



## Improving Independent Logic Skills through Spatial Illustration Intervention in Children with Autism Spectrum Phase A Level at SLB, Deliserdang North Sumatera

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### ABSTRACT

This study aims to analyze the effect of an intervention using spatial illustration media in the form of room illustrations with objects inside them on improving the independence skills of children with special needs (CwSN) with autism spectrum disorder at the elementary level (Phase A) of a Special School in Deliserdang, North Sumatera, Indonesia. The study was conducted at a Special School using a mixed-methods approach involving 13 children as subjects, regardless of gender or age. The intervention was carried out over three weeks, with 60 minutes of intervention per week, through activities matching objects with their corresponding rooms. Quantitative data were analyzed using simple linear regression, showing that students' independence scores increased by an average of 1.192 points each week. Interview data collected from parents supported these findings, indicating that the skills practiced in class began to be applied in daily life at home, such as placing shoes on the rack or taking books independently. Thus, it can be concluded that routine interventions using spatial illustration media have a positive effect on the independence skills of children with autism spectrum disorder, particularly at the elementary level of Special Schools.

### INTRODUCTION

Entering the 21st century, the ability to think critically, to solve problems by utilizing cognitive, reasoning, and spatial skills has become a fundamental foundation that must be developed from an early age (Maharani, Nusantara, As'ari, & Qohar, 2021). A child's ability to think logically will automatically build structured cognitive behavior. This is related to developing a child's basic ability to solve problems rationally (Rahmadhani & Surbakti, 2022), so that in the future they will not only become independent but also analytical individuals with generalization thinking patterns to develop their potential.

Logical thinking is essential for children as it becomes the basis for recognizing themselves and their potential, enabling them to live independently according to their uniqueness (Ulva & Amalia, 2020). This ability is continuously developed in various fields, with the expectation of forming individuals who recognize themselves well, are able to live independently, and can contribute to national progress.

Based on this importance, logical thinking is emphasized in education, including for children with Autism Spectrum Disorder (ASD). The Indonesian Ministry of Education and Culture has incorporated digital problem solving and logical thinking into the curriculum for Special Schools (SLB) as part of technological literacy (Mendikbudristek, 2024), with the expectation that logical thinking will foster independence, creativity, and analytical skills among children with special needs, helping them adapt to their environment and develop their potential for global challenges.

This study aims to analyze the extent to which the use of spatial illustration-based Augmentative and Alternative Communication (AAC) can improve logical thinking skills among children with ASD at Phase A level in Special Schools, specifically in independence education. The study involved 15 children with ASD, categorized as non-verbal and at a moderate level of autism.

### LITERATURE REVIEW

Logical thinking is an individual's ability to use reasoning to solve problems based on truth rather than solely procedural aspects (Rohim & Prayoga, 2023). At an early age, logical thinking can be interpreted as the ability of a child to reason and draw accurate conclusions. It includes skills such as combining, differentiating, recognizing patterns, and classifying, allowing children to solve problems effectively (Putri Ayuni, Komalasari, Ningrum, & Saroinsong, 2022).



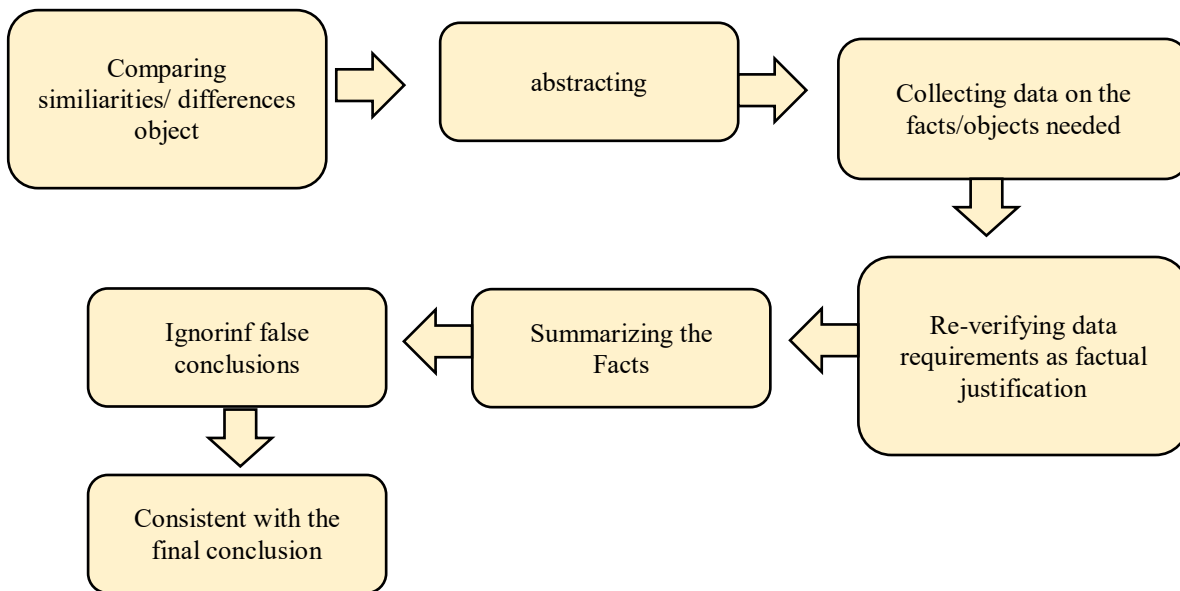


Figure 1. Flow of Developing Logical Thinking in Elementary School Children (O`ljayevna & Shavkatovna, 2020)

In the flow presented by O`rinova Feruza O`ljayevna - candidate of pedagogical sciences, associate professor of the department "Preschool education". Ferghana State University, that the initial development begins with comparing the similarities or differences of objects that are in accordance with the reasoning abilities of early childhood, namely deductive thinking, then analyzing conditions and abstracting. The results of abstraction will direct the situation to the facts towards the entity that corresponds to the facts by verifying them, then summarizing the appropriate facts, concluding the conditions with the required facts, and finally is the stage of consistency of what is concluded.

The principle that every individual is born with their own unique abilities as their innate nature has been carried forward as an educational philosophy echoed by the Indonesian educational figure Ki Hajar Dewantara (Laia & Suastra, 2024). It is the responsibility of academics to develop new innovations in supporting each individual to achieve effective learning, including computational thinking skills, which serve as the foundation for shaping high-quality human resources.

Based on this philosophy, the government, through the Ministry of Education and Culture, emphasizes deep differentiated learning as part of the principles of education at every level. Differentiated learning is defined as being aligned with students' contextual conditions and characteristics, where each educational unit is required to develop the government-designed curriculum in accordance with the characteristics of the learners. To support the development of logical reasoning skills among students according to their abilities, the Indonesian government, through Government Regulation No. 57 of 2021, highlights in Article 5 that: "The graduate competency standards include the dimensions of attitude, knowledge, and skills. In terms of skills, this includes the ability to think logically, critically, creatively, and innovatively as essential competencies" (RI, 2021).

Logical reasoning is a person's behavior in which they are able to reason effectively. Developing logical thinking skills is a crucial foundation in education, shaping individuals to be capable of developing creative, critical, and skillful thinking, which will form the framework of thought in the 21st century (Bronkhorst, Roorda, Suhre, & Goedhart, 2019). Logical reasoning can be understood as a person's cognitive ability to reach goals in a rational and directed manner.

In the world of children, in particular, logical thinking and reasoning are often misinterpreted as reasoning solely within the domain of mathematics. Consequently, many studies on the development of logical reasoning skills at the early childhood level focus on geometry, classification, arithmetic (number processing), and similar areas. Thus, the development of logical reasoning—contextual logic—is often identified only with mathematics learning (Bagassi, et al., 2020; Isomitdinovich & Kamol kizi, 2025).

Developing independent behavior, particularly for Children with Special Needs within the Autism Spectrum, is an urgent necessity that must be underlined. Many studies have highlighted the low likelihood of individuals with Autism Spectrum Disorder achieving success in adulthood, including success in fulfilling daily independent living skills (Baker, Stavropoulos, Baker, & Blacher, 2021). However, recent findings in 2025 show that interventions for children with autism spectrum disorders have demonstrated improvements in independence skills, particularly in virtual settings related to the school environment (Li, et al., 2025). This provides hope for adolescents with autism to be able to lead a high-quality independent life in the future (Gárriz, et al., 2025).

In practice, interventions greatly influence the independence skills of children with autism (Du, et al., 2025), whether through the use of Virtual Campus Environments (Li, et al., 2025) or Applied Behavior Analysis (ABA) techniques (Eckes, Buhlmann, Holling, & Möllmann, 2025). Beyond school-based techniques, parents' ability to guide





their autistic children in their own language has also been proven to enhance their children’s basic independent living skills (e.g., eating, dressing, and so on) (Bakera, Stavropoulos, Bakerb, & Blacher, 2021).

This study discusses interventions carried out using illustrative room media for children with autism spectrum disorder at Phase A level (grades 1–2) in a Special Needs School in Deliserdang. Repeated interventions were conducted over approximately three weeks, with repetition sessions scheduled on Fridays during the independence and daily living skills subject, lasting for 2 class hours (60 minutes).

**METHOD**

This is a mixed-method study, where the research assessment is concluded qualitatively and quantitatively. The study was conducted at a Special School, Mutiara Hati Deliserdang North Sumatera - Indonesia, with 13 students with autism spectrum disorder in Phase A (grades 1-2), both verbal and non-verbal. Gender was ignored by the researcher, because of the 13 students, only two were female.

The study began in the second week of August 2025, with 60-minute sessions every Friday, focusing on learning independence and skills. At the end of the third week, a test was conducted on the intervention, requiring children to attach cut-out pictures of objects to the provided spatial illustrations.

The data processing results used SPSS application with simple linear regression, because the researcher only examined the influence factors of the spatial illustration intervention and ignored gender factors or students' verbal and non-verbal abilities, and others. Meanwhile, qualitatively, the researcher conducted interviews with parents or guardians regarding the development of their independence skills contextually, such as the ability to put shoes on the shelf after school, put dirty clothes after school, and so on.

The scores for this intervention use the IRT (Item Response Theory) or PCM (Partial Credit Model) theory developed by Frederic Lord (1952, 1980), Georg Rasch (1960), and Geoffrey N. Masters (1982, expanded with Wright, 1997). The scores are '0' for no answer, '1' for answer with assistance, and '2' for answering correctly independently or without assistance (Dogan, 2018).

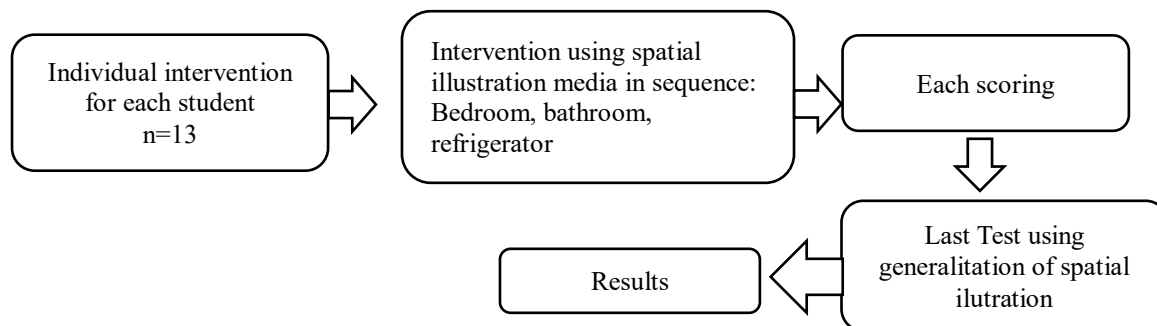


Figure 2. Research Flow

**RESULT**

From the intervention for approximately 3 weeks every Friday for 60 minutes, 2 JP (2 x 30 minutes), progress was obtained every week. Where in the first week of the intervention, students were still given assistance both by prompting and verbally repeatedly, and in the second week, it was found that some children who were assisted in the first week were able to match objects with their spatial illustrations even though they were done randomly. In the 3rd week after the intervention, in the last 30 minutes, objects that matched the spatial illustrations were generalized, for example, so far children have placed pictures of fruits on the refrigerator illustration, in the final test it was a picture of vegetables. For the bathroom space illustration, which usually during the intervention children matched soap objects with bathroom space illustrations, in the final test the soap was replaced with a picture of a toothbrush, and for the bedroom illustration, the pillow was replaced with a picture of a pillow complete with a bolster.

Table 1. Assessment with IRT (Item Response Theory) in Phase A students with Autism Spectru

No	Name	Interview Results
1	Akuina	Able fot put her shoes on the shoe rack, put the rubbish in place
2	Azmi Putra	Able for put the plates on the shelf, put the rubbish in place, put his bag on the table
3	Farez	
4	Hotma	Understand for putting his books and pencil on the table , shoes on the shoe rack
5	Hafiz Al Ghani	
6	Hafiz K	Understand about bath time if the schoool time is come
7	Kamal	Understand the sweeping command
8	Khaira	Understand for putting his books and pencil on the table





9	Maulana	Able fot put her shoes on the shoe rack, put the rubbish in place
10	Raffa	
11	Rayhan	Understand for putting his books and pencil on the table, shoes on the shoe rack
12	Rizky	
13	Zhaki	Paham membuka sepatu dan meletakan di rak sepatu sepulang sekolah Able for put the plates on the shelf, put the rubbish in place, put his bag on the table

In the table above (1) it is explained that there is an increase in the logical abilities of students in Phase A for the illustration of the independent space. In the second week of 13 children regarding the refrigerator room illustration, 8 children were found to be able to match the object with the room illustration, while for the object illustration with the bathroom, it increased to 9 children, and for the bedroom illustration in the second week 7 out of 13 were able to use their logical reasoning to place the appropriate object.

For the final test, the results obtained were, for the refrigerator room illustration, out of 13 students, 11 students were able to place objects in their proper places, for the bathroom illustration, 11 of 13 students were able to complete it, and for the bedroom illustration, 10 of 13 students were able to complete it. This means that there is a development of independent contextual logic abilities in students with the intervention of space illustration media

Table 2. Interview Results

No	Name	Refrigerator Ilustration Intervention			Bathroom Ilustration Intervention			Bedroom Ilustration Intervention		
		Week	Week	Week	Week	Week	Week	Week	Week	Week
		1	2	3	1	2	3	1	2	3
1	Akuina	1	1	2	1	1	2	1	1	2
2	Azmi Putra	1	2	2	1	2	2	1	1	1
3	Farez	1	2	2	1	2	2	1	2	2
4	Hotma	1	1	2	1	1	2	1	1	2
5	Hafiz Al Ghani	1	1	1	1	2	1	1	2	2
6	Hafiz K	1	2	2	1	2	2	1	1	1
7	Kamal	1	2	2	1	2	2	1	2	2
8	Khaira	1	1	2	1	1	2	1	1	2
9	Maulana	1	1	1	1	1	1	1	1	1
10	Raffa	1	2	2	1	2	2	1	2	2
11	Rayhan	1	2	2	1	2	2	1	2	2
12	Rizky	1	2	2	1	2	2	1	2	2
13	Zhaki	1	2	2	1	2	2	1	2	2

Table 3. SPSS Data Result

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.708 <sup>a</sup>	.502	.488	.99636

a. Predictors: (Constant), Minggu

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	36.962	1	36.962	37.232	.000 <sup>b</sup>
	Residual	36.731	37	.993		
	Total	73.692	38			

a. Dependent Variable: Skor

b. Predictors: (Constant), Minggu

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.077	.422		4.920	.000
	Minggu	1.192	.195	.708	6.102	.000

a. Dependent Variable: Skor





Based on the SPSS data analysis table above, the following conclusions can be drawn: with the model summary  $R = 0.708$  and  $R^2 = 0.502$ , it indicates that 50.2% of the variation in independent logic scores can be explained by the intervention week variable. The significance value for  $F = 37.232$  is  $0.000 < p (0.05)$ , which means the linear regression model is significant, where the regression coefficient increases on average by 1.192 points each week. This implies that there is an effect of weekly interventions using room illustrations on the development of independent logical thinking skills.

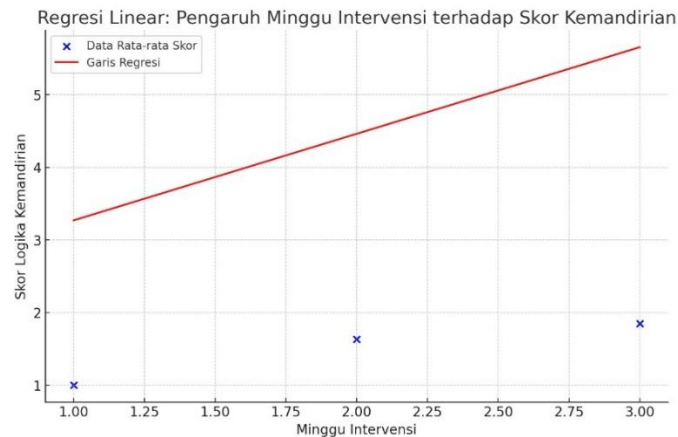


Figure 3. Effect of Spatial Illustration Intervention on Independence Logic Score

From the image above, the results of the average increase in scores were obtained each week (blue dots), there was a significant increase each week after the intervention was given with a red line slope of around 1.192 points.

## DISCUSSION

Based on the findings above, it can be seen that interventions using visual media in the form of spatial illustrations are highly suitable for helping to improve the independence skills of children with special needs with autism spectrum disorder at the lower grade level of Special Schools. The intervention, conducted for 60 minutes per week, successfully increased independence skills by 1.192 points. In light of this, innovations and new breakthroughs are needed, particularly for other children with special needs, considering that independence skills are a fundamental urgency for them.

## CONCLUSIONS

Based on the analysis of both qualitative and quantitative data, the results show a significant effect of the weekly spatial illustration intervention, carried out for approximately three weeks, on the logical independence scores of children with autism spectrum disorder at a Special School in Deliserdang. This study confirms the expectation that interventions using diverse models and media can provide opportunities to enhance children's independent logical reasoning skills and that such learning can be more easily understood when delivered in a contextual manner.

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