

Improving Teachers Knowledge in Making Visual Support for Children with Autism Spectrum Disorders

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Abstract

This study is motivated by the limited knowledge of teachers in creating visual support programs for children with autism spectrum disorders (ASD). It is essential for teachers to increase their knowledge base in creating programs specifically designed for ASD children. Therefore, this study aims to empirically examine the effect of a visual support program to increase the knowledge of teachers in creating visual support programs for ASD children using a pre-experiment with one group pretest-post test design. The participants are nine teachers of ASD children, and non-parametric statistical analysis is conducted to test the difference in knowledge scores before and after administering the program. The results show that the visual support programs effectively increases the knowledge of teachers in making visual support with sig. .01 and effect size of 72%.

Keywords: visual support, teacher knowledge, autism spectrum disorder (ASD)

Abstrak

Penelitian ini dilatarbelakangi oleh kurangnya pengetahuan guru dalam membuat program visual support untuk anak dengan gangguan spectrum autism. Guru perlu meningkatkan pengetahuan dalam membuat program untuk anak dengan gangguan autism. Penelitian ini bertujuan mengkaji secara empirik pengaruh dari program pembuatan visual support untuk meningkatkan pengetahuan guru dalam membuat program visual support untuk anak autism. Metode penelitian menggunakan pra-eksperimen one group pretest posttest design. Subjek penelitian sebanyak 9 guru yang memiliki siswa dengan spectrum autism. Dilakukan analisis statistic non parametric untuk menguji perbedaan skor pengetahuan sebelum dan sesudah diberikan program. Hasil menunjukkan program pembuatan visual support untuk anak dengan gangguan spectrum autism efektif meningkatkan pengetahuan guru dalam membuat visual support (sig. .01 dan effect size 72%).

Kata Kunci: *visual support*, pengetahuan guru, *autism spectrum disorders* (ASD)

Introduction

Education plays a pivotal role in cultivating excellent human resources, thereby facilitating progress in a nation. This is due to its profound impact on social welfare and its contribution to mitigating poverty and inequality (Unicef Indonesia, 2012). Since a good education system is crucial in creating human resources, the concept should be initiated at the earliest possible stage to cater to the unique learning needs of children.

Every child has a unique development but some may experience disabilities and need to receive certain stimulation to grow according to general development. This is due to the presence of either temporary or persistent developmental disorders. One of these

persistent developmental disorders is autism spectrum disorder (ASD). The majority of ASD children continue to experience the condition into adulthood, which may lead to various challenges. For instance, these include difficulties in achieving independent living, finding and maintaining employment, navigating social interactions, communicating effectively, managing behavioral issues, and maintaining positive mental health (Vernhet et al., 2019). Moreover, environmental risk factors, including older paternal age (Lyll et al., 2017) and immune dysfunction (Ramirez-Celis et al., 2021), may increase susceptibility to ASD (Ramirez-Celis et al., 2021).

ASD is a common developmental disorder, affecting between 1 and 2% of the

general population (Hodges et al., 2020; Lord et al., 2018). Affected individuals grow and develop differently due to a gradual decline in cognitive skills (Posar & Visconti, 2017). The symptoms of autism can appear before the age of 3 years, but the condition is not often diagnosed until years later (Kidder & McDonnell, 2017). Furthermore, it is characterized by challenges in communication and behavior regulation, which may result in difficulties to effectively engage with the social environment (Desiningrum, 2016). Children and adolescents with ASD have lower developmental skills (Baron-Cohen, 2000).

Clinically, autism is characterized by stereotyped behaviors and deficits in social interaction and communication (American Psychiatric Association, 2022). Affected individuals may be uncomfortable with eye contact and prefer certain textures of food or clothing. They may exhibit repetitive "stimulation" behaviors such as pacing, hand flapping, or verbally repeating certain words or phrases when overwhelmed by strong emotions, including anxiety and boredom (Sinha et al., 2014). Furthermore, ASD is characterized by challenges in social interaction and communication, as well as a tendency towards repetitive behaviors and a particular set of interests (Rosa et al., 2018). It appears that symptoms of autism exhibit a modest incline as individuals age (Esbensen et al., 2009).

The number of autism cases is difficult to determine because not all countries have national studies on this disorder, such as Indonesia. The prevalence is estimated to be 1 in 44 children (Maenner et al., 2021), with boys four times more likely to receive a diagnosis than girls (Fombonne, 2009; Maenner et al., 2021). The United Nations Educational, Scientific and Cultural Organization (Unesco) estimates that there are 35 million people with autism on a global scale, making an average of 6 out of 1,000 people. Meanwhile, the number of cases in the United States was found to be 1:68 in 2014. This figure shows increased prevalence from

the previous year, where cases were found to be 1:88 (Kemenpppa, 2018). The WHO reports that the average global prevalence of ASD is 1 in 160 children, and increased from 1% in the 2000s to 2% (Elsabbagh et al., 2012).

The symptoms displayed by individuals with ASD can vary greatly, with some exhibiting mild and more severe symptoms. Meanwhile, some individuals with ASD may have below-average intelligence (Peeters, 2004). The DSM-5 outlines a severity classification system for the complication, which includes levels one, two, and three. According to Pennington, the majority of ASD children meet the diagnostic criteria for intellectual developmental disorder, with 30% and 45% within the mild to moderate and severe to profound ranges (Parritz & Troy, 2013).

Wing (1979) showed that ASD children experienced problems with independence due to the highly developed brain areas related to visual information. Therefore, they are called visual learners, which are easier to learn and absorb information through sight and doing. Activities that seem easy for other students to carry out, such as transitioning from one location to the next, organizing learning materials, and completing assigned activities, can be challenging for affected individuals (Wing, 1979).

Students who exhibit problem behaviors are at risk for poor academic and social outcomes (Bulotsky-Shearer et al., 2012). Disruptive behaviors in preschool are associated with lower engagement (Harden et al., 2000), which may continue in kindergarten (Searle et al., 2014). In contrast, high levels of engagement are associated with academic development and achievement (Hofer et al., 2013; Vitiello & Williford, 2016).

The barriers experienced by ASD children require special handling at school. Moreover, ASD children tend to withdraw in school environments that involve frequent group interactions and adherence to strict classroom rules. This is due to their

limitations in comprehending, processing and responding to social norms and expectations.

Based on observations at Cerdas Istimewa Homeschooling in Malang, East Java, teachers still use conventional methods in learning activities. ASD children are taught reading, writing, and counting (calistung) using traditional methods that are predominantly teacher-centered. This approach involves teachers leading the learning activities, which may include lectures, assignments, as well as question-and-answer sessions (Latief, 2016). Since Cerdas Istimewa Homeschooling is a school with an individualized approach to learning, the number of children per class is limited to provide adequate attention to their differences. Currently, there are 20 students, each with different diagnoses, including autism, attention deficit and hyperactivity disorder (ADHD), Down syndrome, tunalaras (unsociable), and inability to hear.

Teachers who work with ASD children often lack adequate training and support to provide effective treatment and care for these individuals. They may not possess the necessary skills related to teaching strategies that cater to the specific needs of ASD children, such as providing visual support. Consequently, they may resort to using conventional calistung methods when teaching affected children.

ASD children often experience challenges in comprehending implied meaning, where communication processes should remain concrete. The integration of visual supports can significantly enhance the effectiveness of expressive and receptive communication with these children. Therefore, visual support is commonly recommended as a psychosocial intervention for ASD children (Denne et al., 2011, 2012, 2018; Pickard et al., 2018). Visual support is an effective tool utilized to illustrate what people expect, rather than relying solely on verbal communication. For instance, when discussing food, instead of simply uttering the word, ASD children are provided with a corresponding image of food to better

comprehend the subject matter. ASD children often possess superior visual memory and retain information more effortlessly through visualization (Barnett et al., 2018).

Visual support in the form of pictures or materials is added to the physical environment to provide information about the expected sequence or stages of activity (Ramirez-Celis et al., 2021). Furthermore, increased interhemispheric interaction in the brains of ASD children can increase the recall skills of visual stimuli (Elison et al., 2013). Stimulation with visual support methods makes it easier for children to understand, build mutual communication, and facilitate the information received (Ganz et al., 2014).

The visuals used in educational materials depict the shapes and images children encounter in their daily lives. The use of unfamiliar images can pose difficulties in connecting the meaning with the intended concept. To facilitate the understanding of pajamas in different colors, it is recommended to create an image that depicts the specific color of their current pajamas. This approach helps avoid confusion and ensures the children grasp the concept before moving on to other colors. More diverse images can be introduced after possessing the ability to generalize the idea of pajamas in various colors.

There are several techniques for using visual supports in developing communication skills in ASD children, including picture exchange communication system (PECS), pragmatic organization dynamic display (PODD), aided language stimulation (ALS), and augmentative and alternative communication (ACC) (Autism Association of Western Australia, 2013).

ASD children require comprehensive support in their learning process. This can be achieved through the implementation of a robust support system, which includes a structured classroom arrangement, visual aids, customized curriculum, and individualized learning plans, provision of education and training to teachers, fostering parental collaboration, and conducting

continuous evaluations (Pradipta & Andajani, 2017). Based on Saadah et al. (2022), the use of visual support makes it easier for ASD children to understand the information conveyed by teachers and express their wishes or feelings despite low verbal communication skills.

Each student possesses unique skills, developmental traits, and individualized needs when creating and providing visual support. Consequently, teachers must tailor visual support programs to accommodate these variations. To achieve this, assessment methods must be adjusted to align with each specific requirement. It is necessary to recognize that schools still require training to enhance expertise in creating effective visual support programs for this demographic.

Methods

This study uses a one-group pretest-posttest, a before-after, which is a form of pre-experimental study design (Ali, 2014). This design is suitable for determining the difference in subject scores before and after treatment. In this study, measurements of the dependent variable are obtained at the outset,

before administering the manipulation, and subsequently following its administration (Seniati et al., 2005).

In this study, visual support shows the expected learning outcomes for children through the use of various aids. It takes the form of pictures, photos, objects, lists, writing such as instructional sentences, or any other means of visual representation. The visuals depict familiar shapes that are easily recognizable to ASD children. The benefits are independence (Siahaan, 2016), social interaction (Mutaqin, 2016), facilitating learning (Macdonald et al., 2018), and understanding the world (Connelly, 2017). Visual support methods in the form of facial expressions, pointing, holding, shaking the head, moving hands, and imitating observer commands, can help ASD children to communicate. Moreover, visual schedules through activity cards and social stories help the independence of children.

The study subjects were nine teachers of Cerdas Istimewa Homeschooling Malang, and the sample was determined using a non-probability technique with a purposive sampling type. The sampling technique involves making certain boundaries based on

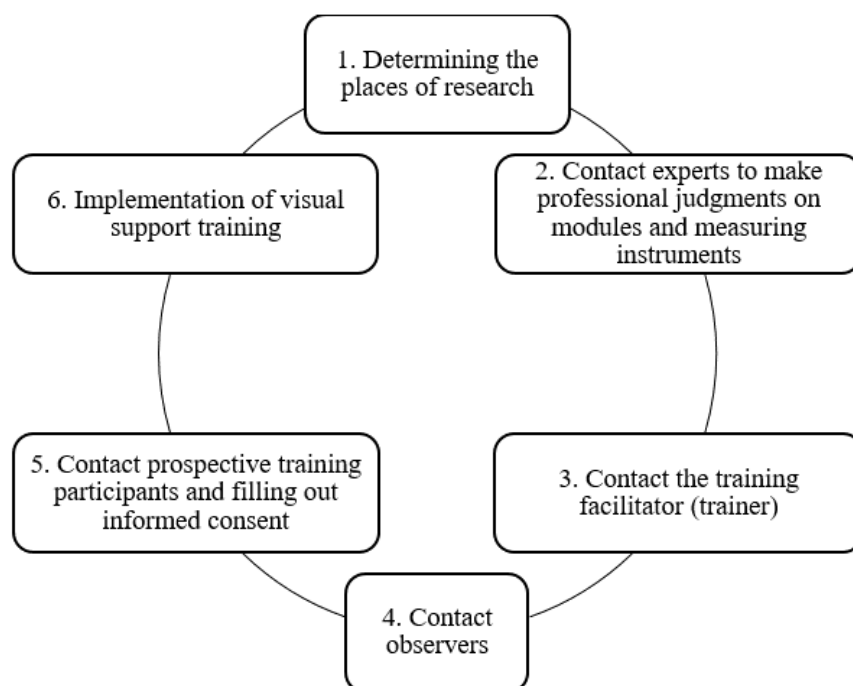


Figure 1. Flow of activities

the characteristics of the subject. These include teaching at Cerdas Istimewa Homeschooling Malang, having a history of teaching ASD children, and being willing to voluntarily become a participant as stated in the informed consent form.

The stages of the activity started with determining the study location to implement the training, as presented in Figure 1. Furthermore, the implementation of training for teachers, including a series of materials, a variety of methods, and objectives to be achieved, are presented in Table 1.

The data collection tools comprise knowledge questions in the format of multiple-choice on the visual support program. Knowledge questions are used to measure the skills related to the cognitive field, including a teacher knowing the techniques of visual support. Some examples of questions are "One of the media supporting visual support is?" (Answer options: a. music and instruments; b. objects; c. sounds; d. animals), "What kind of pictures can support visual support for ASD children?" (Answer options: a. colored; b. colorless; c. splotches; d. black and white).

The content validation test uses CVR (Content Validity Ratio), which is a feasibility test through Subject Matter Expert (SME).

Teachers' knowledge scale has a significance value in the range of .460 - .795, and it is declared valid. The scale reliability test used inter-rater estimation with Interclass Correlation Coefficients (ICC). Furthermore, teachers' knowledge instrument containing ten items shows an alpha value of .701. The pretest-posttest data are calculated by statistical analysis of the Wilcoxon signed rank test and effect size using the SPSS 22.0 for Windows program.



Figure 2. Example of visual support

Figure 2 shows one example of a visual support schedule made for ASD children. To facilitate the arrival process of children, it is recommended to provide visual support for tasks such as adhering to the arrival schedule, putting down the bag, greeting the teacher, forming a line, and engaging in prayer.

Table 1
Intervention Materials

Material	Method	Objective
Material 1 Characteristics, effects, and strategies in ASD children	Video screening, discussion, lecture, as well as questions and answers	Participants follow and understand the characteristics, effects, and strategies of ASD children.
Material 2 Use of Planning Matrix for ASD Children	Lectures, questions, answers, and assignments	Participants understand the use of the and planning matrix for ASD children.
Material 3 Visual Support, the benefits of visual support in ASD children, types of visual support, and how to use visual support	Video screening, discussion, lecture, and questions and answers	Participants understand visual support, the benefits of visual support in ASD children, the types of visual support, and how to use visual support.

Results and Discussion

Results

This present study postulates that providing training on the creation of visual supports is an effective method to enhance teachers' knowledge for ASD children in Homeschooling Malang. The statistical analysis in Table 3 indicates a significant result with a Sig value of .011. Therefore, H_0 is rejected ($.011 < .05$) and there is a significant difference in providing visual support to students before and after training with an effect of 72%.

Table 2 indicates that teachers lacked the knowledge necessary to develop suitable learning techniques designed to the requirements of ASD children. In contrast, teachers of Cerdas Istimewa Homeschooling Malang used conventional methods in learning activities. After three training sessions, significant results were observed among the participating teachers, as evidenced by their increased knowledge and mastery of techniques for using visual support for ASD children.

Furthermore, a follow-up was conducted with teachers after implementing the intervention and post-test. The results showed that teachers could create visual support with simple social stories, provide appropriate positive instructions, and present stories through pictures as a transition of activities while learning in class based on the deficits of ASD children. Based on observations, the trainees could create a visual support program according to the deficits of ASD children in the school.

Discussion

Many individuals with autism cannot automatically distinguish environmental cues necessary for independence. ASD children are perceived as inconsistent, manipulative, defiant, easily distracted, dependent, and unfocused when trying to participate in classroom activities. Therefore, teachers should develop strategies to reduce dependence on adults and facilitate their independence (Bryan & Gast, 2000). Communication and socialization are difficult to carry out in ASD learning of children (Oliveira, 2021).

It is imperative to utilize supportive measures incorporating tangible teaching tools while there is currently no established program or singularly superior approach to aiding ASD children. In this context, the implementation of visual aids is strongly recommended (Rao & Gagie, 2006). In line with this, teachers should design a suitable teaching program (Dai et al., 2021; Cheung et al., 2021; Garcia-Tudela et al., 2021). A structured program emphasizing visual stimuli is recommended to reduce the adverse effects of auditory learning methods on ASD children (Meadan et al., 2011).

Visual support objects are used to visually provide information to enhance an understanding of the physical environment, people, social environment, and abstract concepts, such as elapsed time, sequence of events, or social concepts (Rutherford et al., 2020). Visual support can be provided in different ways in school, home, work, and community.

Table 2

Knowledge Test Results

No	Initials	Gender	Last Education	Pretest	Post-test	Improved
1	S	M	Bachelor of Psychology	16	20	+4
2	A	M	Bachelor of Psychology	16	23	+7
3	S	F	Bachelor of Psychology	16	20	+4
4	R	F	Bachelor of Psychology	18	19	+1
5	K	F	Bachelor of Psychology	16	18	+2
6	K	F	Bachelor of Psychology	16	21	+5
7	H	F	Bachelor of Psychology	16	20	+4
8	R	F	Bachelor of Psychology	16	19	+3
9	N	F	Bachelor of Psychology	16	21	+5

Table 3
Results of Wilcoxon Analysis of Teachers' Knowledge
 before training - after training

Z	-2.530 ^b
Asymp. Sig. (2-tailed)	.011
Effect size	.72

In addition, Kluth and Darmody-Latham (2003) suggested using the concept through graphs, flowcharts, and Venn diagrams. Visual support has been used to teach various task analytic skills to individuals with autism, including simple cooking, grooming, and assembling skills. Pictures have been used to teach ASD children to complete daily tasks, including dressing, laundry, and setting the table (Duttlinger et al., 2013). Visual support can be made from simple and inexpensive materials to improve processing skills as well as teach social, play, academic, and communication skills in the primary grades (Rao & Gagie, 2006).

Simpson (2005) explained that ASD children would have tremendous difficulty processing language, but visual support makes it easier to process and understand the concept. However, teachers need to understand the unique nature of the needs of every individual before providing visual support. According to Greenspan (2006), employing the Developmental, Individual Difference, and Relationship-Based (DIR) model can be beneficial for comprehending the distinctive requirements of ASD children and for devising support strategies that revolve around scrutinizing the family, culture, and potential strengths to evaluate needs, formulate a plan, and deliver effective support. Visual support is easy to implement and identify as an acceptable intervention to improve students' outcomes (Fees et al., 2014; Wikete Lee, 2016).

It is often considered atypical for ASD children to engage in any form of play, even though play can be an effective intervention. Students may concentrate their efforts on a particular area, such as the swing, and establish a repetitive routine during each instance when they show a pronounced inclination towards playing (Cassidy et al.,

2008). Therefore, the utilization of a visual schedule is expected to assist students in exploring and broadening their knowledge at the playground. The schedule is filled out for students based on the order of equipment and the allocated time for each activity. Students can comprehend the concept of balancing rest and work within their designated schedule by using the visual schedule approach (Rao & Gagie, 2006).

Moreover, a visually presented activity schedule can assist ASD children in maintaining focus and organization during their activities. It can alleviate anxiety and stress that often arise from uncertainty (Van Bourgondien & Coonrod, 2013).

Concerning the limitation, this study used a pre-experimental method that only measured the increase in knowledge before and after the intervention was given to one group of subjects. Moreover, the number of subjects was limited to nine teachers in one school only. The intervention was only conducted for three days to increase teachers' knowledge in making visual support. Therefore, it is necessary to conduct further studies that involve interventions over an extended period to improve skills training programs.

Conclusion

Based on the results, it can be concluded that the visual support-making program effectively increases the knowledge of teachers in making visual support at Cerdas Istimewa Homeschooling in Malang. In future studies, it may be advantageous to incorporate a more extensive sample, encompassing ASD children, teachers, and parents. Additionally, the creation of intervention modules designed could be a fruitful avenue of exploration, and employing a quasi-experimental research design may yield valuable insights.

References

- Ali, Z. (2014). *Metode penelitian hukum*. Sinar Grafika.
 American Psychiatric Association. (2022).

- Diagnostic and statistical manual of mental disorders, fifth edition, text revision DSM-5-TR.* American Psychiatric Association.
- Autism Association of Western Australia. (2013). *Hands-out workshop on autism.* University of Louisville Special Education Conference: Innovative Research to Practical Application.
- Barnett, J. H., Trillo, R., & More, C. M. (2018). Visual supports to promote science discourse for middle and high school students with autism spectrum disorders. *Intervention in School and Clinic, 53*(5), 292–299. <https://doi.org/10.1177/1053451217736865>
- Baron-Cohen, S. (2000). Theory of mind and autism: A review. *International Review of Research in Mental Retardation, 23*, 169–184. [https://doi.org/10.1016/s0074-7750\(00\)80010-5](https://doi.org/10.1016/s0074-7750(00)80010-5)
- Bryan, L. C., & Gast, D. L. (2000). Teaching on-task and on-schedule behaviors to high-functioning children with autism via picture activity schedules. *Journal of Autism and Developmental Disorders, 30*(6), 553–567. <https://doi.org/10.1023/A:1005687310346>
- Bulotsky-Shearer, R. J., Bell, E. R., Romero, S. L., & Carter, T. M. (2012). Preschool interactive peer play mediates problem behavior and learning for low-income children. *Journal of Applied Developmental Psychology, 33*(1), 53–65. <https://doi.org/10.1016/j.appdev.2011.09.003>
- Cassidy, A., McConkey, R., Truesdale-Kennedy, M., & Slevin, E. (2008). Preschoolers with autism spectrum disorders: The impact on families and the supports available to them. *Early Child Development and Care, 178*(2), 115–128. <https://doi.org/10.1080/03004430701491721>
- Cheung, S. K. S., Kwok, L. F., Phusavat, K., & Yang, H. H. (2021). Shaping the future learning environments with smart elements: Challenges and opportunities. *International Journal of Educational Technology in Higher Education, 18*(1), 1–9. <https://doi.org/10.1186/s41239-021-00254-1>
- Connelly, A. (2017). *The use of visual schedules* (Master's thesis unpublished). Northwestern College, Orange City.
- Dai, Z., Sun, C., Zhao, L., & Li, Z. (2021). Assessment of smart learning environments in higher educational institutions: A study using AHP-FCE and GA-BP methods. *IEEE Access, 9*, 35487–35500. <https://doi.org/10.1109/ACCESS.2021.3062680>
- Denne, L. D., Hastings, R. P., & Hughes, C. J. (2018). Common approaches to intervention for the support and education of children with autism in the UK: An internet-based parent survey. *International Journal of Developmental Disabilities, 64*, 105–112. <https://doi.org/10.1080/20473869.2016.1275439>
- Desiningrum, D. R. (2016). *Psikologi anak berkebutuhan khusus.* Psikosain.
- Duttlinger, C., Ayres, K. M., Beville-Davis, A., & Douglas, K. H. (2013). The effects of a picture activity schedule for students with intellectual disability to complete a sequence of tasks following verbal directions. *Focus on Autism and Other Developmental Disabilities, 28*(1), 32–43. <https://doi.org/10.1177/1088357612460572>
- Elison, J. T., Paterson, S. J., Wolff, J. J., Reznick, J. S., Sasson, N. J., Gu, H., Botteron, K. N., Dager, S. R., Estes, A. M., Evans, A. C., Gerig, G., Hazlett, H. C., Schultz, R. T., Styner, M., Zwaigenbaum, L., & Piven, J. (2013). White matter microstructure and atypical visual orienting in 7-month-olds at risk for autism. *American Journal of Psychiatry, 170*(8), 899–908. <https://doi.org/10.1176/appi.ajp.2012.12>

- 091150
- Elsabbagh, M., Divan, G., Koh, Y. J., Kim, Y. S., Kauchali, S., Marcin, C., Montiel-Nava, C., Patel, V., Paula, C. S., Wang, C., Yasamy, M. T., & Fombonne, E. (2012). Global prevalence of autism and other pervasive developmental disorders. *Autism Research: Official Journal of the International Society for Autism Research*, 5(3), 160-179. <https://doi.org/10.1002/aur.239>
- Esbensen, A. J., Seltzer, M. M., Lam, K. S., & Bodfish, J. W. (2009). Age-related differences in restricted repetitive behaviors in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, 39(1), 57-66. <https://doi.org/10.1007/s10803-008-0599-x>
- Fees, B. S., Kaff, M., Holmberg, T., Teagarden, J., & Delreal, D. (2014). Children's responses to a social story song in three inclusive preschool classrooms: A pilot study. *Music Therapy Perspectives*, 32(1), 71-77. <https://doi.org/10.1093/mtp/miu007>
- Fombonne, E. (2009). Epidemiology of pervasive developmental disorders. *Pediatric Research*, 65(6), 591-598. <https://doi.org/10.1203/PDR.0b013e31819e7203>
- Ganz, J. B., Boles, M. B., Goodwyn, F. D., & Flores, M. M. (2014). Efficacy of handheld electronic visual supports to enhance vocabulary in children with ASD. *Focus on Autism and Other Developmental Disabilities*, 29(1), 3-12. <https://doi.org/10.1177/1088357613504991>
- Garcia-Tudela, P., Predes, P., & Solano-Fernandez, I. M. (2021). Smart learning environments: A basic research towards the definition of a practical model. *Smart Learning Environments*, 8.
- Greenspan, S. I. (2006). Understanding autism. *Scholastic Early Childhood Today*, 20(4), 22.
- Harden, B. J., Winslow, M. B., Kendziora, K. T., Shahinfar, A., Rubin, K. H., Fox, N. A., Crowley, M. J., & Zahn-Waxler, C. (2000). Externalizing problems in head start children: An ecological exploration. *Early Education and Development*, 11(3), 357-385. https://doi.org/10.1207/s15566935eed1103_8
- Hodgdon, L. A. (1995). *Visual strategies for improving communication*. QuirkRoberts.
- Hodges, H., Fealko, C., & Soares, N. (2020). Autism spectrum disorder: Definition, epidemiology, causes, and clinical evaluation. *Translational Pediatrics*, 9(8), S55-S65. <https://doi.org/10.21037/tp.2019.09.09>
- Hofer, K. G., Farran, D. C., & Cummings, T. P. (2013). Preschool children's math-related behaviors mediate curriculum effects on math achievement gains. *Early Childhood Research Quarterly*, 28(3), 487-495. <https://doi.org/10.1016/j.ecresq.2013.02.002>
- Juandi, A., & Sontani, U. T. (2017). Keterampilan dan kreativitas mengajar guru sebagai determinan terhadap prestasi belajar siswa. *Jurnal Pendidikan Manajemen Perkantoran*, 2(2), 242-250. <https://doi.org/10.17509/jpm.v2i2.8114>
- Kemenpppa. (2018, April 2)). *Hari peduli autisme sedunia: Kenali gejalanya, pahami keadaannya*. Kemenpppa. <https://www.kemenpppa.go.id/index.php/page/read/31/1682/hari-peduli-autisme-sedunia-kenali-gejalanya-pahami-keadaannya>
- Kidder, J. E., & McDonnell, A. P. (2017). Visual aids for positive behavior support of young children with autism spectrum disorders. *Young Exceptional Children*, 20(3), 103-116. <https://doi.org/10.1177/1096250615586029>
- Kluth, P., & Darmody-Latham, J. (2003). Beyond sight words: Literacy opportunities for students with autism. *The Reading Teacher*, 52(6), 532-535.
- Oliveira, L. M. (2021). *A aprendizagem na*

- criança autista: Dificuldades e desenvolvimento potencial.*
<https://www.vittude.com/blog/fala-psico/a-aprendizagem-na%02crianca-autista-dificuldades-e-desenvolvimento-potencial/>
- Latief, H. (2016). Pengaruh pembelajaran kontekstual terhadap hasil belajar (Studi eksperimen pada mata pelajaran geografi kelas 7 di SMPN 4 Padalarang). *Jurnal Geografi Gea*, 14(2), 14–28. <https://doi.org/10.17509/gea.v14i2.3395>
- Lord, C., Elsabbagh, M., Baird, G., & Veenstra-Vanderweele, J. (2018). Autism spectrum disorder. *The Lancet*, 392(10146), 508–520. [https://doi.org/10.1016/S0140-6736\(18\)31129-2](https://doi.org/10.1016/S0140-6736(18)31129-2)
- Lyall, K., Croen, L., Daniels, J., Fallin, M. D., Ladd-Acosta, C., Lee, B. K., Park, B. Y., Snyder, N. W., Schendel, D., Volk, H., Windham, G. C., & Newschaffer, C. (2017). The changing epidemiology of autism spectrum disorders. *Annual Review of Public Health*, 38, 81–102. <https://doi.org/10.1146/annurev-publhealth-031816-044318>
- Macdonald, L., Trembath, D., Ashburner, J., Costley, D., & Keen, D. (2018). The use of visual schedules and work systems to increase the on-task behaviour of students on the autism spectrum in mainstream classrooms. *Journal of Research in Special Educational Needs*, 18(4), 254–266. <https://doi.org/10.1111/1471-3802.12409>
- Maenner, M. J., Shaw, K. A., Bakian, A. V., Bilder, D. A., Durkin, M. S., Esler, A., Furnier, S. M., Hallas, L., Hall-Lande, J., Hudson, A., Hughes, M. M., Patrick, M., Pierce, K., Poynter, J. N., Salinas, A., Shenouda, J., Vehorn, A., Warren, Z., Constantino, J. N., & Cogswell, M. E. (2021). Prevalence and characteristics of autism spectrum disorder among children aged 8 years- Autism and developmental disabilities monitoring network, 11 sites, United States, 2018. *MMWR Surveillance Summaries*, 70(11), 1–16. <https://doi.org/10.15585/mmwr.ss7011a1>
- Meadan, H., Ostrosky, M. M., Triplett, B., Michna, A., & Fettig, A. (2011). Using visual supports with young children with autism spectrum disorder. *TEACHING Exceptional Children*, 43(6), 28–35. <https://doi.org/10.1177/004005991104300603>
- Mutaqin, W. R. (2016). Keefektifan strategi visual dalam pembelajaran keterampilan sosial pada anak dengan kondisi spektrum autis tipe sindroma asperger (ASD). *Jurnal Keterampilan Fisik*, 1(2), 119–123. <https://doi.org/10.37341/jkf.v1i2.102>
- National Collaborating Centre for Women’s and Children’s Health (UK). (2011). *Autism: Recognition, referral and diagnosis of children and young people on the autism spectrum*. RCOG Press.
- Parritz, R., & Troy, M. (2013). *Disorders of childhood: Development and psychopathology (2nd Edition)*. Cengage Learning.
- Peeters, T. (2004). *Hubungan pengetahuan teoritis dan intervensi pendidikan bagi penyandang autis*. Dian Rakyat.
- Pickard, K., Meza, R., Drahota, A., & Brikho, B. (2018). They're doing what? A brief paper on service use and attitudes in ASD community-based agencies. *Journal of Mental Health Research in Intellectual Disabilities*, 11(2), 111–123. <https://doi.org/10.1080/19315864.2017.1408725>
- Posar, A., & Visconti, P. (2017). Autism in 2016: The need for answers. *Jornal de Pediatria*, 93(2), 111–119. <https://doi.org/10.1016/j.jped.2016.09.002>
- Pradipta, R. F., & Andajani, S. J. (2017). Motion development program for parents of child with cerebral palsy (Pengembangan program bina gerak untuk orang tua anak cerebral palsy). *Jurnal Penelitian dan Pengembangan Pendidikan Luar Biasa*, 4(2), 160-164.

- <http://dx.doi.org/10.17977/um029v4i22017p160-164>
- Quill, K. A. (1995). *Teaching children with autism: Strategies to enhance communication and socialization*. Delmar.
- Ramirez-Celis, A., Becker, M., Nuño, M., Schauer, J., Aghaeepour, N., & Van de Water, J. (2021). Risk assessment analysis for maternal autoantibody-related autism (MAR-ASD): A subtype of autism. *Molecular Psychiatry*, 26(5), 1551–1560.
<https://doi.org/10.1038/s41380-020-00998-8>
- Rao, S., & Gagie, B. (2006). Learning through seeing and doing: Visual supports for children with autism. *TEACHING Exceptional Children*, 38(6), 26–33.
<https://doi.org/10.1177/00400599060380604>
- Rokom. (2013, April 09). *Autisme ada di sekeliling kita, mari wujudkan kepedulian kita!*. SehatNegeriku.
<https://sehatnegeriku.kemkes.go.id/baca/rilis-media/20130409/097585/autisme-ada-di-sekeliling-kita-mari-wujudkan-kepedulian-kita/>
- Rosa, V. I., Silva, R. P. da, & Aymone, J. L. F. (2018). Design inclusivo: Processo de desenvolvimento de prancha de comunicação alternativa e aumentativa para crianças com transtorno do espectro do autismo utilizando realidade aumentada. *Design E Tecnologia*, 8(15), 51-67.
<https://doi.org/10.23972/det2018iss15pp51-67>
- Rutherford, M., Baxter, J., Grayson, Z., Johnston, L., & O'Hare, A. (2020). Visual supports at home and in the community for individuals with autism spectrum disorders: A scoping review. *Autism*, 24(2), 447–469.
<https://doi.org/10.1177/1362361319871756>
- Saadah, A., Huda, A., & Irvan, M. (2022). Implementasi TEACCH dalam pembelajaran untuk siswa autisme di sekolah khusus. *Jurnal Ortopedagogia*, 8(1), 12–18.
<http://dx.doi.org/10.17977/um031v8i12022p12-18>
- Searle, A. K., Sawyer, M. G., Miller-Lewis, L. R., & Baghurst, P. A. (2014). Prospective associations between children's preschool emotional and behavioral problems and kindergarten classroom engagement, and the role of gender. *The Elementary School Journal*, 114, 380–405.
<https://doi.org/10.1086/674421>
- Seniati, R., Liche, & Yulianto, A. (2005). *Psikologi eksperimen*. PT. Indeks.
- Siahaan, E. (2016). Efektivitas metode visual schedule dalam meningkatkan kemandirian pada anak sindrom asperger. *Jurnal Psikologi Universitas HKBP Nommensen*, 2(1).
- Simpson, R. L. (2005). Evidence-based practices and students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, 20(3), 140–149.
<https://doi.org/10.1177/10883576050200030201>
- Sinha, P., Kjelgaard, M. M., Gandhi, T. K., Tsourides, K., Cardinaux, A. L., Pantazis, D., Diamond, S. P., & Held, R. M. (2014). *Autism as a disorder of prediction*. Proceedings of the National Academy of Sciences of the United States of America, 111(42), 15220–15225.
<https://doi.org/10.1073/pnas.1416797111>
- UNICEF INDONESIA. (2012). *Laporan tahunan 2012*. UNICEF.
- Van Bourgondien, M. E., & Coonrod, E. (2013). TEACCH: An intervention approach for children and adults with autism spectrum disorders and their families. In S. Goldstein & J. A. Naglieri (Eds.), *Interventions for autism spectrum disorders: Translating science into practice* (pp. 75–105). Springer Science + Business Media.
https://doi.org/10.1007/978-1-4614-5301-7_5

- Vernhet, C., Dellapiazza, F., Blanc, N., Cousson-Gélie, F., Miot, S., Roeyers, H., & Baghdadli, A. (2019). Coping strategies of parents of children with autism spectrum disorder: A systematic review. *European Child and Adolescent Psychiatry*, 28(6), 747–758. <https://doi.org/10.1007/s00787-018-1183-3>
- Vitiello, V., & Williford, A. P. (2016). Relations between social skills and language and literacy outcomes among disruptive preschoolers: Task engagement as a mediator. *Early Childhood Research Quarterly*, 36, 136–144. <https://doi.org/10.1016/j.ecresq.2015.12.011>
- Wikete Lee, M. A. (2016). *Early childhood educators' use of teacher-created stories to support the social and emotional development of preschool students* (Dissertations unpublished). Saint Louis University, Curriculum and Instruction.
- Wing, L., & Gould, J. (1979). Severe impairments of social interaction and associated abnormalities in children: epidemiology and classification. *Journal of Autism and Developmental Disorders*, 9(1), 11–29. <https://doi.org/10.1007/BF01531288>