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The Use of Gagne's Model in Introducing Geometric Shapes to Intellectual Disability Children with Hearing Loss

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Abstract

Intellectual disability children with hearing loss, due to limitations in intellectual and hearing functions, had difficulty understanding geometric shapes. Therefore, an effective learning model was needed to teach these concepts. This study aimed to introduce geometric shapes (circles, squares, and triangles) to intellectual disability children with hearing loss. The hypothesis proposed was that using Gagne's model would affect the ability to recognize geometric shapes, specifically circles, squares, and triangles, in intellectual disability children with hearing loss. This study was a single-subject research study with an A-B-A design. The measuring instrument used in this study was a checklist method filled in by the researcher. The participant was a 5-year-11-month-old girl diagnosed with mild intellectual disability and hearing loss, who attended an inclusive playgroup. The research procedure lasted for 21 sessions, consisting of three baseline sessions, 15 intervention sessions, and three maintenance sessions. The data analysis technique in this study used descriptive techniques from graphs. The results of this study indicated that Gagne's model method was effective in introducing geometric shapes. Based on these results, the hypothesis was accepted, indicating that using Gagne's model influenced the ability of intellectual disability children with hearing loss to recognize geometric shapes. The implication of this study was that Gagne's model could be applied to intellectual disability children with hearing loss to teach geometric shapes effectively.

Keywords: *gagne's model, geometry concept, hearing loss, intellectual disability*

INTRODUCTION

In inclusive schools, children with intellectual disabilities were required to take lessons alongside their peers. This approach was based on the principle that inclusive education provided equal opportunities without differentiating based on special needs, ensuring that all children had the same rights and obligations and did not receive special treatment (Alfikri et al., 2022).

One of the fundamental lessons children had to master in school was recognizing geometric shapes. Geometry was a critical component of mathematics, taught continuously at every level of education, including in inclusive schools. It involved understanding the properties and relationships of points, lines, shapes, and spaces, which formed the foundation for more advanced mathematical topics and were essential in other fields such as science, technology, engineering, and cartography (Bergstrom & Zhang, 2016; Clements et al., 2022). Therefore, it was important for every child to be introduced to basic geometric shapes from an early age, including children with intellectual disabilities.

Intellectual disability was categorized into four severity: mild, moderate, severe, and profound (APA, 2022). Children with mild intellectual disabilities could learn simple and basic skills related to both education and daily life (Patel et al., 2018, 2020). However, they still faced challenges in learning due to a slower developmental process compared to their peers (Angelka & Goran, 2018). Children with mild intellectual disabilities generally performed better than those with moderate or

profound disabilities, but their performance remained below that of children without disabilities (Bouck & Satsangi, 2015; Hord et al., 2020). Additionally, children with intellectual disabilities were more likely to experience visual and hearing impairments, which made their needs particularly complex (Bhaumik & Alexander, 2020).

Children with intellectual disabilities, due to their limitations, had difficulty understanding geometric shapes. This was because they had limited intellectual abilities and deficiencies in adaptive behavior, particularly in academic functions such as reading, writing, and mathematics (Friend, 2018). These children exhibited cognitive and learning characteristics such as a slow learning pace, poor memory, attention problems, difficulty retaining and generalizing learned concepts, and low motivation (Heward et al., 2017). This could hinder the learning process, even though they still had to participate to keep up with their peers. This challenge was even greater when the child also had hearing loss, making it even more difficult for them to follow the lessons.

Based on the results of initial observations on February 8, 2023, which were carried out in class when participants were studying, revealed that the participant struggled to recognize basic geometric shapes such as triangles, circles, and squares. During a short test on geometric shapes, the participant often guessed the answers. The observations also showed that the participant frequently lost focus, often turning his head toward the outside of the classroom when someone passed by or distracting himself by looking at his friends instead of paying attention to the teacher. These observations were consistent with the results of the initial interview with the teacher, who reported that the participant frequently lacked concentration during lessons and guessed at answers on assignments.

According to Heward et al. (2017), teaching children with intellectual disabilities was both challenging and demanding, as teachers had to be well-organized, firm, and consistent. They also needed to manage various aspects of teaching, including supervising paraprofessional assistants, student teachers, peer tutors, and volunteers. A teacher is an individual who plans learning programs and organizes and manages the classroom to facilitate student learning. Their role is to guide students toward growth and maturity, preparing them to progress to the next stages of their educational journey (Ramopoly & Bua, 2022). The inclusion of children with intellectual disabilities alongside their peers in regular classrooms places additional responsibilities on teachers in inclusive schools. Teachers must adapt their teaching methods to meet the unique characteristics and needs of each child with special needs, ensuring that learning is both accessible and effective for all students (Of et al., n.d.).

This study aimed to introduce geometric shapes, such as circles, squares, and triangles, to children with intellectual disabilities and hearing loss. Therefore, it was crucial to design an effective and inclusive learning approach to help these children recognize geometric shapes. Several methods were used to introduce geometry to children with intellectual disabilities, including the Miles and Huberman method (Laja et al., 2021), the van hiele method (Pradhitya et al., 2017; Yunaini & Arnidha, 2022), the constant time delay (CTD) procedure (Orihuela et al., 2019), digital game-based education (Demir, 2022), and many more.

Researchers employed Gagne's nine events of instruction, developed by Robert Gagne, because this method offered detailed stages that were well-suited for the research participant. Gagne's theory was classified as an instructional theory because it aimed to describe the conditions under which individuals could intentionally regulate their learning to achieve specific performance outcomes (Orbe, 2019).

Gagne's instructional model was based on an information processing framework that described the mental events occurring when a person was exposed to various stimuli. It emphasized learning outcomes and how to organize specific learning

events to achieve those outcomes. According to Gagne (as cited in Curry et al., 2021) effective learning comprised nine distinct steps built upon each other and facilitated communication to support the learning process. The application of Gagne's nine-event model was regarded as the best approach for ensuring an effective and systematic learning program, as it provided a structured learning plan and a comprehensive view of teaching (Khadjooi et al., 2011).

Gagne et al. (2005) defined instruction as a series of events embedded in activities that aimed to facilitate learning, where instruction was more likely to be effective if it was planned to involve children in events and activities that facilitated learning. Gagne et al. (2004) stated that there were 9 events of instruction in their learning model, namely gaining attention and motivation, presenting the learning objective, recall prerequisites, presenting the new content, providing learning guidance, eliciting performance, providing feedback, assessing performance, and providing for retention and transfer. Different internal and external conditions are required for each type of learning (Orbe, 2019).

The Gagne's model has been widely applied in the learning process across various educational levels, including elementary schools (Sari & Anam, 2022; Zulfah & Mukhoiyaroh, 2022), junior high schools (Haqiqy et al., 2024; Musa et al., 2024), high schools (Orbe, 2019; Uğraş et al., 2016; Yulinda et al., 2024), vocational schools (Daleon, 2023; Rini et al., 2015), and even in the university (Jaiswal, 2019; Kohzaki, 2023, 2024; Pandey, 2020; Qutieshat, 2018). However, there has been limited research exploring the application of Gagne's model in inclusive schools, special education settings, or for students with special needs.

Several studies involving children with intellectual disabilities have demonstrated the effectiveness of Gagne's nine events of instruction model in introducing geometric shapes to this population. For instance, research by Ozmen & Unal (2008) compared Gagne's model with the Merrill and Tennyson model for teaching concepts to students with intellectual disability, finding that Gagne's model was more effective and required less teaching time. Furthermore, research by Kocaöz & Yalçın (2022) confirmed the model's effectiveness in teaching geometric shapes to children with intellectual disability. Despite these findings, there is currently no research investigating the effectiveness of Gagne's model in teaching geometric shapes to children who have both intellectual disability and hearing loss.

Therefore, the hypothesis proposed was that using Gagne's model would affect the ability to recognize geometric shapes, specifically circles, squares, and triangles, in intellectual disability children with hearing loss.

METHOD

This study was a single-subject research study with an A-B-A design. The A-B-A design was an extension of the A-B design, in which baseline conditions were repeated after the intervention (Sunanto et al., 2005). The participant was a 5-year-11-month-old girl diagnosed with mild intellectual disability (IQ 55 based on the Snijders-Oomen Non-Verbal Scale) and hearing loss, who attended an inclusive playgroup in Kendal regency.

The measuring instrument used in this study was a checklist method that contained the development of participant abilities in identifying geometric shapes, filled in by the first researcher. Data collected by the Gagne 9 event of instruction, include: 1) Provide for attention and motivation), 2) Present the learning objective, 3) Recall prerequisites, 4) Present the new content, 5) Provide learning guidance, 6) Eliciting performance, 7) Provide feedback, 8) Asess performance, and 9) Provide for retention and transfer. Participants will get a score of 1 if they can point to a geometric shape without prompt and a score of 0 if they point to a geometric shape with prompt. The research procedure lasted for 21 sessions, consisting of three

baseline sessions, 15 intervention sessions, and three maintenance sessions, each lasting approximately 45 minutes. Each intervention session will use different geometric shapes intervention materials and colors. The materials included wood, sponge, styrofoam, plastic, and cardboard, each shaped as a circle, square, and triangle, respectively, in yellow, purple, blue, red and green colors.

Data analysis in this study used graphical analysis. Data analysis was carried out by descriptively comparing the score values in the baseline, intervention, and final baseline phases.

RESULT

Based on the intervention that had been carried out, it was found that there was an increase in participant recognizing the three geometric shapes with the following details:

1. Circle

   During the baseline phase, the participant provided no correct responses for identifying the geometric shape of a circle. However, by meetings 4 and 5, the participant had successfully identified the circle without any prompts. In the maintenance phase, the participant consistently provided correct answers for the geometric shape of a circle.

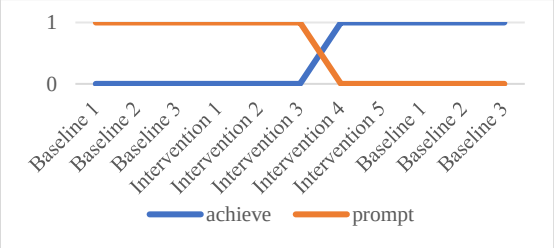

Figure 1. Intervention Results for the Ability to Recognize
Geometric Shapes of Circle

2. Square

   For the geometric shape of a square, the number of correct responses during the baseline phase was zero. The participant successfully identified the geometric shape of a square without prompts during the final two meetings, specifically meetings 4 and 5. In the maintenance phase, the participant consistently provided accurate answers for the geometric shape of a square.

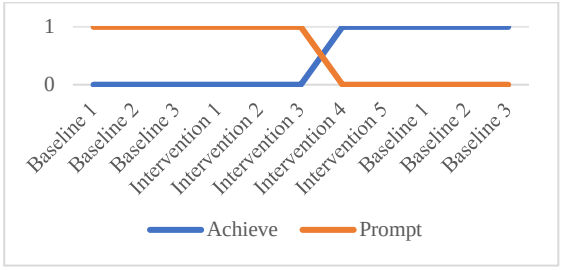

Figure 2. Intervention Results for the Ability to Recognize
Geometric Shapes of Square

3. Triangle

   In the geometric shape of a triangle, at the baseline stage, the number of correct responses was zero. The participant was able to correctly identify the geometric shape of a triangle without prompts at meetings 1 and 2, but at meeting 3, the participant was unable to answer correctly. The participant was able to identify the triangle correctly again at meetings 4 and 5. In the maintenance phase, the participant consistently provided correct answers for the geometric shape of a triangle.

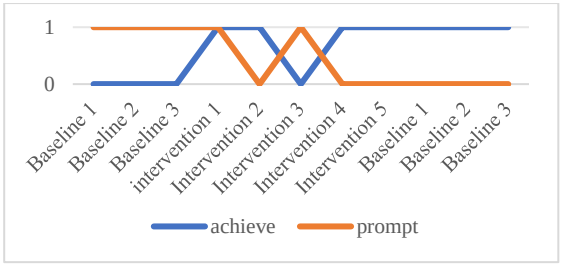

Figure 3. Intervention Results for the Ability to Recognize
Geometric Shapes of Triangles

DISCUSSION

This study aimed to determine the effectiveness of Gagne's model on intellectual disabilities children with hearing loss as measured based on children's recognition of geometric shapes before and after the intervention. The results of this study indicate that there is an increase in the ability

to recognize geometric shapes in intellectual disability children with hearing loss. Before the intervention, the participant had not recognized the shapes of circles, squares, and triangles. However, after being given an intervention using the gagne model method, the participant was able to recognize these three geometric shapes. This outcome demonstrated that Gagne's model effectively introduced geometric shapes to intellectual disability children with hearing loss. This is shown by participant who have been able to recognize the geometric shapes of circles, squares, and triangles. This means that the application of Gagne's model given to participant is effective in improving the participant ability to recognize the geometric shapes of circles, squares, and triangles. Based on these results, this hypothesis is accepted, namely that there is an effect of using Gagne's model on the ability to recognize geometric shapes in children with intellectual disabilities.

Previous study conducted by Özmen & Ünal (2008) showed that Gagne's model is more effective in teaching the concept of geometric square and triangle. These study are in line with the result of research that the use of the Gagne model has proven effective in introducing geometric shapes. Research conducted by Kocaöz & Yalçın (2022) also showed that Gagne's model effectively teaches the concept of geometric shapes to children with intellectual disability. The difference between this study and previous studies is that the participants in this study were intellectual disability children with hearing loss, while the participants in the previous study did not have hearing problems. This shows that Gagne's method is effective for use on children with intellectual disabilities with or without hearing impairments. Thus, the implication of this study was that Gagne's model could be applied to intellectual disability children with hearing loss to teach geometric shapes effectively.

There were limitations in the present research. First, communication was limited due to the child's hearing problem, and since the child was not yet familiar with sign language, extra effort was required for communication. Second, there was a limitation in facilities and infrastructure, as there were not many variations of geometric shapes around the research place, resulting in only a limited number of geometric shape examples that could be shown to the child.

CONCLUSION

Based on the findings of the study, it was concluded that there was a significant improvement in the ability to recognize geometric shapes, based on score differences across baseline A, intervention, and baseline B. These results show that the application of geometric shape toys using Gagne's model was effective in facilitating the recognition of geometric shapes in intellectual disabilities children with hearing loss. This was further supported by the fact that the participant demonstrated the ability to recognize circles, squares, and triangles.

Based on the limitations of this study, the suggested recommendation for future research is to incorporate additional media, such as digital simulations, to facilitate communication and provide participants with more tangible examples of geometric shapes relevant to the research.

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