Top Lang Disord.* 2000;20(4):85-100.
183. Forgrave KE. Assistive technology: Empowering students with learning disabilities. *The Clearing House.* 2002;75(3):122-6.
184. Baron-Cohen S. The extreme male brain theory of autism. *Trends Cogn Sci.* 2002;6(6):248-54.
185. Baron-Cohen S. The hyper-systemizing, assortative mating theory of autism. *Prog Neuropsychopharmacol Biol Psychiatry.* 2006;30(5):865-72.
186. Troyb E, Orinstein A, Tyson K, Helt M, Eigsti I-M, Stevens M, et al. Academic abilities in children and adolescents with a history of autism spectrum disorders who have achieved optimal outcomes. *Autism.* 2014;18(3):233-43.
187. Griswold DE, Barnhill GP, Myles BS, Hagiwara T, Simpson RL. Asperger syndrome and academic achievement. *Focus Autism Other Dev Disabl.* 2002;17(2):94-102.
188. Bouck EC, Satsangi R, Doughty TT, Courtney WT. Virtual and concrete manipulatives: a comparison of approaches for solving mathematics problems for students with autism spectrum disorder. *J Autism Dev Disord.* 2014;44(1):180-93.
189. Spooner F, Root JR, Saunders AF, Browder DM. An updated evidence-based practice review on teaching mathematics to students with moderate and severe developmental disabilities. *Remedial Spec Educ.* 2019;40(3):150-65.