



Assistance in making ecobricks from inorganic waste: Improving motor skills and environmental awareness of autistic students

Muhammad Shodiq Ash Sidqi ^{a,1,*}, Aulia Icha Saputri^{a,2}, Ardelia Salsabila Rahman^{b,3}, Weandy Putri Setya Wardana^{b,4}, N. Nurlaila^{a,5}, Dyah Worowirastri Ekowati^{a,6}, Minatun Nadlifah^{c,7}, Arina Restian^{a,8}, Erna Yayuk^{a,9}

^a Primary Teacher Education Department, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang, Jl. Raya Tlogomas 246 Malang, East Java 65144, Indonesia

^b Department of Psychology, Faculty of Psychology, Universitas Muhammadiyah Malang, Jl. Raya Tlogomas 246 Malang, East Java 65144, Indonesia


^c Mathematics Education Department, Faculty of Teacher Training and Education, Universitas Muhammadiyah Malang, Jl. Raya Tlogomas 246 Malang, East Java 65144, Indonesia

¹shodiqashsidqi@webmail.umm.ac.id*; ²auliaicha@webmail.umm.ac.id; ³ardeliasalsabila@webmail.umm.ac.id;

⁴Weandywardana@webmail.umm.ac.id; ⁵Nuelaelap91@webmail.umm.ac.id; ⁶worowirastri@umm.ac.id, ⁷minatunnadlifah@umm.ac.id,

⁸arestian@umm.ac.id, ⁹erna17@umm.ac.id

* Corresponding author

ARTICLE INFO	ABSTRACT
<p>Article history Received: 2024-07-08 Revised: 2024-10-09 Accepted: 2024-11-02 Published: 2024-11-02</p> <p>Keywords Autism Student Environmental awareness Inorganic waster Motor skill</p>	<p>SD Muhammadiyah 9 Malang with the highest number of students with 24 classes produces plastic waste ± 0.5 kg per class. On average, every day produces ± 12 kilograms of unused plastic waste. Therefore, this service activity aimed to assist in making Ecobrick from inorganic waste: improving motor skills and environmental awareness of autistic students of SD Muhammadiyah 9 Malang. The methods used in this community service activity are potential problems, data collection, program planning, program concept preparation, creative concept creation related to the fine motor skills of autistic students, program implementation, program monitoring, and mentoring. The results of this service in the form of mentoring show an increase in motor skills in autistic students. Other results are in the form of Ecobrick products from inorganic materials in the form of pencil holders and shelves produced by autistic students. In the future, it is necessary to follow up to assist teachers accompanying autistic students in improving the quality of learning in the classroom.</p>
<p>Kata Kunci Kesadaran lingkungan Keterampilan motorik Pembuangan sampah anorganik Siswa Autisme</p>	<p>Pendampingan pembuatan eco brick dari sampah anorganik: Meningkatkan kemampuan motorik dan kepedulian lingkungan pada siswa autis. SD Muhammadiyah 9 Malang dengan jumlah siswa terbanyak dengan 24 kelas menghasilkan sampah plastik ± 0,5 kg per kelas. Rata-rata setiap harinya menghasilkan ±12 kilogram sampah plastik yang tidak terpakai. Oleh karena itu, kegiatan pengabdian ini bertujuan untuk membantu pembuatan Ecobrick dari sampah anorganik: meningkatkan kemampuan motorik dan kepedulian lingkungan siswa autis SD Muhammadiyah 9 Malang. Metode yang digunakan dalam kegiatan pengabdian masyarakat ini adalah potensi masalah, pengumpulan data, perencanaan program, penyusunan konsep program, penciptaan konsep kreatif terkait motorik halus siswa autis, pelaksanaan program, monitoring program, dan pendampingan. Hasil pengabdian berupa pendampingan ini menunjukkan adanya peningkatan kemampuan motorik pada siswa autis. Hasil lainnya berupa produk Ecobrick dari bahan anorganik berupa tempat pensil dan rak yang diproduksi oleh siswa autis. Untuk kedepannya perlu dilakukan tindak lanjut untuk membantu guru pendamping siswa autis dalam meningkatkan kualitas pembelajaran di kelas.</p> <p style="text-align: right;">Copyright © 2024, Sidqi et al This is an open access article under the CC-BY-SA license</p> <div style="text-align: right;">  </div>

How to cite: Sidqi, M. S. A., Saputri, A. I., Rahman, A. S., Wardana, W. P. S., Nurlaila, N., Ekowati, D. W., Nadlifah, M., Restian, A., & Yayuk, E. Assistance in making ecobricks from inorganic waste: Improving motor skills and environmental awareness of autistic students. *Journal of Community Service and Empowerment*, 5(3), 504-514. <https://doi.org/10.22219/jcse.v5i3.34901>

INTRODUCTION

Muhammadiyah 9 Malang Elementary School has 18 students with special needs. A total of 6 students are in the category of autistic students. Based on discussions with partners, the first problem was that the school did not have motor training and play therapy for autistic students by utilizing the environment. As an inclusion school, ideally, it has programs and mechanisms for dealing with autistic children that are programmed and measurable (Phytanza et al., 2023). However, in reality, this elementary school does not have special programs to deal with autistic children based on the environment. In their daily lives at school, autistic students are limited to carrying out activities to introduce the school environment and self-development carried out by shadowteachers, which are owned by some autistic students, and some other autistic students, do not have Shadowteachers (Ayu & Muzayin, 2021; Jung et al., 2022). Shadow teachers are needed to provide educational assistance to students with a tendency to experience autism with severe symptoms or autistic students who are difficult to handle by accompanying teachers (Julianti & Fatmawati, 2018; Junttila et al., 2024; Paynter et al., 2024). The school also does not provide therapy for autistic students.

At the elementary school level, therapy can be organized through play activities. Research on play therapy has been widely conducted, one of which is research conducted by Dessy Hendrifika (2016) with the results of 7-session play therapy interventions for 7 days increasing concentration in autistic children. Other research related to play therapy was also conducted by Siska Iskandar (2019) which discussed play therapy with associative having an impact on improving the motor skills of autistic students. Research conducted by Sutinah (2017) showed that there was an influence on autistic children after being given play therapy on their interaction skills. These previous studies concluded that Play therapy has proven to be very effective for practicing focus, motor skills, and social interaction, with other students (Duijzer et al., 2019; Kim & Kasari, 2023). Play therapy can be implemented through a variety of activities, such as sorting plastics, placing plastic into bottles, and performing other activities that involve hand movements and eye-hand coordination (Kim & Kasari, 2023; Ulandary & Shodiq, 2020). Autistic students in Muhammadiyah 9 Malang Elementary School are very lacking in terms of fine motor habituation, gross motor, balance motor, and play therapy, so that in this school needs programs on this matter.

The second problem is that Muhammadiyah 9 Malang Elementary School has 2 teachers accompanying students with special needs and has not been able to meet all the needs of students with special needs. This accompanying teacher has a background in counseling guidance, out-of-school education, and a business economics education background. So knowledge related to the program for handling autistic students is considered lacking. Special assistant teachers create individualized learning programs (Indahwati & Krisniawan, 2020) that apply to all students with special needs, and do not focus on autistic students (Albright et al., 2024; G. Li et al., 2024). So far, the program has focused on handling the abilities of students with special needs such as fine and gross motor skills. There is no training program related to increasing students' concern for the environment.

On the other hand, Muhammadiyah elementary schools have problems that can be used as a learning tool for autistic students. The third problem is each class produces 0.5 kilograms of inorganic waste every day. The school has 24 classes, meaning that on average every day it produces ± 12 kilograms of inorganic waste that is not used. Through this program, inorganic waste will be used as the main medium for training the fine motor skills of autistic students. Therefore, this service activity aimed to assist in making Ecobrick from inorganic waste: improving motor skills and environmental awareness of autistic students of SD Muhammadiyah 9 Malang. This program also aims to improve the fine motor skills and environmental awareness of autistic children through an interactive and technology-based approach. An interactive, technology-based approach to autistic children can improve communication skills, and support visual and kinesthetic learning styles (Alper, 2018; Julianto & Aziz, 2024).

Thus, autistic children can improve their fine motor skills effectively and sustainably and have a higher environmental awareness (Alyousef & Alhamidi, 2024; Paynter et al., 2024). This program can also help autistic children improve their critical and creative thinking skills, as well as increase their self-awareness of the importance of environmental awareness and fine motor skills in various aspects of life (Pantaleo, 2021; Wulandari et al., 2020).

In this process, autistic children can improve their critical and creative thinking skills, as well as increase their self-awareness of the importance of environmental awareness and fine motor skills in various aspects of life (Kim & Kasari, 2023; Kurjenoja et al., 2021; Palupi et al., 2020). Thus, this service can contribute to the development of more effective and sustainable education for autistic children. Fine motor development programs for autistic students can make a substantial contribution to the development of more effective and sustainable education. Therefore, this program is aligned with the Sustainable Development Goals (SDGs), especially SDG 4: Quality Education (Prieto-Jiménez et al., 2021; Situmeang et al., 2021). Improving the fine motor skills of autistic students is an integral element in increasing their accessibility to actively participate in the learning process (M. Li et al., 2022). Through these interactive media, the academic and non-academic learning outcomes of autistic students can be significantly improved. In addition, this program also helps improve inclusion and equality in education by providing adaptive learning methods that are relevant to the specific needs of autistic students (Alper, 2018; Cosenza & Sanna, 2021; Ekowati et al., 2020; Rofiah & Suhendri, 2023; Wati et al., 2023). In addition, this service can also help increase public awareness about the importance of environmental awareness and fine motor skills in improving the quality of education for autistic children.

METHOD

The method used is service and training (Kurniawati et al., 2020). This community service will be carried out with a descriptive qualitative approach. This community service will describe the improvement of fine motor skills of autistic students through an individual learning program using eco-bricks.

This community service technique will implement potential problems, data collection, program planning, program concept preparation, creation of creative concepts related to the fine motor skills of autistic students, program implementation, program monitoring, and mentoring. Data collection uses a child's fine motor development instrument that has been validated by a psychology lecturer.

Community service setting and subjects

Community service was carried out at SD Muhammadiyah 9 Malang City, in April 2024, with 3 special supervisors, 2 shadow teachers, and 6 autistic students. Community service data collection technique was carried out using instruments consisting of interview instruments, children's fine motor skills instruments, and daily fine motor development instruments.

Data Analysis

Descriptive analysis was carried out to analyze qualitative data obtained from the results of interviews, results of initial motor skills, daily motor development, and final motor skills of autistic students. All information is analyzed to obtain conclusions and results of service (Creswell, 2014; Creswell & Clark, 2018; Saleh, 2021). The Table 1 shows the criteria for children's motor skills.

Table 1. Children's motor development

Developer Field	Indicator	Sub-Indicators	Assessment Criteria			
			4	3	2	1
Fine Motor	Thickening pattern	Thickening simple patterns (square, rectangle, circle)				
		Thickens the straight line well				
	Grasping	Grasping small and long objects (pencils, pens, skewer pieces)				
		Grasping large objects (scissors, bottles)				
	Fold	Folding vertical objects (plastic pieces, paper pieces)				
		Folding horizontal objects (plastic, cardboard)				
	Inserting objects	Putting objects in containers (garbage into the trash can)				
	Scissor	Cutting straight and winding lines (Plastic, plastic bottles, mica)				
		Scissor simple shapes (circles, squares, rectangles)				

RESULTS AND DISCUSSION

The initial stage in the implementation of the service is an analysis of potential problems. SD Muhammadiyah 9 Malang has 3 special supervisors with a background in education, each teacher is in psychology, out-of-school education, and English. There are 2 shadow teachers with an education background in Sharia economics. From the educational background, teachers have not met the need to handle students with special needs in the school. Children's abilities in the period of growth and development will develop rapidly if they are not given the appropriate stimulus, the child's abilities will not follow their age development (Karasheva et al., 2021; Muthivhi & Kriger, 2019; Nor Annisa et al., 2022). So, to answer the needs of SD Muhammadiyah 9 Malang, we collaborate in making programs and training for the growth and development of students with special needs in the school. SD Muhammadiyah 9 Malang has at least 24 classes on average every day, each class produces ± 0.5 kg of plastic waste, with 24 classes, meaning that on average every day produces ± 12 kilograms of unused plastic waste.

The results and steps of the community service carried out at SD Muhammadiyah 9 Malang went through a long journey. The process began with an analysis of potential problems, where it was identified that there was a lack of variety in motor skill training media and the inadequate educational background of the teachers. Subsequently, data collection was conducted to design a PPI (Initial Learning Program) tailored to the needs of the students. The training was carried out over 10 days, involving activities such as play therapy, cutting, and compacting plastic waste, which not only improved the students' motor skills but also effectively utilized plastic waste (Abe, 2020; Hauksson-Tresch, 2021). This program also fostered long-term collaboration between the school and relevant institutions to support inclusive education and ensure the sustainability of the program in the future. The steps of service are explained as follows:

1. Communication and Coordination to Partner School Principals

The initial step of service began by communicating and coordinating with the principal of the partner school, namely SD Muhammadiyah 9 Malang. The main goal is to socialize, survey locations, and offer cooperation in programs to overcome problems. During this process, it is ensured that the principal and teachers of SD Muhammadiyah 9 Malang understand the basic concept of the ecobrick program and the goals to be achieved.

2. Coordination of PKM Activity Program Planning to Partner School Principals

Preparation and Socialization to special accompanying teachers and shadow teachers. After the initial step was completed, the service team coordinated the planning of the activity program with the teachers of SD Muhammadiyah 9 Malang. The main goal is to prepare and socialize teachers about the understanding of concepts that will be applied. Thus, teachers can facilitate the implementation of the program more optimally.

3. Preparation of PPI (Individual Learning Program)

Conducting discussions and communication related to the creation of PPI (Individual Learning Program). PPI was made to adapt ecobrick activities to the needs of autistic students.

4. Creation of the Ecobrick Creation Concept

Create a creative concept by designing shelves and pencil cases. The main goal is to improve the motor skills of autistic children through creative and environmentally effective activities. In this way, children can learn to turn waste into a value-added product.

5. Preparation of Tools and Materials According to PPI Needs

Purchase of necessary tools and materials and prepare them at SD Muhammadiyah 9 Malang. This preparation is very important because all materials used must be safe and hygienic for use by autistic students.

6. Implementation of PPI Using Ecobricks

Training and mentoring to improve the fine motor skills of autistic students are carried out many times 10 times. Autistic students are expected to improve their motor skills by making Ecobricks from waste. This activity is not only educational but also contributes to the environment.

7. Monitoring and evaluation of eco-brick activities

This monitoring aims to evaluate the effectiveness of the program and ensure that autistic children benefit from the activities. Evaluation data was used to determine the improvement of fine motor skills of autistic students after the ecobrick program.

The environmental condition of autistic students in SD Muhammadiyah 9 Malang, has at least 3 rooms that are actively used. The first is the BK room which is used for teaching and learning activities by teachers and students with special needs in schools (Benitez et al., 2017; Julhadi & Ritonga, 2023; Prain et al., 2022). The two media and self-study rooms, which are used for self-development activities every Thursday, also contain learning media used in teaching autistic students and other special needs students, these media also support the process of student cognitive development (Gagatsis et al., 2016; Mercer et al., 2019; Pierson & Clark, 2019). The last is the tantrum room, the tantrum room is used when autistic students are not in good condition to carry out activities, so the a need for a tantrum room for autistic students to do activities with the accompanying shadow teacher (Alyousef & Alhamidi, 2024; G. Li et al., 2024; Paynter et al., 2024; Sam et al., 2021).

The second stage in the implementation of the service is data collection. Data collection is used as a reference in the creation of the program. From the results of the analysis of potential problems, two main problems were obtained, namely the lack of a variety of fine motor training programs for autistic children, and the lack of proper non-organic waste processing. Thus, the first data collection carried out is about the initial fine motor ability of autistic students, described in Figure 1.

From Figure 1, it can be seen that the initial motor skills of autistic students show an average carry, especially in inserting objects and scissors. This service will conduct training and mentoring to improve the fine motor skills of autistic students by utilizing non-organic waste at school by making eco-brick media.

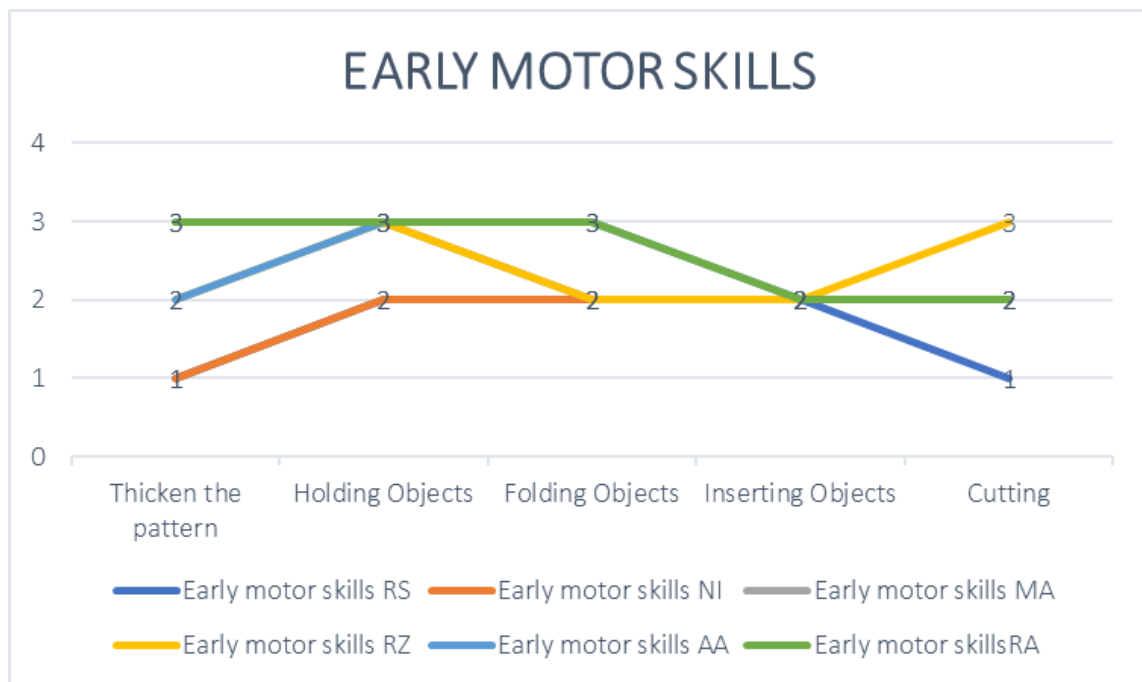


Figure 1. Early fine motor skills of autistic students

This activity from this service is training and mentoring by using Eco bricks and utilizing existing non-organic waste. Previously, SD Muhammadiyah 9 Malang, already had a motor training program by stimulating the fine motor skills of autistic students through texture games, in a long period the activity showed the motor development of autistic students. In the implementation of this service, training will be held for 10 consecutive days. The provision of activities through 3 stages, namely:

a) Days 1-3: Fine Motor Skills Training for Autistic Students through Play Therapy

The first three days of the program are focused on play therapy activities for autistic students, including grasping and pattern-making exercises. This activity aims to gradually improve the fine motor skills of autistic students by involving them with various objects.

b) Days 4-6: Ecobrick-Based Fine Motor Training for Autistic Students

From the fourth to the sixth day, autistic students were trained to make simple patterns on the plastic waste provided. During this period, they were also trained to cut various simple patterns and different types of non-organic waste (mica, plastic snacks, and used straws). This training aims to strengthen the hand muscles of autistic students, thereby improving their fine motor skills.

c) Days 7-10: Fine Motor Training through Eco brick Assembly

From the seventh to the tenth day, students are trained to put small pieces of garbage (which are cut into small pieces) into small and medium-sized plastic bottles. This training aims to increase the strength of their finger muscles, thereby improving their fine motor skills. In addition, this training helps autistic students develop focus and patience in solving problems.

After the training, tests were carried out on the fine motor skills of autistic students through fine motor skills instruments that have been validated by psychology lecturers. The final results of the motor skills of autistic students are presented in Figure 2. Figure 2 presents the final fine motor skills of autistic students after the implementation of the training. There is a fairly rapid development in the motor skills of autistic students, this is due to the selection of the right program and intense training for these autistic students. When compared to the initial fine motor ability, it can be seen in Figure 3.

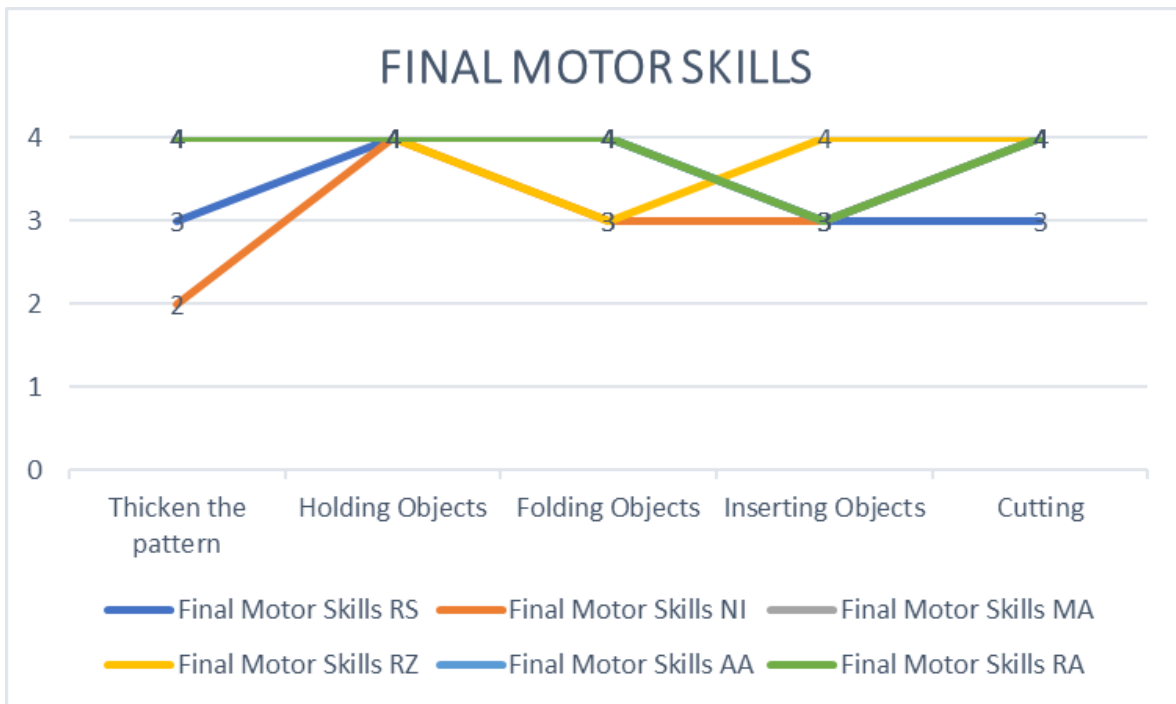


Figure 2. Final fine motor skills of autistic students

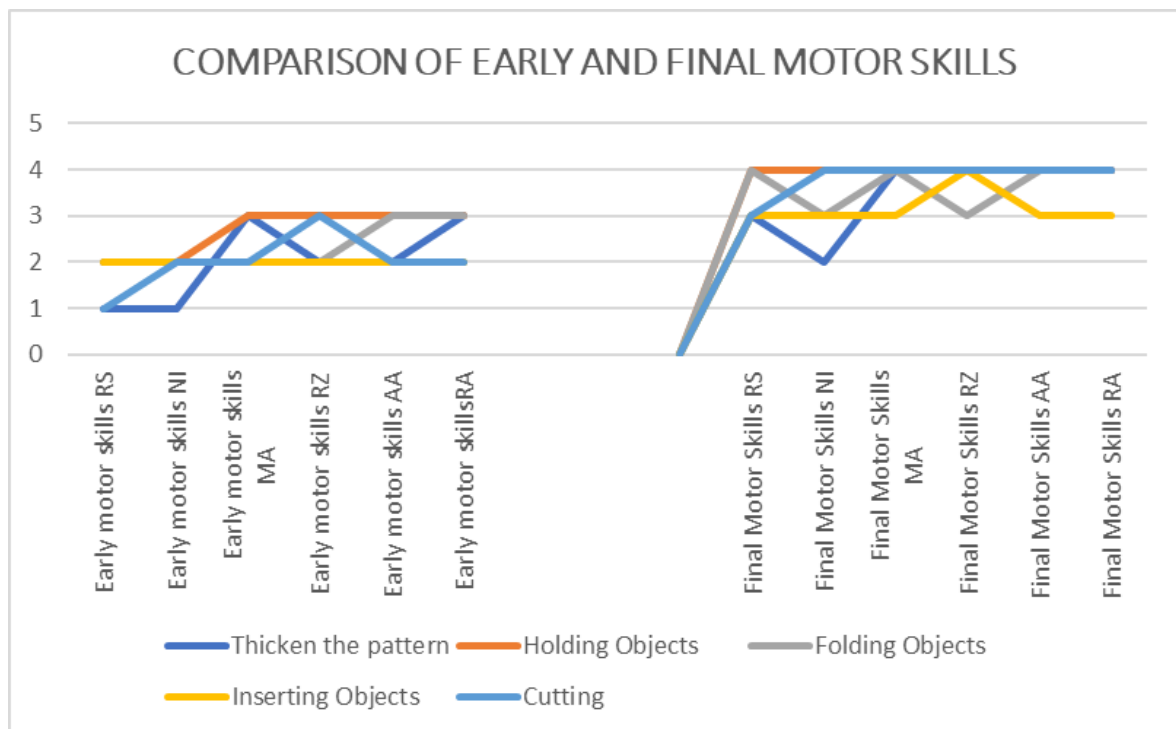


Figure 3. Comparison of early and final motor skills of autistic students

Figure 3 offers a comparative view of the fine motor skills demonstrated by autistic students before and after the training program. This illustration effectively highlights the significant improvements observed across various skill indicators, particularly in tasks such as cutting and pattern-making. The data indicates that the training had a positive impact on the students' abilities, showcasing their enhanced proficiency in handling tools and engaging in activities that require fine motor coordination. This figure serves as compelling evidence of the successful outcomes resulting from the intervention, emphasizing the importance of targeted training in fostering the development of fine motor skills among autistic students.

Figure 3, shows a comparison of fine motor skills of autistic students. It can be seen that rapid development occurs in the indicator of cutting and thickening patterns. The indicator of repeating patterns is the beginning of success of other indoctrinators because thickening patterns involves holding a pen which will be the beginning of the stages of supporting writing skills. Scissor indicators prove that the motor muscles of autistic students are strong enough for them to perform

daily activities that involve styling. From the results of interviews and testimonials by teachers and parents, it is stated that motor training activities, have a significant impact on strengthening fine motor muscles and the ability to carry out daily activities, and autistic students experience a fairly rapid increase in focus.

In the mentoring activity, the school will be given a fine motor training book using ecobrick. The cover of the book will be presented in Figure 4.



Figure 4. Fine motor training book using eco-brick

In the mentoring activity, the school will be given a fine motor training book using ecobrick. The cover of the book, which visually represents the program's focus on enhancing motor skills through eco-friendly practices, will be presented in Figure 4. This guidebook will focus on how to make Eco bricks by utilizing non-organic waste, implementation with the use of PPI (Initial Learning Program), and the sequence of activities in the implementation of fine motor training activities. This book can be used not only for autistic students but can also benefit other students in need.

This guidebook will focus on how to make Eco bricks by utilizing non-organic waste, implementation with the use of PPI (Initial Learning Program), and the sequence of activities in the implementation of fine motor training activities. This book can be used not only for autistic students but can be used for other students in need.

CONCLUSION

The results of the analysis showed that motor skills in autistic students who did not develop according to their age were not caused by the side effects of the congenital disorder, but by the lack of motor training given to them. This should have been given from an early age because the motor skills of autistic students are not trained at home from an early age, usually because parents consider their children incapable of doing simple things such as eating on their own or doing daily activities independently. As a result, autistic students do not practice their motor skills, which results in a decrease in ability. Therefore, the school can create a new program that involves various motor abilities of autistic students to be more trained. This program will be more effective if parents are involved in the implementation of the program. The results of activities through Ecobrick can be said to be successful because the fine motor skills of autistic students have

increased significantly in a fairly short time. The guidebook will be used by schools as a reference in the use of the Eco Brick program in improving the fine motor skills of autistic students.

ACKNOWLEDGEMENT

Thank you to Headmaster of SD Muhammadiyah 9 Malang for providing the opportunity to carry out PKM activities at school.

REFERENCES

- Abe, M. (2020). Interactional practices for online collaborative writing. *Journal of Second Language Writing, 49*.
<https://doi.org/10.1016/j.jslw.2020.100752>
- Albright, J., Fok, M., DeLucia, E. A., & Scarpa, A. (2024). A Qualitative Examination of the Impact of COVID-19 on Transition Services for Autistic Youth. *Journal of Autism and Developmental Disorders, 54*(8), 3028–3042.
<https://doi.org/10.1007/s10803-023-06009-3>
- Alper, M. (2018). Inclusive sensory ethnography: Studying new media and neurodiversity in everyday life. *New Media and Society, 20*(10), 3560–3579. <https://doi.org/10.1177/1461444818755394>
- Alyousef, S. M., & Alhamidi, S. A. (2024). Psychiatric-Mental Health Nurse Perspectives of Caring for Patients with Disorders of Autism. *SAGE Open, 14*(3), 1–12. <https://doi.org/10.1177/21582440241271195>
- Ayu, F., & Muzayin, A. (2021). Peranan Guru Melalui Pendidikan Inklusi dalam Menanamkan Sikap Sosial Siswa di SD Negeri 14 Mulyoharjo Pematang. *Jurnal Bashrah, 1*(2), 72–83.
- Benitez, P., de CarvalhoGomes, M. L., Bondioli, R., & Domeniconi, C. (2017). Mapping of inclusive strategies for students with intellectual disabilities and autism. *Psicologia Em Estudo, 22*(1), 81–93.
<https://doi.org/10.4025/psicolestud.v22i1.34674>
- Cosenza, G., & Sanna, L. (2021). The Origins of the Alleged Correlation between Vaccines and Autism. A Semiotic Approach. *Social Epistemology, 00*(00), 1–14. <https://doi.org/10.1080/02691728.2021.1954716>
- Creswell, J. W. (2014). Research design : qualitative, quantitative, and mixed methods approaches. In V. Knight, J. K. Young, K. Bauhaus, B. Markanich, & Megan (Eds.), *SAGE Publications, Inc.* (4th ed.). SAGE Publications, Inc.
- Creswell, J. W., & Clark, V. L. P. (2018). *Designing and conducting mixed methods research approach*. 849.
- Duijzer, C., Van den Heuvel-Panhuizen, M., Veldhuis, M., & Doorman, M. (2019). Supporting primary school students' reasoning about motion graphs through physical experiences. *ZDM - Mathematics Education, 51*(6), 899–913.
<https://doi.org/10.1007/s11858-019-01072-6>
- Ekowati, D. W., Cholily, Y. M., Hakim, R. R., Artadana, I. B. M., Sumarsono, P., & Lailiyah, U. B. (2020). Dissemination of instructional book on catfish cultivation: An effort for illiteracy eradication in minapolitan area. *Journal of Community Service and Empowerment, 1*(1), 17–24. <https://doi.org/10.22219/jcse.v1i1.11513>
- Gagatsis, A., Deliyianni, E., Elia, I., Panaoura, A., & Michael-Chrysanthou, P. (2016). Fostering representational flexibility in the mathematical working space of rational numbers. *Bolema - Mathematics Education Bulletin, 30*(54), 287–307. <https://doi.org/10.1590/1980-4415v30n54a14>
- Hauksson-Tresch, N. (2021). Visual Rhetoric of the Truth in the Dreyfus Affair: A Semiotic Approach. *International Journal for the Semiotics of Law, 34*(1), 127–143. <https://doi.org/10.1007/s11196-019-09617-4>
- Hendrifika, D. (2016). Terapi Bermain untuk Meningkatkan Konsentrasi pada Anak yang Mengalami Gangguan Autis. *Procedia : Studi Kasus Dan Intervensi Psikologi, 4*(2), 47–56.
- Indahwati, N., & Krisniawan, F. A. (2020). Peningkatan Kemampuan Motorik Siswa Autis Melalui Permainan Sirkuit. *Jurnal Pendidikan Olahraga Dan Kesehatan, 8*(2), 7–10.
- Iskandar, S., & I. (2019). Efektivitas Terapi Bermain Asosiatif Terhadap Kemampuan Motorik Pada Anak Autis. *Journal of Nursing and Public Health, 7*(2), 72–76. <https://doi.org/10.37676/jnph.v7i2.889>
- Julhadi, & Ritonga, M. (2023). Human Resource Management in Islamic Educational Institutions to Improve Competitiveness in Society 5.0 Era. In *International Journal of Sustainable Development and Planning* (Vol. 18, Issue 2, pp. 611–619). <https://doi.org/10.18280/ijdsdp.180231>
- Julianti, E., & Fatmawati. (2018). Keterampilan Shibori untuk Meningkatkan Kemampuan Motorik Halus bagi Anak Autisme. *Jurnal Penelitian Pendidikan Khusus, 6*, 142–149.
- Julianto, A. D., & Aziz, A. N. (2024). Implementasi Game Design Document pada Perancangan Permainan Interaktif Menggunakan Joystick untuk Keterampilan Sosial Anak Spektrum Autisme. *Jurnal Pendidikan Tambusai, 8*(2), 17371–17380.
- Jung, J. H., Bang, G. H., & Kim, Y. C. (2022). Posthuman Learning Culture and Internet-Based Private Tutoring in South Korea: Implications for Online Instruction in Public Schooling. *Sustainability (Switzerland), 14*(21).
<https://doi.org/10.3390/su142114566>

- Junttila, M., Kielinen, M., Jussila, K., Joskitt, L., Mäntymaa, M., Ebeling, H., & Mattila, M. L. (2024). The traits of Autism Spectrum Disorder and bullying victimization in an epidemiological population. *European Child and Adolescent Psychiatry*, 33(4), 1067–1080. <https://doi.org/10.1007/s00787-023-02228-2>
- Karasheva, Z., Amirova, A., Ageyeva, L., Jazdykbayeva, M., & Uaidullakzy, E. (2021). Preparation of future specialists for the formation of educational communication skills for elementary school children. *World Journal on Educational Technology: Current Issues*, 13(3), 467–484. <https://doi.org/10.18844/wjet.v13i3.5954>
- Kim, S. A., & Kasari, C. (2023). Working memory of school-aged children on the autism spectrum: Predictors for longitudinal growth. *Autism*, 27(8), 2422–2433. <https://doi.org/10.1177/13623613231165599>
- Kurjenoja, A. K., Schumacher, M., & Carrera-Kurjenoja, J. (2021). Landscape sensitizing through expansive learning in architectural education. *Land*, 10(2), 1–20. <https://doi.org/10.3390/land10020151>
- Kurniawati, N. D., Makhfudli, M., Laili, N. R., Sukartini, T., Wahyuni, E. D., & Yasmara, D. (2020). Peningkatan Kemampuan Melakukan Pertolongan Pertama Pada Kecelakaan Siswa Smu Di Sekolah Menengah Umum Melalui Metode Simulasi Dan Role Play. *Jurnal Pengabdian Masyarakat Dalam Kesehatan*, 2(1), 1. <https://doi.org/10.20473/jpmk.v2i1.18086>
- Li, G., Zarei, M. A., Alibakhshi, G., & Labbafi, A. (2024). Teachers and educators' experiences and perceptions of artificial-powered interventions for autism groups. *BMC Psychology*, 12(1), 1–12. <https://doi.org/10.1186/s40359-024-01664-2>
- Li, M., Lin, Y., Bao, T., Zhao, Q., Wang, Y., Li, M., Chen, Y., Qian, Y., Chen, L., & Zhu, D. (2022). Inclusive education of elementary students with autism spectrum disorders in Shanghai, China: From the teachers' perspective. *BioScience Trends*, 16(2), 142–150. <https://doi.org/10.5582/bst.2022.01104>
- Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research*, 97, 187–199. <https://doi.org/10.1016/j.ijer.2017.08.007>
- Muthivhi, A. E., & Kriger, S. (2019). Music instruction and reading performance: conceptual transfer in learning and development. *South African Journal of Childhood Education*, 9(1), 1–12. <https://doi.org/10.4102/sajce.v9i1.544>
- Abe, M. (2020). Interactional practices for online collaborative writing. *Journal of Second Language Writing*, 49. <https://doi.org/10.1016/j.jslw.2020.100752>
- Albright, J., Fok, M., DeLucia, E. A., & Scarpa, A. (2024). A Qualitative Examination of the Impact of COVID-19 on Transition Services for Autistic Youth. *Journal of Autism and Developmental Disorders*, 54(8), 3028–3042. <https://doi.org/10.1007/s10803-023-06009-3>
- Alper, M. (2018). Inclusive sensory ethnography: Studying new media and neurodiversity in everyday life. *New Media and Society*, 20(10), 3560–3579. <https://doi.org/10.1177/1461444818755394>
- Alyousef, S. M., & Alhamidi, S. A. (2024). Psychiatric-Mental Health Nurse Perspectives of Caring for Patients with Disorders of Autism. *SAGE Open*, 14(3), 1–12. <https://doi.org/10.1177/21582440241271195>
- Ayu, F., & Muzayin, A. (2021). Peranan Guru Melalui Pendidikan Inklusi dalam Menanamkan Sikap Sosial Siswa di SD Negeri 14 Mulyoharjo Pematang. *Jurnal Bashrah*, 1(2), 72–83.
- Benitez, P., de CarvalhoGomes, M. L., Bondioli, R., & Domeniconi, C. (2017). Mapping of inclusive strategies for students with intellectual disabilities and autism. *Psicologia Em Estudo*, 22(1), 81–93. <https://doi.org/10.4025/psicoestud.v22i1.34674>
- Cosenza, G., & Sanna, L. (2021). The Origins of the Alleged Correlation between Vaccines and Autism. A Semiotic Approach. *Social Epistemology*, 00(00), 1–14. <https://doi.org/10.1080/02691728.2021.1954716>
- Creswell, J. W. (2014). Research design : qualitative, quantitative, and mixed methods approaches. In V. Knight, J. K. Young, K. Bauhaus, B. Markanich, & Megan (Eds.), *SAGE Publications, Inc.* (4th ed.). SAGE Publications, Inc.
- Creswell, J. W., & Clark, V. L. P. (2018). *Designing and conducting mixed methods research approach*. 849.
- Duijzer, C., Van den Heuvel-Panhuizen, M., Veldhuis, M., & Doorman, M. (2019). Supporting primary school students' reasoning about motion graphs through physical experiences. *ZDM - Mathematics Education*, 51(6), 899–913. <https://doi.org/10.1007/s11858-019-01072-6>
- Ekowati, D. W., Cholily, Y. M., Hakim, R. R., Artadana, I. B. M., Sumarsono, P., & Lailiyah, U. B. (2020). Dissemination of instructional book on catfish cultivation: An effort for illiteracy eradication in minapolitan area. *Journal of Community Service and Empowerment*, 1(1), 17–24. <https://doi.org/10.22219/jcse.v1i1.11513>
- Gagatsis, A., Deliyianni, E., Elia, I., Panaoura, A., & Michael-Chrysanthou, P. (2016). Fostering representational flexibility in the mathematical working space of rational numbers. *Bolema - Mathematics Education Bulletin*, 30(54), 287–307. <https://doi.org/10.1590/1980-4415v30n54a14>
- Hauksson-Tresch, N. (2021). Visual Rhetoric of the Truth in the Dreyfus Affair: A Semiotic Approach. *International Journal for the Semiotics of Law*, 34(1), 127–143. <https://doi.org/10.1007/s11196-019-09617-4>
- Hendrifika, D. (2016). Terapi Bermain untuk Meningkatkan Konsentrasi pada Anak yang Mengalami Gangguan Autis. *Procedia : Studi Kasus Dan Intervensi Psikologi*, 4(2), 47–56.
- Indahwati, N., & Krisniawan, F. A. (2020). Peningkatan Kemampuan Motorik Siswa Autis Melalui Permainan Sirkuit. *Jurnal Pendidikan Olahraga Dan Kesehatan*, 8(2), 7–10.

- Iskandar, S., & I. (2019). Efektivitas Terapi Bermain Asosiatif Terhadap Kemampuan Motorik Pada Anak Autis. *Journal of Nursing and Public Health*, 7(2), 72–76. <https://doi.org/10.37676/jnph.v7i2.889>
- Julhadi, & Ritonga, M. (2023). Human Resource Management in Islamic Educational Institutions to Improve Competitiveness in Society 5.0 Era. In *International Journal of Sustainable Development and Planning* (Vol. 18, Issue 2, pp. 611–619). <https://doi.org/10.18280/ijstdp.180231>
- Julianti, E., & Fatmawati. (2018). Keterampilan Shibori untuk Meningkatkan Kemampuan Motorik Halus bagi Anak Autisme. *Jurnal Penelitian Pendidikan Khusus*, 6, 142–149.
- Julianto, A. D., & Aziz, A. N. (2024). Implementasi Game Design Document pada Perancangan Permainan Interaktif Menggunakan Joystick untuk Keterampilan Sosial Anak Spektrum Autisme. *Jurnal Pendidikan Tambusai*, 8(2), 17371–17380.
- Jung, J. H., Bang, G. H., & Kim, Y. C. (2022). Posthuman Learning Culture and Internet-Based Private Tutoring in South Korea: Implications for Online Instruction in Public Schooling. *Sustainability (Switzerland)*, 14(21). <https://doi.org/10.3390/su142114566>
- Junttila, M., Kielenen, M., Jussila, K., Joskitt, L., Mäntymaa, M., Ebeling, H., & Mattila, M. L. (2024). The traits of Autism Spectrum Disorder and bullying victimization in an epidemiological population. *European Child and Adolescent Psychiatry*, 33(4), 1067–1080. <https://doi.org/10.1007/s00787-023-02228-2>
- Karasheva, Z., Amirova, A., Ageyeva, L., Jazdykbayeva, M., & Uaidullakzy, E. (2021). Preparation of future specialists for the formation of educational communication skills for elementary school children. *World Journal on Educational Technology: Current Issues*, 13(3), 467–484. <https://doi.org/10.18844/wjet.v13i3.5954>
- Kim, S. A., & Kasari, C. (2023). Working memory of school-aged children on the autism spectrum: Predictors for longitudinal growth. *Autism*, 27(8), 2422–2433. <https://doi.org/10.1177/13623613231165599>
- Kurjenoja, A. K., Schumacher, M., & Carrera-Kurjenoja, J. (2021). Landscape sensitizing through expansive learning in architectural education. *Land*, 10(2), 1–20. <https://doi.org/10.3390/land10020151>
- Kurniawati, N. D., Makhfudli, M., Laili, N. R., Sukartini, T., Wahyuni, E. D., & Yasmara, D. (2020). Peningkatan Kemampuan Melakukan Pertolongan Pertama Pada Kecelakaan Siswa Smu Di Sekolah Menengah Umum Melalui Metode Simulasi Dan Role Play. *Jurnal Pengabdian Masyarakat Dalam Kesehatan*, 2(1), 1. <https://doi.org/10.20473/jpmk.v2i1.18086>
- Li, G., Zarei, M. A., Alibakhshi, G., & Labbafi, A. (2024). Teachers and educators' experiences and perceptions of artificial-powered interventions for autism groups. *BMC Psychology*, 12(1), 1–12. <https://doi.org/10.1186/s40359-024-01664-2>
- Li, M., Lin, Y., Bao, T., Zhao, Q., Wang, Y., Li, M., Chen, Y., Qian, Y., Chen, L., & Zhu, D. (2022). Inclusive education of elementary students with autism spectrum disorders in Shanghai, China: From the teachers' perspective. *BioScience Trends*, 16(2), 142–150. <https://doi.org/10.5582/bst.2022.01104>
- Mercer, N., Hennessy, S., & Warwick, P. (2019). Dialogue, thinking together and digital technology in the classroom: Some educational implications of a continuing line of inquiry. *International Journal of Educational Research*, 97, 187–199. <https://doi.org/10.1016/j.ijer.2017.08.007>
- Muthivhi, A. E., & Kriger, S. (2019). Music instruction and reading performance: conceptual transfer in learning and development. *South African Journal of Childhood Education*, 9(1), 1–12. <https://doi.org/10.4102/sajce.v9i1.544>
- Nor Annisa, Nanik Rahayu, Noor Padilah, Saniyya Putri Hendrayana, Reni Rulita, & Debie Susanti. (2022). Usulan Standar Tingkat Pencapaian Perkembangan Anak (STPPA) Pendidikan Anak Usia Dini Usia 2-3 Tahun. *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, 4(1), 79–88. <https://doi.org/10.62775/edukasia.v4i1.100>
- Palupi, W., Wahyuningsih, S., Widiyastuti, E., Nurjanah, N. E., & Pudyaningtyas, A. R. (2020). Pemanfaatan Ecobricks Sebagai Media Pembelajaran Untuk Anak Usia Dini. *DEDIKASI: Community Service Reports*, 2(1), 28–34. <https://doi.org/10.20961/dedikasi.v2i1.37624>
- Pantaleo, S. (2021). Elementary students' meaning-making of the science comics series by the first second. *Education 3-13*, 49(8), 986–999. <https://doi.org/10.1080/03004279.2020.1818268>
- Paynter, J., O'Leary, K., & Westerveld, M. (2024). Pre-school Skills and School-age Reading Comprehension in Children on the Autism Spectrum: A Preliminary Investigation. *Journal of Autism and Developmental Disorders*, 54(5), 1834–1848. <https://doi.org/10.1007/s10803-023-05949-0>
- Phytanza, D. T. P., Nur, R. A., Hasyim, Mappaompo, A. M., Rahmi, S., Oualeng, A., Silaban, P. S. M., Suyuti, Iswati, & Rukmini, B. S. (2023). Pendidikan Inklusif: Konsep, Implementasi, dan Tujuan. In *EduHumaniora Jurnal Pendidikan Dasar Kampus Cibiru* (Issue 1).
- Pierson, A. E., & Clark, D. B. (2019). Sedimentation of Modeling Practices: Dimensions of Co-operative Action at a Classroom Scale. *Science and Education*, 28(8), 897–925. <https://doi.org/10.1007/s11191-019-00050-4>
- Prain, V., Ferguson, J., & Wickman, P.-O. (2022). Addressing methodological challenges in research on aesthetic dimensions to classroom science inquiry. *International Journal of Science Education*. <https://doi.org/10.1080/09500693.2022.2061743>

- Prieto-Jiménez, E., López-Catalán, L., López-Catalán, B., & Domínguez-Fernández, G. (2021). Sustainable development goals and education: A bibliometric mapping analysis. *Sustainability (Switzerland)*, 13(4), 1–20. <https://doi.org/10.3390/su13042126>
- Rofiah, N. H., & Suhendri. (2023). *The Progress of Inclusive Education Toward Agenda 2030 in Indonesia*. 21, 191–207. <https://doi.org/10.1108/s1479-363620230000021013>
- Saleh, Z. (2021). BAB III analisis 2. 1Lexy J. Meleong, *Metodologi Penelitian Kualitatif (Bandung: PT. Remaja Rosdakarya, 2007)*, 1, 9–25.
- Sam, A. M., Odom, S. L., Tomaszewski, B., Perkins, Y., & Cox, A. W. (2021). Employing Evidence-Based Practices for Children with Autism in Elementary Schools. *Journal of Autism and Developmental Disorders*, 51(7), 2308–2323. <https://doi.org/10.1007/s10803-020-04706-x>
- Situmeang, D. E., Hawa, M. M., & Ismail, K. (2021). PEMBANGUNAN BERKELANJUTAN SDGs 2030 Goals 4 ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL "Memastikan kualitas pendidikan yang inklusif dan adil dan mempromosikan kesempatan belajar seumur hidup untuk. *Research Gate*, June, 1–19. <https://doi.org/10.13140/RG.2.2.11219.96809>
- Sutinah. (2017). Terapi bermain berpengaruh terhadap kemampuan interaksi sosial pada anak autis 1. *Riset Informasi Kesehatan*, 6(1), 1–11.
- Ulandary, Y., & Shodiq. (2020). Melatih Motorik Halus Anak Autis Melalui Terapi Bermain. *Jurnal Pendidikan Khusus*, 19(1), 54–60.
- Wati, O. P., Ekowati, D. W., Nusantara, T., & Sudjimat, D. A. (2023). *Bead Maze Media Semiotics Objects : A Study of Mathematics Teaching for Autism Students in Elementary School*. 7(3), 414–424.
- Wulandari, F. S., Palupi, W., & Nurjanah, N. E. (2020). Pengaruh Kreasi Ecobrick Terhadap Perkembangan Motorik Halus Anak Usia 5-6 Tahun. *Jurnal Kumara Cendekia*, 8(3), 331–341.