Journal of Pedagogical Research
Volume 6, Issue 4, 2022
https://doi.org/10.33902/JPR.202216895

Research Article

The effectiveness of Gagne's model in concept teaching for a student with intellectual disability

Onur Emre Kocaöz[1] and Gülistan Yalçın[2]

[1]*Aksaray University, Turkey (ORCID: 0000-0001-8412-0736)*
[2]*Aksaray University, Turkey (ORCID: 0000-0002-9668-0359)*

The aim of this study is to investigate the effectiveness of Gagne's model in teaching the concept of geometric shapes, triangle, circle and square, to a student with intellectual disability. A multiple-probe design across behaviors, a single-subject design, was used to demonstrate the effectiveness of the adopted model. The participant of this study was a 74-month-old boy with moderate intellectual disability. A criterion referenced form was used to measure the performance of the student. The results revealed the effectiveness of the model in teaching geometric shapes. Moreover, the participant's special education teacher and pre-school teacher both expressed positive opinions about the intervention process. The implications of this study can be used by teachers who are studying with students with intellectual disabilities in the planning and implementation of concept teaching.

Keywords: Intellectual disability; Concept teaching; Gagne's model; Single subject

Article History: Submitted 25 May 2022; Revised 2 August 2022; Published online 4 September 2022

1. Introduction

The American Association on Intellectual and Developmental Disabilities [AAIDD] defines intellectual disability [ID] by considering two main characteristics which are significant limitations in cognitive functions and adaptive behavior that are expressed as conceptual, social, and practical skills (AAIDD, 2010). Further, these disabilities are the limitations that are diagnosed before the age of 18. Individuals with ID may experience a broad category of deficits that negatively affect an individual's cognitive, academic, daily life, and social skills (Schalock et al., 2010). As the basis of many different skills and behaviors, concept learning can be described as being able to classify objects, events, and cases. To prepare for school, preschool children need to learn concepts such as colour, shape, size, thickness, and number, as well as those related to different disciplines (Özyürek, 1984; Varol, 1991). In contrast to children with normal development who acquire skills from their cognitive skills and/or modeling the people around them, children with ID need assistance in acquiring gross motor skills, everyday life skills, and academic skills (Ayres et al., 2013).

Individuals with ID often struggle with learning mathematical concepts. It is important for children with ID to learn geometric shapes before entering elementary school since these concepts

Address of Corresponding Author

Onur Emre Kocaöz, PhD, Aksaray University, Faculty of Education, Department of Special Education, 68100, Aksaray, Turkey.

✉ onurkocaoz@aksaray.edu.tr

How to cite: Kocaöz, O. E. & Yalçın, G. (2022). The effectiveness of Gagne's model in concept teaching for a student with intellectual disability. *Journal of Pedagogical Research, 6*(4), 101-110. https://doi.org/10.33902/JPR.202216895

play a fundamental role in the curriculum. Research has shown that individuals with ID struggle in enhancing mathematical skills and concepts which are abstract and complex when compared to their normally developing peers (Arı et al., 2010; Tekin-İftar et al., 2008; Wilmshurst, 2012). Triangles, squares, circles, and rectangles are geometric concepts that pre-schoolers should know and be able to identify. However, children with ID may experience delays in acquiring these concepts due to cognitive functioning limitations (Hord & Bouck, 2012). Researchers have pointed out that the process of teaching geometric shapes needs to be designed with consideration of the following fundamental steps: a) environments and materials, b) the type of instructional methods, c) the type of target of concept learning, and d) the learning characteristics of the child. Furthermore, researchers have shown that a well-planned concept analysis plays a key role in the process of teaching a newly acquired concept to students with ID (Karabulut & Yıkmış, 2010; Yıkmış, 1999).

A variety of effective teaching models have been developed and implemented in concept teaching, including Bruner's (1961) model, Gagne's model (1965), Merrill-Tennyson's model (1977), direct instruction (Engelmann & Carnine, 1982; Tuncer & Altunay, 2004), and constant time delay (Orihuela et al., 2019). Gagne's model is one of the most commonly used models in which a concept is taught by describing the features of the concept. This presentation promotes recall and understanding of key concept items' attributes and descriptors, which is a critical component. Thus, concept teaching through Gagne's model consists of presenting positive and negative examples and asking whether these examples represent the concepts taught (Gagne, 1965; Gagne et al., 1998). This model presents positive and negative examples simultaneously without explaining or defining the associated qualities of the concept.

A number of studies show that Gagne's model is effective in teaching mathematics and school readiness concepts such as size, shape, and number sense to individuals with ID (e.g. Varol, 1991; Yıldırım Alptekin, 2000). Further, Güzel Özmen and Ünal (2008) designed a study to investigate the effectiveness of two different concept teaching methods, the Gagne's model and the Merrill-Tennyson's model, to students with ID. The study found that the Gagne's model is more effective in teaching concepts to children with ID. Similarly, Metin (2015) conducted a study to compare the effectiveness of the Gagne's model and the Merrill-Tennyson's model in teaching the concepts of cube and cylinder as geometric objects to individuals with ID. The study found no significant differences between the Gagne's model and the Merril-Tennyson's model in the effectiveness in learning and maintaining concepts. However, noticeable differences were found in the instruction time as the Gagne's model took less time than the Merrill-Tennyson's.

In pre-school mathematics, geometric shapes are a major content area. At this school level, children learn geometric shapes (square, rectangle, triangle, circle) (Guven, 2005). Seeing pictures and listening to verbal descriptions of geometric shapes may not be sufficient to teach pre-schoolers the concept of geometric shapes. Instead, children should touch, manipulate, draw, and present shapes in various forms (Sezer, 2015). Considering the limitations experienced by children with ID, they need structured teaching and a large number of teaching materials related to the teaching of geometric shapes. In previous studies, the effectiveness of Gagne's model was examined with elementary and middle school students. Using Gagne's model, the aim of the current study was to evaluate the effectiveness of teaching triangles, circles, and squares to a pre-school student who has a moderate level of intellectual disability.

2. Method

2.1. Participant

The participant of the study is a 74-month-old boy with moderate ID. The World Health Organization [WHO] (2009) categorizes intellectual disability in four groups: mild (IQ 50-69), moderate (IQ 35-49), severe (IQ 20-34), and profound (IQ < 20). The IQ level of the participant was reported as 55 according to the Wechsler Intelligence Scale for Children--Revised (WICS-R). Further, the participant was a pre-school education student in the general education setting.

Hence, he attends swimming and gymnastics courses and receives individualized education two days a week at the special education and rehabilitation center. Further, the participant uses language for communication purposes to identify the rectangle among geometric shapes, and main colors.

2.2. Setting

Baseline, intervention and maintenance phases were carried out in the resource room at the special education and rehabilitation centre. In the classroom, there is a blackboard hanging on a white wall, a bean table, student and teacher chairs, a materials cabinet and a carpet. Before starting the study, the researcher removed all the images on the walls and made a seating plan with the back of the participant facing the door throughout the study. A purposeful body orientation was used to maximize the participant's attention and decrease distraction.

2.3. Practitioner

Data collection and intervention sessions were carried out by the second researcher. Researcher completed undergraduate, master's, and doctoral degrees in special education. Her undergraduate education included a concept teaching course, and she is currently teaching a special education course titled *Concept Teaching to Individuals with ID* at the undergraduate level.

2.4. Teaching Materials

Both teaching and assessment materials for each concept were developed with respect to Gagne's model. Table 1 shows examples of these materials.

Table 1
Examples of teaching and assessment materials for triangle in Gagne's model

	The concept of triangle
Teaching Materials	Wooden blue triangle, circle
	Plastic yellow triangle, circle
	Sponge green triangle, circle
	Cardboard red triangle, circle
Assessment Materials	Corrugated cardboard yellow triangle, circle, square
	Fabric red triangle, circle, square
	Plastic green triangle, circle, square
	Sponge yellow triangle, circle, square

In one of the teaching sessions of the concept of triangle, wooden blue triangles and circles, plastic yellow triangles and circles, sponge green triangles and circles, and cardboard red triangles and circles were used. A corrugated cardboard yellow triangle, circle, and square was used in the end-of-teaching assessment of the same session, along with a fabric red triangle, circle, and square, a plastic green triangle, circle, and square, and a sponge yellow triangle, circle, and square.

2.5. Experimental Design

A multiple-probe design (Gast et al., 2014) was used to evaluate Gagne's model for concept learning before, during, and after intervention on three geometric shapes over time. Baseline, intervention, and maintenance phases were planned to demonstrate participant performance on the target behaviors. The dependent variable in the current research was participant performance in identifying the concepts of triangle, circle, and square, while the independent variable was the Gagne's model that was designed for the concept teaching procedure.

2.6. Instruments

Prior to the intervention implementation phases, reinforcement identification forms were used to determine which reinforcements would be used in the teaching sessions. In all phases of the study, the participant's performance on triangle, circle, and square concepts was measured using

criterion-referenced forms of triangle, circle, and square concepts. It includes six statements that ask the student to show and respond to geometric shapes on real objects and pictures. There were four questions for every statement. Student behavior is considered to be expressed if he answers three out of four questions correctly. The measurement tool consists of a table with statements, a criteria column with 3/4 ratio, and comments columns. The statements related to the concept were presented by the practitioner. In the measurement instrument form, correct responses were indicated with a (+) sign and incorrect responses with a (-) sign next to the relevant situation. In order to gather data on social validity, the participan's pre-school teachers and teachers of special education were interviewed. Second author interviewed pre-school teachers one by one about their teaching sessions with five closed-ended questions. In the next step, the special education teacher was contacted and this process was repeated.

2.7. Implementation Process

Prior to the intervention phase, three sessions were conducted to measure the participant's current level of correct response to triangle, circle, and square. As part of the intervention for triangles, no baseline data were collected for circles or squares. The three concepts were then probed after teaching the triangle concept. After that, the circle teaching intervention began. Following the circle concept's teaching, probe data was collected from all the concepts, and the last concept, the square, was taught. After the participant reached the 3/4 criteria in three concepts, maintenance data was collected.

During the intervention process, the triangle concept was taught following the sessions of Gagne's model. Materials were introduced to the student during the introduction to teaching sessions. The researcher put the primary education set on the table and asked, "Look, this is a triangle" and ran his finger around the triangle. Then she took the circle in her hand and said, "Look, this is not a triangle", running her finger around it. Then she put the triangle and square in a row in a mixed way and asked, "Show me the triangle". If the student responded incorrectly, the practitioner repeated the instruction with the same set of materials and mixed the materials again, saying "Show me the triangle". Then she asked, "Which one is not a triangle, show me". She then repeated the same process with the other three sets of materials. After the application was carried out with all teaching materials, the end-of-teaching assessment was performed. The researcher placed the first set of tools that she would use in the assessment side by side in front of the student and showed the geometric objects with her finger, saying "Look at these and show me the triangle" and waited for 1-2 seconds. In the case that the student gave a correct answer, she reinforced it and then changed the position of the tools, asking that "Show me which one is not a triangle" and waited for 1-2 seconds after that. If the student responded correctly, she reinforced the response by saying, “Well done, you showed me the non-example-triangle”. If the student gave an incorrect response or remained unresponsive within the specified time, the researcher repeated the instruction without any reaction. All teaching sessions were conducted in this way. Teaching sessions on the concept of triangle were carried out in 4 sessions of 15 minutes. After the instruction, when the participant reached the intended criterion level (3/4), multiple-probe was used three times. For the other two concepts, the implementation process was carried out as in the teaching of the triangle concept. A maintenance data was collected after 7 days, 14 days, and 21 days to determine whether participant could retain the triangle, circle, and square concepts he learned.

2.8. Data Analysis

A multiple-probe design across behaviors was used in this study. Baseline, intervention, and maintenance phases data was analysed visually. The findings from all phases are shown in Figure 1. The mean level changes in baseline, intervention, and maintenance phase conditions were compared for three skills. The social validity data of the study are shown by providing direct quotes from the teachers.

2.9. Procedural Reliability

Procedural reliability data was collected by the first author using the procedural reliability form which consisted of the steps of the intervention procedure. The first author followed 40% of the procedure for each phase across behaviors. Procedural reliability was calculated by dividing the observed practitioner behavior by the planned practitioner behavior (Billingsley et al., 1980). The calculations determined that the procedural reliability of the research was 98%.

3. Results

3.1. Effectiveness of the Model

This study investigated the effectiveness of the Gagne's model in teaching the concepts of triangle, circle and square to a student with ID. The number of correct responses on the participant's performance level recognizing geometric shapes (triangle, circle, square) obtained from the baseline, intervention, and maintenance phases (triangle, circle, square) are illustrated in Figure 1. The performance level on recognizing geometric shapes was determined as the total number of correct answers given by the participant for six different questions and was calculated separately across behaviours for every probe of each phase.

Through the Gagne's model of concept teaching, the participant's ability to recognize the three concepts increased. Based on three different sessions, the participant demonstrated a high level of skill recognition for two concepts (triangle and circle) with a mean of 6 correct number responses and a mean of 5.3 correct number responses.

3.1.1. Triangle

According to Figure 1, the total number of correct responses on the triangle recognizing level was zero based on three baseline sessions. The distribution of the baseline level data does not vary and it was perfectly stable. The participant's total number of correct answers for the triangle concept increased significantly from zero to six after introducing the Gagne's model in the teaching process. According to the visual analysis of the intervention phase, the participant's performance in respect of the triangle concept recognizing level remained stable during the intervention phases. A total of 3 sessions were organized during the maintenance phase. The first maintenance probe data was collected seven days after the end of the application, the second maintenance probe data was collected 14 days later, and the last maintenance probe data was collected 21 days after the end of the application. In total, the participant gave correct answers to all questions regarding target behavior.

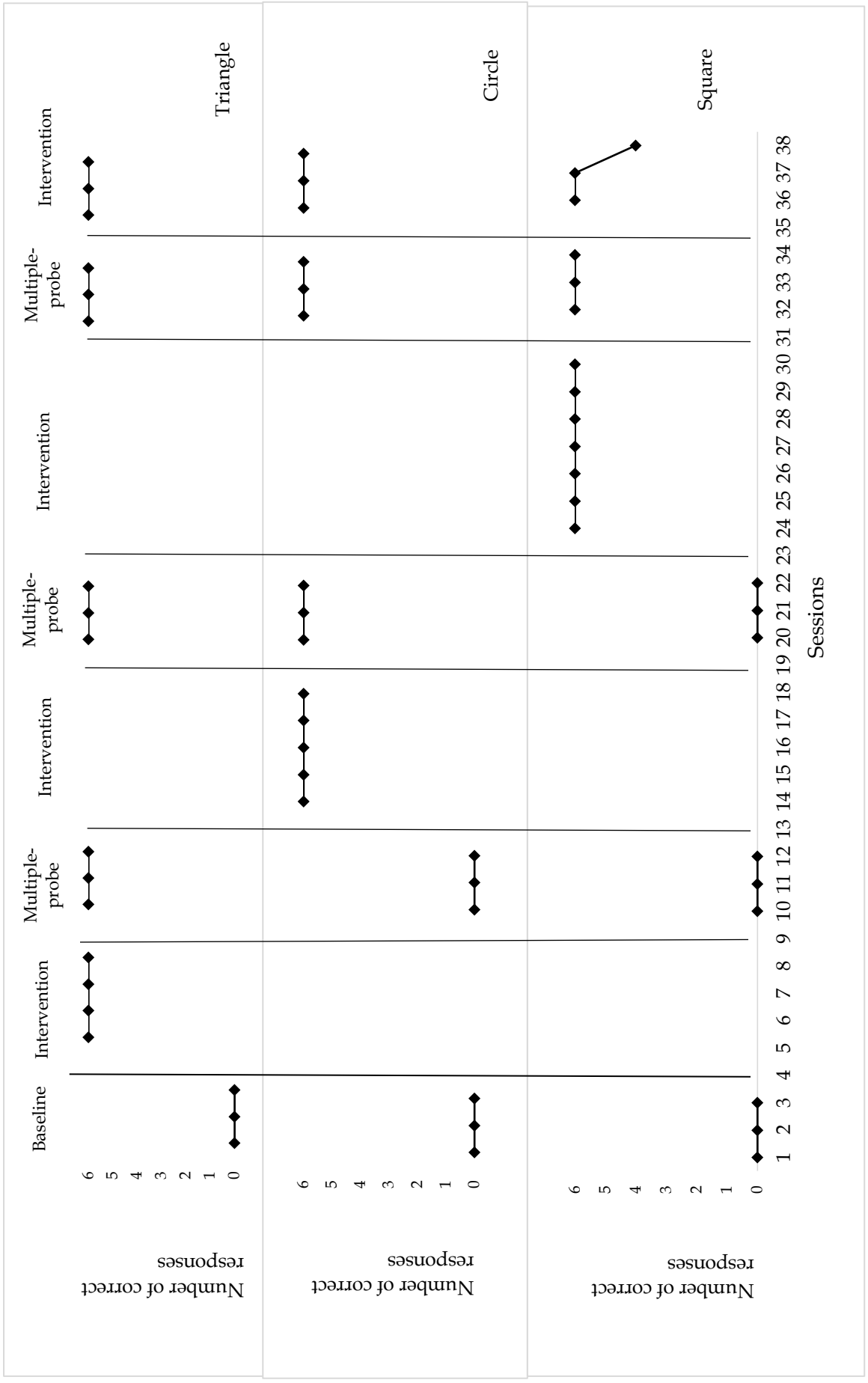
3.1.2. Circle

Based on the baseline data collected in 6 sessions, no correct responses were given by the participant for the circle concept. The participant showed immediate improvement in performance after the first day of teaching by responding correctly to all the targets related to circle concept questions. Data patterns showed a stable trend in the five intervention phase sessions. Following the last intervention phase session, the maintenance phase took place on days 7, 14, and 21. In the maintenance phase, the participant answered all six statements about the concept of circle in each of the three sessions. According to the data collected during the maintenance phase, Gagne's model was effective by allowing the participant to maintain a level of recognition of the circle concept for the entire course.

3.1.3. Square

Among 9 baseline probes, the participant's current recognition level of square concept prior to introduction to the Gagne's model can be seen in Figure 1. The numbers of correct responses in all sessions were zero and stable before the intrvention. Participant showed the same performance

Figure 1
Results of Effectiveness of Gagne's Model



with a mean of 6 correct responses on the 24th day of the study as he had previously shown in the process of concept triangle and circle intervention. In the first two maintenance phase sessions, the participant answered all questions correctly about the target behavior. Following the maintenance probe, the participant showed a decreasing trend in the last maintenance probe in which he responded correctly to 4 of the 6 statements.

For each geometric shape, Table 2 displays the participant's average number of correct answers in the baseline, intervention, and maintenance phases, as well as the percentage of non-overlapping data (PND).

Table 2
Calculation of the percentage of non-overlapping data

	Baseline	*Intervention*	*Maintenance*	*Total PND*
Triangle	0%	100%	100%	100%
Circle	0%	100%	100%	100%
Square	0%	100%	88%	100%
Mean Across Skills	0%	100%	96%	100%

As shown in Table 2, the percentage of non-overlapping data presented for the participant's triangle, circle and square concepts was calculated as 100% baseline, intervention and maintenance. PND was calculated with data across baseline and intervention phases. The PND value of less than 50% reflects unreliable treatment, a PND score between 50% and 70% can be considered as questionable effectiveness, a PND score ranging between 70% and 90% reflects fairly effective, and a PND score of higher than 90% reflects an independent variable as highly effective (Gast, 2010). Accordingly, this study can be considered highly effective based on the result.

3.2. Social Validity Results

A summary of the social validity data collected from the participant's special education teacher and pre-school teacher can be found in Table 3.

Table 3
Social validity data

Statements		*Yes*	*No*	*Not sure*
The intervention is appropriate for the age of the child.	*PST*	+		
	SET	+		
This intervention, which is used in the teaching of geometric shapes, is suitable for use by teachers in classrooms.	*PST*	+		
	SET		+	
The intervention was effective in the child's learning of geometric shapes.	*PST*	+		
	SET	+		
The materials used during the teaching are sufficient for the teaching of geometric shapes.	*PST*	+		
	SET	+		
I liked the intervention implemention procedure.	*PST*	+		
	SET	+		

Note. PST: Pre-school teacher, SET: Special education teacher

As indicated in Table 3, the participant's pre-school and special education teachers found that the Gagne's model was appropriate for the child's age to be used in teaching geometric shapes and that it was effective in the teaching process. Additionally, the materials used were adequate. Pre-school teachers, however, did not see the intervention as suitable for use in classroom settings, as opposed to the special education teacher.

4. Discussion and Conclusion

In this study, Gagne's model was evaluated for its effectiveness in teaching triangle, circle, and square to an intellectually disabled student. The results revealed that student with intellectual

disability benefited from the model when learning geometric shapes (triangle, circle, square). In particular, the participant's ability to recognize geometric shapes improved from baseline to intervention phases. A number of studies have shown that Gagne's model is effective in teaching concepts such as color, size, shape, number, and geometric shapes (Güzel Özmen & Ünal 2008; Metin, 2015; Varol, 1991; Yıldırım Alptekin, 2000). Thus, the results of this study support those from previous studies.

The difference between this study and the previous one was in the time spent on instruction and/or the number of intervention sessions. Güzel Özmen and Ünal (2008) compared the effectiveness of the Gagne's model and the Merril Tennyson's model in teaching concepts to students with intellectual disabilities. In their study, compared to Merril Tennyson's model, Gagne's model was completed in a shorter amount of time. In a study conducted by Metin (2015), individuals with intellectual disabilities were taught cube and cylinder concepts by using the Gagne's and Merril Tennyson models. The instruction time of the Gagne's model was also shorter than the Merrill Tennyson's model while teaching two students. In this current study, the triangle concept was taught in four teaching sessions, the circle concept in five teaching sessions, and the square concept in seven teaching sessions. As a result, 16 sessions were performed to teach the three targeted concepts. Participant characteristics, the duration of the teaching sessions, the application environments, and the characteristics of the teaching materials may contribute to this difference. The teaching sessions in this study lasted 20 minutes, while they lasted 45 minutes in Metin's (2015) study. For future studies, it should be noted that the duration may vary depending on the number and characteristics of participants in the environment.

As another result of this study, the participant maintained the triangle and circle concepts on 7th, 14th, and 21st days, while the square concept decreased on the 21st day. Participant was found to have confused the concept of square with rectangle they had previously learned. The maintenance data suggests that the participant can confuse two similar concepts, leading to a decrease in the square concept. It has been reported in the literature that preschool children have difficulty distinguishing geometric shapes when they associate them with similar features (Kesicioğlu et al., 2011; Turan Topal, 2010). Nevertheless, Hannibal (1999) indicates that children should have developed the understanding that a square is not a rectangle by the age of five.

The participant's acquisition and maintenance of geometric shapes following teaching through Gagne's model may be attributed to some component of the intervention procedure. One of these components was the use of reinforcement with food during the teaching process. Before beginning teaching, the second author interviewed the participant's teacher and family. During the study, the specified food was not used in any situation. Accordingly, reinforcement may play a role in maintaining participant attention. Besides the intervention procedure, the materials also played a role. The materials used varied in colors and materials. As the participant examined the materials before the teaching, he seemed excited and liked them. Several studies (e.g., Eski & Kazancı-Gül, 2021) demonstrate that a large number of materials enhance geometry instruction. The use of a variety of materials is therefore supported by these findings in previous studies.

The study also reported social validity results, which were the opinions of special education teachers and pre-school teachers on the intervention. According to the social validity findings, the intervention was appropriate for the child's age in teaching geometric shapes through materials. While the special education teacher said the intervention could be used in classroom settings, the pre-school teacher claimed that it was not suitable. This situation is thought to be due to the fact that the experimentatiın was carried out with a single student. After watching the three teaching practices, the pre-school teacher suggested conducting the intervention individually to provide classroom management as underlined by Lemons et al. (2018).

When evaluating the results of this study, some limitations should be considered. First, this research was conducted with the participation of only a single student with intellectual disability. Despite the positive results of this study on geometric shapes and recognition of the performance of a student with intellectual disabilities, the results can be replicated with a larger, more

heterogeneous group of participants. For instance, the effectiveness of the Gagne's model in concept teaching can be investigated with various disability groups. The second limitation of the study was that one of the researchers implemented the intervention. The validity and reliability of future studies can be strengthened by working with different practitioners.

Author contributions: All authors have sufficiently contributed to the study, and agreed with the results and conclusions.

Funding: No funding source is reported for this study.

Declaration of interest: No conflict of interest is declared by author.

References

American Association on Intellectual and Developmental Disabilities [AAIDD]. (2010). *Intellectual disability: Definition, classification, and systems of supports*. Author.

Arı, A., Deniz, L., & Düzkantar, A. (2010). The effectiveness of simultaneous prompting procedure on teaching addition and subtraction operations to a mentally handicapped child. *Abant İzzet Baysal University Journal of Faculty of Education, 10*(1), 49-58.

Ayres, K. M., Mechling, L., & Sansosti, F. J. (2013). The use of mobile technologies to assist with life skills/independence of students with moderate/severe intellectual disability and/or autism spectrum disorders: Considerations for the future of school psychology. *Psychology in the Schools*, *50*(3), 259-271. https://doi.org/10.1002/pits.21673

Billingsley, F. F., White, O. R., & Munson, R. (1980). Procedural reliability: A rationale and an example. *Behavioral Assessment*, *2*, 229 – 241.

Bruner, J. (1961). *The process of education*. Harvard University Press

Engelmann, S., & Carnine, D. (1982). *Theory of instruction: Principles and applications*. Irvington Publishers.

Eski, C. & Kazancı-Gül M. (2021). Opinions toward teaching of geometry topics to visually impaired students. *Journal of Sustainable Education Studies*, *2*(4), 1-17.

Gagne, R. M. (1965). The learning concepts. *The School Review, 75,* 187-196

Gagne, R. M., Briggs, L. J., & Wager, W. W. (1988). *Principles of instructional design*. Holt, Rinehart & Winston.

Gast, D. L., Lloyd, B. P., & Ledford, J. R. (2014). Multiple baseline and multiple probe designs. In D. L. Gast & J. R. Ledford (Eds.), *Single case research methodology: Applications in special education and behavioral sciences* (pp. 251-296). Routledge.

Güven, Y. (2005). *Erken çocuklukta matematiksel düşünme ve matematiği öğrenme* [Mathematical thinking and learning mathematics in early childhood]. Küçük Adımlar.

Güzel Özmen, R. & Ünal, H. (2008). Comparing the effectiveness and efficiency of two methods of teaching geometric shape concepts to students with mental retardation. educational sciences. *Theory and Practice, 8*(2), 669-680.

Hannibal, M. A. Z (1999). Young children's developing understanding of geometric shapes. *Teaching Children Mathematics, 5*(6), 353-355. https://doi.org/10.5951/TCM.5.6.0353

Hord, C., & Bouck, E. C. (2012). Review of academic mathematics instruction for students with mild intellectual disability. *Education and Training in Autism and Developmental Disabilities*, *47*(3), 389-400.

Karabulut, A., & Yıkmış, A. (2010). The effectiveness of simultaneous prompting on teaching the skill of telling the time to individuals with mental retardation. *Abant İzzet Baysal University Journal of Faculty of Education, 10*(2), 103-113.

Kesicioğlu, O. S., Alisinanoğlu, F., & Tuncer, A. T. (2011). The analysis of kindergarteners` recognition degrees of geometric shapes. *Elementary Education Online*, *10*(3), 1093-1111.

Lemons, C. J., King, S. A., Davidson, K. A., Puranik, C. S., Al Otaiba, S., & Fidler, D. J. (2018). Personalized reading intervention for children with Down syndrome. *Journal of School Psychology*, *66*, 67-84. https://doi.org/10.1016/j.jsp.2017.07.006

Merrill, M. D., & Tennyson, R. D. (1977). *Teaching concepts: An instructional design guide.* Educational Technology Publications.

Metin, H. (2015). *Comparative analysis of effective teaching methods used in the concept of education for the mentally disabled individuals* [Unpublished master's thesis]. Necmettin Erbakan Üniversitesi, Konya.

Orihuela, S. M., Collins, B. C., Spriggs, A. D., & Kleinert, H. (2019). An instructional package for teaching geometric shapes to elementary students with moderate intellectual disability. *Journal of Behavioral Education*, *28*(2), 169-186. https://doi.org/10.1007/s10864-018-09314-5

Özyürek, M. (1983). Kavram öğrenme ve öğretme [Learning and teaching of concepts]. *Ankara Universtity Journal of Faculty of Educational Sciences, 16*(2), 347-366.

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, V. J., Buntinx, W. H., Coulter, D. L., Craig, E. M., … Yeager, M. H. (2010). *Intellectual disability: Definition, classification, and systems of supports*. American Association on Intellectual and Developmental Disabilities.

Sezer, T. (2015). *The development of early geometry skills test and the investigation of children geometric skills* [Unpublished doctoral dissertation]. Marmara University, İstanbul.

Tekin-İftar, E., Kurt, O., & Acar, G. (2008). Enhancing instructional efficiency through generalization and instructive feedback: A single-subject study with children with mental retardation. *International Journal of Special Education, 23*(1), 147-158.

Tuncer, T., & Altunay, B. (2004). *Doğrudan öğretim modelinde kavram öğretimi* [Concept teaching in direct instruction model]. Kök Publishing.

Turan Topal, Y. (2010). *How do the preschool age children percieve the geometry concepts which are learnt?* [Unpublished master's thesis]. Gazi University, Ankara.

Varol, N. (1991). *Zihinsel engelli çocuklara kırmızı, sarı, daire, üçgen, uzun, bir tane, iki tane ve kalın kavramlarını kazandırmada açık anlatım yöntemiyle sunulan bireyselleştirilmiş kavram öğretim materyalinin etkililiği* [The effectiveness of the individualized concept teaching material presented with the open explaining method in teaching the mentally handicapped children the concepts of red, yellow, circle, triangle, long, one, two and thick] [Unpublished doctoral dissertation]. Anadolu University, Eskişehir.

World Health Organization [WHO]. (2009). *Global health risks: Mortality and burden of disease attributable to selected major risks.* Author.

Wilmshurst, L. (2012). *Clinical and Educational Child Psychology an Ecological Transactional Approach to Understanding Child Problems and Interventions*. Wiley.

Yıkmış, A. (1999). *Zihin engelli çocuklara temel toplama ve çıkarma işlemlerinin kazandırılmasında etkileşim ünitesi ile sunulan bireyselleştirilmiş öğretim materyalinin etkililiği* [The effectiveness of the individualized teaching materials presented with interactive unit on the teaching of the basic addition and subtraction skills to the student with mental retardion]. Yayınlanmamış Doktora Tezi, Anadolu Üniversitesi, Eğitim Bilimleri Enstitüsü, Eskişehir.

Yıldırım-Alptekin, S. (2000). *Zihinsel engelli öğrencilere renk ve şekil kavramlarının açık anlatım ve basamaklandırılmış yöntemle sunulmasının etkililiği* [The effectiveness of presenting the concepts of colour and shape to mentally handicapped students with open explaining and graded teaching method] [Unpublished master's thesis]. Gazi University, Ankara.