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Introduction of Simple Shapes in Early Childhood Low Vision Children through a Multisensory Approach

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Keywords:
geometric shape recognition; low vision; multisensory learning; single-subject research; VAKT approach.

Abstract

This study aims to examine changes in basic geometric shape recognition among children with low vision following the implementation of the Visual, Auditory, Kinesthetic, and Tactile (VAKT) multisensory approach. A quantitative single-subject research (SSR) method with an A-B-A design was employed, involving one eight-year-old child with low vision and developmental delays at PAUDIT BIS Balikpapan, Indonesia. Data were collected across four initial baseline sessions (A1), five intervention sessions (B), and five post-intervention baseline sessions (A2). Shape recognition was assessed through six indicators covering the ability to identify circles, triangles, squares, and rectangles, name shapes, and match geometric shapes with concrete objects. Data were analyzed descriptively using visual analysis of performance levels, trends, stability, and overlapping data. The findings revealed an increase in mean performance from 33.33% during A1 to 80% during the intervention, with a peak achievement of 83.33%. Performance subsequently stabilized at 66.67% during A2, indicating partial retention after the intervention was discontinued. The absence of overlapping data between A1 and B demonstrated a substantial performance difference across phases. These findings suggest that integrating residual vision with auditory instructions, kinesthetic movements, and tactile exploration may support geometric shape recognition in children with low vision. However, the single-subject design limits causal inference and generalizability, highlighting the importance of continued reinforcement and further investigation.

Kata kunci:
anak low vision; pengenalan bentuk geometri; pembelajaran multisensori; single subject research; pendekatan VAKT.

Abstrak

Penelitian ini bertujuan untuk menganalisis perubahan kemampuan mengenal bentuk geometri dasar pada anak dengan hambatan penglihatan (low vision) setelah penerapan pendekatan multisensori Visual, Auditory, Kinesthetic, and Tactile (VAKT). Penelitian menggunakan pendekatan kuantitatif dengan metode Single Subject Research (SSR) desain A-B-A yang melibatkan seorang anak berusia delapan tahun dengan kondisi low vision dan keterlambatan perkembangan di PAUDIT BIS Balikpapan. Pengumpulan data dilakukan melalui empat sesi baseline awal (A1), lima sesi intervensi (B), dan lima sesi baseline setelah intervensi dihentikan (A2). Kemampuan mengenal bentuk diukur menggunakan enam indikator yang mencakup kemampuan menunjuk lingkaran, segitiga, persegi, dan persegi panjang, menyebutkan nama bentuk, serta mencocokkan bentuk geometri dengan benda konkret. Data dianalisis secara deskriptif melalui analisis visual terhadap tingkat kemampuan, kecenderungan arah, stabilitas, dan tumpang tindih data. Hasil penelitian menunjukkan peningkatan rata-rata kemampuan dari 33,33% pada fase A1 menjadi 80% selama intervensi, dengan capaian tertinggi sebesar 83,33%. Pada fase A2, kemampuan bertahan pada 66,67%, yang menunjukkan adanya retensi sebagian setelah intervensi dihentikan. Tidak adanya tumpang tindih data antara fase A1 dan B menunjukkan perbedaan capaian yang nyata antarfase. Temuan ini mengindikasikan bahwa integrasi sisa penglihatan, instruksi auditori, gerakan kinestetik, dan eksplorasi taktil berpotensi mendukung pengenalan bentuk geometri. Namun, keterbatasan subjek tunggal membatasi penarikan kesimpulan kausal dan generalisasi sehingga diperlukan penguatan berkelanjutan serta penelitian lanjutan.

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Introduction

Education at an early age is an important foundation for honing children's mindset, sensory sensitivity, and social skills. In general, children learn to recognize new things, such as shapes and colors, especially through sight, because sight is very dominant in children's perception (Hatwell et al., 2003). However, children with *low vision* have limitations in seeing so that they need special support from teachers to continue to get equal learning opportunities (Mardi Fitri, 2021) The need for accessible learning media is becoming increasingly important in inclusive education. Research on visually impaired students in Indonesia shows that access to teaching materials is still limited, while students tend to need audio-based media, voice simulations, and tactile maps (Afrian et al., 2025) Visual images risk putting children with visual impairments at a disadvantage. Therefore, early childhood teachers need to provide a learning experience that can not only be seen, but also heard, touched, and passed through body movements (Badiah & Kurniawan, 2025)

In Indonesia, the right of children with special needs to obtain education with other students is guaranteed through the Regulation of the Minister of National Education Number 70 of 2009 concerning Inclusive Education and Law Number 8 of 2016 concerning Persons with Disabilities. The implementation of inclusive education at the PAUD level is greatly influenced by the experience and readiness of practitioners in the field (Jusni et al., 2023) In addition, inclusive education policies in Indonesia need to be followed by the provision of learning services and facilities in educational units (Novrizal & Manaf, 2024) Consequently, teachers in early childhood education units, including those who receive children with visual impairments, are required to be able to adapt learning to the needs of each child. In reality, these adjustments are often hampered by the limited learning media that is suitable for children with visual impairments (Liza et al., n.d.) The multisensory approach is also relevant to the characteristics of early childhood development, which generally learn more effectively through concrete experiences and the simultaneous involvement of several senses. Studies of various multisensory programs show that the involvement of visual, auditory, kinesthetic, and tactile modalities contributes to the strengthening of early literacy skills. Multisensory approaches in early childhood have also been studied through a systematic review of multisensory reading (Kucirkova & Rodriguez-Leon, 2023) and through the perspective of educators in the field (Lupiya Mpolomoka, 2025). Although the research focuses more on initial reading skills, the underlying principles can be applied to the introduction of other basic concepts, including geometric shapes.

Children *low vision* still has residual vision, but his vision distance and visual acuity are limited even after using glasses or other correctional devices. This condition is functional and varies between individuals; the rest of his vision can still be used to plan and perform tasks, including learning activities (Catalano et al., 2026). Therefore, learning for children *low vision* need to consider its functional vision, such as size, contrast, and visibility of the material (Corn & Koenig, 2002). The use of optical aids has also been studied in relation to students' reading speed and comprehension *low vision* (Corn et al., 2002). *Increased visual behavior in low vision children*. American Foundation for the Blind (Wilhelmsen et al., 2023) which explains that visual function can be developed through structured stimulation. As a result, they can have difficulty distinguishing simple shapes such as circles or triangles when presented in images on plain paper, so media with contrast, size, texture, or multisensory feedback is more appropriate (Tennison et al., 2023). Without appropriate learning media, children can repeatedly fail in visual tasks and need additional support to stay confident in learning (Çetin & Ekici, 2023).

In children with visual impairments, multisensory strategies can serve as an alternative pathway to obtain information that is not optimally conveyed through vision. A case study of students with visual impairments in Indonesia found that kinesthetic audio media combined with elements of local culture increased student engagement, motivation, and conceptual understanding (Ismaya & Sutono, 2026). Although the context of the study does not specifically concern early childhood with *low vision,* The results support the importance of participatory, contextual, and non-sensory learning. Thus, the use of residual vision needs to be combined with hearing, movement, and touch so that basic form recognition becomes more meaningful.

Knowing basic shapes is not only important for children's thinking skills, but also the basis for understanding space and performing movements more independently (Jelatu et al., 2019). Therefore, basic learning needs to be adjusted to the visual needs of children, which begins with an examination of the rest of their functional vision (Sidiq, 2021). For children who cannot rely on their vision completely, active touching of concrete objects becomes an important source of information about the shape, size, and edges of objects (Hatwell et al., 2003)

One approach that is seen as potential is VAKT multisensory learning (*visual, auditory, kinesthetic, tactile*), i.e. learning that involves sight, hearing, movement, and touch simultaneously (Rostan et al., 2020). This approach is rooted in techniques developed to help children with learning difficulties, then widely adapted in special education. More broadly, a multisensory approach can be traced to Orton-Gillingham-based teaching (Ritchey & Goeke, 2006) and the VAKT strategy itself has been researched in primary school students with dyslexia (Ziadat, 2021). Theoretically, the involvement of multiple senses in a single learning activity can strengthen information processing, and a number of studies report that multisensory training tends to be more effective than training that involves only one sense. (Epstein, 2008) In addition, sight and touch are known to share some of the mechanisms in representing the shape of objects in the brain (Lacey & Sathian, 2011) So that the sensory experience can complement visual information that is not clear. Children not only rely on vision, but are also invited to touch a shape board made of sponge or textured wood so that they can recognize shapes through their fingers (Ferrell, 2011) However, the use of tactile media such as concrete objects and touching activities is still not optimal in early childhood learning, so children often receive more verbal explanations than direct experiences. Teachers

tend to use flat drawing cards with less contrasting colors based on the researcher's initial observations, so that children *low vision* It is difficult to recognize the corners and sides of flat buildings. This condition shows that there is a gap between the needs of children in inclusive schools and the available learning media (Abdul Hakim Hidayat et al., 2024).

A number of studies have shown that touching activities have a significant impact on children's ability to recognize geometric shapes (Fitri, n.d.) Finger guidance around the edges of objects while listening to the teacher's directions is thought to strengthen the child's memory of the shape (Ferrell, 2011). Thus, visual impairment is thought to be partially compensated by other senses (Rostan et al., 2020). However, the evidence on the effect of this approach on children *low vision* Early age, especially in the introduction of basic forms, is still limited. VAKT adapted to students' visual access *low vision* It has indeed been reported in inclusive elementary school students (Handayani, 2026) However, studies at the PAUD level are still rarely found. This condition is increasingly complex in children who, in addition to experiencing visual impairments, also show developmental delays, because this group is rarely the subject of research. In fact, their learning needs require concrete media and can be learned through many sensory pathways. In early childhood with visual impairments and additional barriers, tactile modalities are also seen to help compensate for limited access to visual information (Peltokorpi et al., 2024).

Research with a single subject is appropriate for such conditions because it allows behavioral changes to be monitored repeatedly in individuals whose characteristics are diverse and limited in number (Horner et al., 2005). This study uses *Single Subject Research* (SSR) design A-B-A (Sunanto et al., n.d.) in one child *low vision* with developmental delays. The VAKT stages were structured to answer the gaps that had been described by high-contrast visual media replacing flat cards, while verbal explanations, tracing gestures, and textured shape board touches complemented the limited visual information. Because it involved only one subject without replication, the results were read as a tendency for change, rather than evidence of a cause-and-effect relationship.

Based on the study, the VAKT approach has the potential to bridge the gap between the learning characteristics of low-vision children and the limitations of learning media in inclusive early childhood education. This approach allows teachers to present basic forms through high-contrast images, verbal naming and explanations, movements tracing the edges of the building, and touching textured shape boards. This combination is expected to help children build a more complete understanding of shapes, not just through limited vision. However, the systematic application of VAKT in children with *developmental* delays at the PAUD level still needs to be further studied, so this study was conducted to fill these gaps.

Based on this, this study aims to determine the tendency of the influence of the VAKT multisensory approach on the ability to recognize basic shapes (pointing, naming names, and matching real objects with circles, triangles, squares, and rectangles) in *children with low vision*. The results of this study are expected to be an initial reference for teachers and parents in developing learning media that optimally utilizes the rest of children's vision and tactile experiences.

Methods

This study uses a quantitative approach with the *Single Subject Research* (SSR), which is a method that focuses on an individual's repeated appearance over a period of time to see the effect of an intervention on the target's behavior (Sunanto et al., n.d.) The A-B-A design begins with the initial capability measurement (*baseline* 1/A1), followed by intervention (B), then

measurement again without intervention (*baseline* 2/A2). Because learned skills can persist after the intervention is stopped, A2 is not positioned as an intervention *withdrawal* to prove cause and effect, but rather as an observation of ability after the intervention (an indication of retention). Interphase changes are interpreted as predisposition, with the limitations of one subject, no comparison group, and no replication.

The subject is H, an 8-year-old boy at the Integrated Islamic Early Childhood Education (PAUDIT) BIS Balikpapan daycare. H has low *vision* impairment due to a history of seizures since infancy, using glasses with examination results on June 29, 2023, the child was diagnosed with minus 2.50 D in both eyes with *a base-in prism* of 8 diopters (right eye) and 6 diopters (left eye). H attended kindergarten B because he was indicated to have developmental delays with a developmental age equivalent to 3-5 years. This characteristic is in accordance with the group that is rarely studied as described in the introduction. The research was carried out in the classroom of PAUDIT BIS Balikpapan at hours outside of teaching and learning activities. Other students were not involved during the session.

The bound variable is the ability to recognize basic shapes as measured through the three abilities in Table 1. A score of 1 is given if the answer is correct without assistance and 0 if it is wrong or does not answer. The maximum total score of 6 is expressed as a percentage (score of ÷ 6 × 100%).

Table 1. Instruments

Yes	Capabilities	Indicator	Technique	Max Score
1	Pointing shapes	a. Circle	Deeds test	1
		b. Triangle	Deeds test	1
		c. Square	Deeds test	1
		d. Rectangle	Deeds test	1
2	Naming shapes	Mention the name of the shape [asked]	Oral test	1
3	Matching real things	Matching the surrounding concrete objects with the appropriate geometric shapes	Deeds test	1
	Total			6

Baseline (A1) was carried out for 4 sessions until the data was stable at 33%, with stability if the data was in the range of 15% of the *mean level* (Sunanto et al., n.d.) Intervention (B) was carried out in 5 sessions, each of 10 minutes, 5 times per week. The stages were arranged according to the VAKT framework (Rostan et al., 2020) and adapted to the needs of the child *low vision*:

1. Visual: Presentation of black background letters, mudan green base color with bright yellow lettering borders, uppercase letters about 18, and a distance of about 1-3 m, then adjust to the results of each child's assessment.
2. Auditory: verbal explanation of names and shape features (number of sides and angles).
3. Kinesthetical: tracing shapes with hands or bodies (Ferrell, 2011)
4. Tactile: touch the textured shape board [sponge/wood] with finger guidance around the edges (Hatwell et al., 2003)
5. End-of-session assessment using Table 1.

Baseline 2 (A2) was carried out in 5 sessions without intervention, 10 minutes each.

The reliability of the observations is tested through *inter-observer agreement* between researchers and classroom teachers in [4] sessions [distributed in A1, B, A2] with results of

[88]%, using the ÷ agreement formula (agreement + disagreement) × 100%, with a minimum limit of 80% (Sunanto et al., n.d.) The data were analyzed descriptively through visual analysis under conditions (length of conditions, *Trend* by the *split-middle*, stability, *mean level*, range, *level change*) and between conditions (changes *Trend*, stability, level, and percentage *overlap*) (Sunanto et al., n.d.) The result is interpreted as a tendency for change.

Results And Discussion

Results

Based on the results of research conducted by researchers on Ananda to recognize simple forms in *early childhood low vision* children through a multisensory approach, the following data were produced:

Baseline Condition 1 (A1)

In the Baseline 1 (A1) phase, Ananda's initial ability was measured for four sessions without special stimulation. Ananda obtained a score of 2 out of a maximum score of 6 in each session, so that the percentage of achievement was consistent at 33.33% and was in the Undeveloped category. Ananda was only able to show limited recognition of circle and triangle shapes, but was not able to name shapes independently, distinguish between squares and rectangles, and match geometric shapes with real objects.



Table 1. Baseline condition 1 (A1)

Observation notes: Ananda is able to recognize circles and triangles in a limited way; does not recognize squares and rectangles; has not named shapes independently; still has difficulty matching shapes; visual response is limited; tends to see at close range; takes longer; and has not shown improvement despite repetition.

Visual analysis A1: The ability level was at 33.33%. The data trend was horizontal (*zero-celerating*) because there was no change in score during the four sessions. The data was very stable because all data points (100%) were at the same value. This condition shows that before the intervention, the ability to recognize Ananda's simple form had not improved.

2. Intervention Conditions (B)

Entering the Intervention (B) phase for five sessions, Ananda was given learning to recognize simple shapes through the multisensory approach of VAKT. Learning utilizes high-contrast media, textured shape boards, verbal cues, and motor

movements. The measurement results showed an increase in ability from an average of 33.33% in Baseline 1 to an average of 80% in the intervention phase, with the highest achievement of 83.33% and in the category of Developing as Expected.

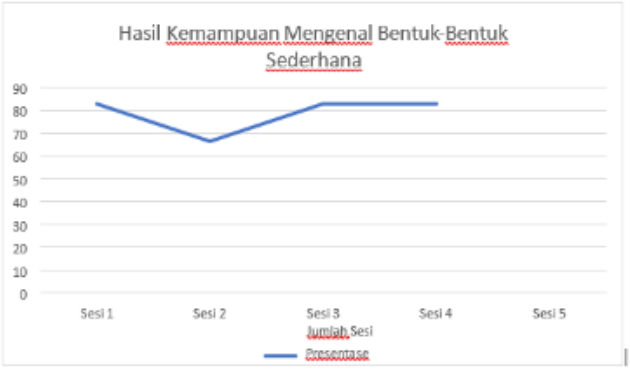


Table 2. Baseline conditions 2 (B)

Observation notes: Ananda began to be able to identify angles in triangle, rectangle, and rectangular shapes; pronounce shape names with the help of verbal cues; as well as match geometric shapes to real objects around them. High-contrast media and textured boards help Ananda notice shape features through sight and touch, while motor movements reinforce shape recognition through kinesthetic experiences.

Visual analysis B: There was an increase in the level from 33.33% in A1 to 80% in phase B, with an average increase of 46.67%. The data trend increased (*accelerating*) from session 1 to session 2, then stabilized at 83.33% in sessions 2 to session 5. As many as 80% of the data points were at a value of 83.33%, so the intervention phase data was relatively stable. The changes that occurred after the intervention showed the positive effect of VAKT's multisensory approach on the ability to recognize simple shapes.

Calculation of A1–B overlap: The highest score in A1 was 33.33%, while the overall score in phase B was 66.67% and 83.33%. Thus, there was no intervention data that overlapped with the initial baseline data, so *Percentage of Nonoverlapping Data* (PND) A1–B is 100%. This shows a clear change in level and a strong intervention effect. Visual analysis in single-subject studies did emphasize changes in level, trends, stability, and overlap between phases to assess the effects of interventions (Lane & Gast, 2014)

3. Baseline condition (A2)

In the Baseline 2 (A2) phase, the intervention was stopped for five sessions to measure Ananda's retention or memory. The observation results showed a fixed score of 4 out of 6 or 66.67% at each session. The achievement remained in the Developing as Expected category and did not return to the initial condition of 33.33% at A1.

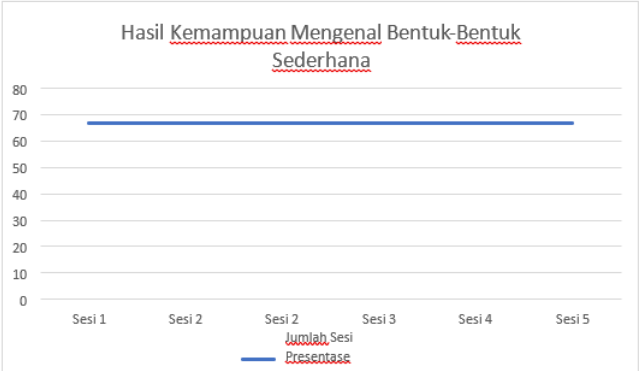


Table 3. Baseline condition 2 (A2)

Observation note: Ananda is still able to recognize circles, triangles, and some rectangular shapes without direct intervention. Ananda is also still able to name some shapes and match shapes to real objects, although it takes longer than in the intervention phase. A2 visual analysis: The ability level was at 66.67%. The data trend was flat (*zero-celerating*) because the score did not change for five sessions. All data points (100%) were at the same value, so the data was very stable. Despite the adjustment from the average intervention phase of 80% to 66.67%, the A2 achievement was still 33.34% higher than the initial baseline of A1.

Calculation of overlap B–A2: All data A2 was at 66.67%, while data B was at 66.67% and 83.33%. There was an overlap at 66.67%, so that PND B–A2 was 80% because four of the five intervention data were above the A2 data. This condition indicates that most of the intervention achievements were maintained after the intervention was stopped.

Conclusion of the Analysis

Based on visual analysis of A1–B–A2 data, the VAKT multisensory approach was effective in improving the ability to recognize simple shapes in early Ananda low vision. The increase was seen from the change in level from 33.33% to 80%, PND A1–B by 100%, and the ability stage in A2 by 66.67%. This pattern shows that the understanding of geometric shape concepts has begun to be internalized in Ananda's long-term memory, although the achievement in phase A2 decreased slightly compared to the peak of the intervention achievement (Tanious & Onghena, 2021).

Discussion

This study aims to assess the effectiveness of the multisensory approach (V-A-K-T) in improving the ability to recognize simple geometric shapes in children with *low vision* in early childhood. In general, the data show an improvement in performance from baseline phase 1 (A1) to intervention phase (B), as well as changes when intervention is stopped at baseline 2 (A2). However, the interpretation of the findings needs to be critically reviewed, especially related to learning mechanisms, the effect of repetitive exercises, and possible other factors other than the effects of intervention.

1) Multisensory learning mechanisms and their relationship with *low vision characteristics*

The improvement in ability during the intervention phase can be explained through the following possible mechanisms. First, the use of textured tactile media and high-contrast shape boards is likely to help the child build a representation of the shape through alternative sensory inputs when visual access is limited. In *children with low vision*, the integration between the remaining visual information and tactile stimuli can reinforce form discrimination, for example in distinguishing the corners and faces/edges that characterize geometry.

Second, verbal instruction and gesture cues (kinesthetic) likely facilitate more stable coding of concepts because the child not only "sees," but also "feels" the shape and associates it with verbal labels (shape names). This process is in line with the idea that multisensory increases the chances of memory imprints forming through more than one processing pathway.

Thus, the spike in performance in phase B does not simply indicate that the child is "becoming more accustomed", but can reflect a more meaningful learning process: the child acquires a connection between form (visual-residual + tactile), label (auditory/verbal), and movement/action (kinesthetic).

2) Critical analysis of 0% overlap claims and causal attribution

Your research calls the 0% overlap value between A1 and B. It should be emphasized that the 0% overlap supports the existence of a very large difference numerically, but does not fully "prove" that the increase is caused exclusively by the intervention. In the intervention-baseline design (although controlled), the potential for attribution bias remains, for example:

1. There is a attention/expectation effect (children and observers interact more intensely during the intervention),
2. Increased exposure to form material due to changing procedures (not solely due to multisensory elements), or
3. Changes in the child's strategy due to previous experiences.

Therefore, it is more appropriate for the 0% overlap to be positioned as a strong indicator of the effects of changes after the intervention, rather than as a single evidence that multisensory is the only cause.

3) Possible effect of practice

The increase from A1 to B can also be affected by the *practice effect* or the effect of repeated exercises. Even though at baseline 1 a special intervention has not been given, the child still gets repeated exposure to the task of recognizing the shape. When entering phase B, the number of repetitions increases along with the change in method. This means that the improvement can come from:

1. Increased frequency of exercise,
2. Improved children's response strategies (e.g. learning to wait for clues or scanning shapes in a certain way),
3. or sharpening of teaching procedures.

For a more critical analysis, it should be discussed that the improvement that occurred during B could potentially be the result of a combination of multisensory and adaptation to training procedures. The advantages of the multisensory approach can still be maintained, but the interpretation needs to include the possible contribution of repetitive exercises.

4) Interpretation of baseline 2 (A2): caution against the claim of "permanent internalization"

At baseline phase 2 (A2), performance remained at 66.67%. A decrease from phase B (e.g., a peak of about 83%) indicates that ability is not fully stable at the highest level during the intervention. Because the intervention is stopped for 5 sessions, A2 can be more accurately interpreted as an indication of retention, rather than an automatic evidence of permanent internalization in long-term memory. Stability of A2 remaining above A1 indicates retention compared to the initial state, but a decrease in B indicates that some knowledge is still dependent on learning support (e.g., multisensory assistance, stimulation intensity, or repetitive reinforcement).

Thus, important findings worth analysing are: a decrease after the intervention is stopped may indicate that (a) retention occurs but not at the maximum level, (b) requires maintenance or further reinforcement, or (c) the child needs more transfer sessions to maintain consistent ability.

5) Alternative factors that may explain the increase in ability

In addition to multisensory mechanisms, there are alternative factors that may contribute:

1. The novelty effect: new intervention procedures can increase the child's motivation and attention.
2. Changes in intensity and quality of reinforcement: it is possible that in the intervention phase the child's response gets more specific feedback.
3. Task strategy skills: the child may learn "how to work" before actually mastering the concepts in a variety of contexts.
4. Limited generalizations: when shape recognition is measured in a similar context at the time of the intervention, the improvement may reflect narrow generalizations, rather than a deep understanding of all situations.

The discussion should state that the findings best support the role of multisensory, but still consider the contribution of these factors.

Conclusion of the discussion

Overall, the data showed an improvement in geometric shape recognition ability after being given V-A-K-T multisensory learning. The improvement is plausible explained by the integration of visual-residual, tactile, verbal, and kinesthetic inputs that help form concept representations. An overlap value of 0% indicates a very noticeable change after the intervention, but cannot be treated as a single causal evidence. Meanwhile, baseline 2 of 66.67% indicates retention compared to baseline 1, but interpretation as a "long-term permanent internalization" requires caution given the decline in the intervention phase. Thus, the findings of a decrease after the intervention is stopped are important information that can lead to the need for a maintenance strategy, gradual reinforcement, and longer retention evaluation.

The practical implications of these findings are the need for multisensory intervention design that does not stop at the core training phase, but continues with *a maintenance* strategy to maintain and stabilize achievement after the intervention has been stopped. Given that baseline 2 (A2) shows retention but decreases from the peak during phase B, learning programs should include periodic reinforcement sessions in the short term (e.g. weekly) as well as gradual transfer exercises to more diverse contexts so that children are not only able when multisensory support is available, but can also maintain a more consistent form discrimination strategy. Thus, the V-A-K-T approach remains the main framework, but duration, frequency, and form of maintenance need to be planned as an integral part of the intervention in order for the internalization of concepts to be more stable and generalization to increase.

Conclusion

The multisensory approach (Visual, Auditory, Kinesthetic, Tactile / V-A-K-T) showed an effective indication of improving the ability to recognize simple shapes in children *with low vision* at an early age at PAUDIT BIS Balikpapan City. The observation results showed an improvement in performance from phase A1 (initial baseline of 33% / Not yet Developed) to phase B (intervention reached a peak of 83% / Very Well Developed). An overlap value of 0% indicates a noticeable change after the intervention began, so that the relationship between intervention and ability improvement is very possible. In phase A2 (baseline 2 after the

intervention was stopped), the child's ability was at 66.67% (category of Developing as Expected). These findings suggest that ability does not return to its initial level, but also does not fully persist at peak levels during the intervention, so retention occurs but still requires support or maintenance to achieve more stable consistency.

Thus, based on evidence on a single subject, the V-A-K-T approach is worthy of consideration as a learning strategy that helps the child utilize residual vision and integrate tactile exploration and auditory support. However, given the research design in one child and the variation in performance from the peak to the maintenance phase, conclusions about effectiveness and causality need to be formulated carefully and not generalized broadly for all children with *low vision.*

Suggestions

It is recommended that educators and parents routinely use tangible objects that have contrasting colors, tactile textures, or audible sounds, both at school and at home. The use of concrete objects helps children with *low vision* connect shape names with visual, tactile, and auditory experiences in a more meaningful way. Teachers can use everyday objects such as balls, boxes, cans, plates, or geometrically shaped toys, and then invite the child to point, name them, and match them to the basic shape. Verbal assistance while the child touches the edges and surfaces of objects is also necessary so that the child gains more complete information about shapes, sizes, and textures. This approach is in line with the recommendation that children with visual impairments require concrete experiences as well as exploration through touch and hearing to clarify the understanding of concepts

In addition, parents can continue learning at home by using objects that are easy to find, such as buttons, spoons, toys, fruits, or kitchen utensils. These objects can be used for activities to sort colors, shapes, and textures, so that children get a repetition of the learning experience in natural situations. Real objects in the home environment can help children focus their attention, build connections between concepts, and make learning more enjoyable. Therefore, collaboration between teachers and parents is important so that the use of multisensory media does not only occur in intervention sessions, but also become part of children's daily activities.

For future researchers, it is recommended to increase the duration and frequency of training sessions so that changes in children's abilities can be observed more stablely. This research can also be developed by involving more children *with low vision*, including children with varying levels of residual vision and developmental delays, so that the results can be more generalized. In addition, the VAKT multisensory approach can be tested on other basic skills, such as recognizing colors, recognizing numbers, understanding large and small concepts, and improving fine motor skills. The use of tactile media that is contrasting, safe, and appropriate to the size of the child's hand also needs to be considered so that learning activities are more effective and comfortable for children.

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Ethical Statement

This study involved an eight-year-old child with low vision and developmental delays in a single-subject educational intervention. The research procedures included repeated assessments and multisensory learning activities conducted in an educational setting. Given the participant's age and developmental characteristics, particular attention was required to protect the child's welfare, privacy, dignity, and personal information. The authors should report the actual procedures for obtaining parental or guardian consent, institutional permission, and any applicable ethical approval. Identifying clinical and educational information should be disclosed only to the extent necessary for scientific reporting and in accordance with the permissions obtained.

Artificial Intelligence (AI) Use Statement

Artificial intelligence (AI) tools were used solely to assist with language editing, grammatical correction, and improving the clarity and readability of the manuscript. AI was not used to generate or manipulate research data, implement the VAKT intervention, calculate performance scores, conduct visual analysis of the A-B-A phases, or formulate research findings and conclusions. All scholarly interpretations, statistical descriptions, references, and substantive content were reviewed and verified by the authors, who take full responsibility for the accuracy, originality, and integrity of the manuscript.

Author Contributions

Nur Fatimah Maulidiah Rahmah contributed to the conceptualization, research design, development of multisensory learning activities, intervention implementation, data collection, visual data analysis, and preparation of the original manuscript. Ahsan Romadlon Junaidi contributed to methodological development, research supervision, validation of the single-subject research procedures, interpretation of findings, and critical review and revision of the manuscript. Ranti Novinati contributed to the development and evaluation of the VAKT intervention, methodological validation, interpretation of the research findings, and manuscript review and editing. All authors reviewed and approved the final version of the manuscript.

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Conflict of Interest Statement

The authors declare that they have no financial, professional, institutional, or personal conflicts of interest that could have influenced the conduct, analysis, interpretation, or publication of this research.

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