

The Effect of Talking Flashcards on Geometric Shape

Recognition among Children Aged 3–4 Years

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ABSTRACT

Recognizing geometric shapes is an essential component of early childhood cognitive development that supports spatial reasoning and foundational mathematical skills. Preliminary observations at KB Fi Dhillalil Qur'an, Banyuwangi, indicated that children aged 3–4 years experienced difficulties in identifying, naming, and classifying basic geometric shapes. This study aimed to examine changes in children's geometric shape recognition abilities following the implementation of Talking Flashcard media. A quantitative approach employing a pre-experimental one-group pretest–posttest design was conducted with 13 children selected through total sampling. Data were collected using an observation instrument covering three indicators: naming, identifying, and classifying geometric shapes. The findings revealed an increase in the mean score from 6.00 in the pretest to 9.15 in the posttest, representing a mean improvement of 3.15 points. The Shapiro–Wilk test yielded significance values of 0.132 and 0.084 for the pretest and posttest, respectively. A paired-

samples t-test indicated a statistically significant difference between pretest and posttest scores, $t(12) = -30.281$, $p < .001$. The greatest proportional improvement was observed in the ability to name geometric shapes (87.8%). These findings suggest that Talking Flashcards may be a promising learning medium for supporting geometric shape recognition among children aged 3–4 years. However, further research involving control groups and larger samples is recommended to establish their effectiveness more conclusively.

Introduction

Early childhood is a critical period for the development of cognitive, language, motor, and socio-emotional abilities. During this stage, children develop foundational skills that support their readiness for subsequent learning experiences. One important aspect of cognitive development is the ability to recognize geometric shapes, which provides an early foundation for spatial reasoning, classification, problem-solving, and mathematical understanding. Geometric shape recognition involves identifying, naming, distinguishing, and grouping shapes based on their characteristics. Aslan and Arnas (2007) demonstrated that preschool children may experience difficulties recognizing geometric shapes when their orientation, size, or proportions differ from familiar examples. These findings indicate that introducing geometric concepts requires developmentally appropriate learning experiences that encourage children to recognize and compare

different shapes.

Early geometric understanding is closely associated with children's broader cognitive and mathematical development. Verdine et al. (2014a) identified significant contributions of spatial skills and executive functions to preschool mathematics achievement, while Verdine et al. (2014b) demonstrated that spatial assembly abilities among three-year-old children were associated with early mathematical performance. Similarly, Libertus et al. (2024) found that preschool children's patterning abilities predicted subsequent geometric knowledge. These findings highlight the importance of providing early learning experiences that support spatial reasoning and geometric understanding.

In early childhood education, geometric concepts are generally introduced through familiar objects and engaging learning activities. Children aged 3–4 years are beginning to develop symbolic thinking and benefit from concrete representations, repetition, and interactive experiences when learning new concepts. However, learning activities that rely primarily on verbal explanations or limited visual materials may not provide sufficient opportunities for children to explore geometric characteristics. Fisher et al. (2013) found that guided play supported preschool children's acquisition of geometric knowledge more effectively than free play or direct instruction in the conditions examined. This finding emphasizes the importance of combining appropriate learning materials with active teacher guidance to support

children's understanding of geometric concepts.

Preliminary observations at KB Fi Dhillalil Qur'an, Kaliputih Village, Genteng District, Banyuwangi Regency, indicated that several children aged 3–4 years experienced difficulties naming, identifying, and grouping basic geometric shapes, particularly circles, triangles, and squares. Learning activities were also predominantly supported by conventional instructional materials, indicating the need for more engaging and interactive learning media. To address these difficulties, Talking Flashcards were considered a potential alternative because they combine visual representations of geometric shapes with audio features that pronounce the corresponding shape names. Through repeated exposure to images and spoken labels, children may have additional opportunities to associate geometric forms with their verbal representations.

Previous studies have demonstrated the potential of various learning media to support geometric understanding in early childhood. Hamida and Aulina (2021) investigated the use of tangram media among children aged 4–5 years and reported improvements in geometric shape recognition following the intervention. Similarly, Putri and Suparno (2020) examined computer-assisted geometry learning among children aged 4–5 years and identified improvements in naming, grouping, and imitating geometric shapes during classroom learning activities. These findings suggest that interactive learning experiences can facilitate children's recognition of geometric forms through different

instructional approaches.

Other studies have explored innovative media that integrate concrete materials and interactive learning activities. Fitriana and Widayati (2025) developed G-MAG media to support the recognition of triangles and squares among children aged 5–6 years, demonstrating the potential of geometry-focused learning materials for strengthening children's understanding of basic shapes. Novriyanti and Zettira (2025), through a literature-based study, discussed the potential of geometry pouch media for supporting early childhood cognitive development through shape and color recognition activities. More recently, Puspitasari et al. (2026) examined GeoPlay 3D learning media among children aged 5–6 years, reporting improvements in their ability to recognize three-dimensional geometric shapes. Collectively, these studies illustrate the relevance of concrete, interactive, and technology-supported media for introducing geometry in early childhood education.

Additional evidence suggests that the effectiveness of geometric learning media may depend not only on their visual presentation but also on the learning experiences they provide. Gecu-Parmaksiz and Delialioglu (2019) compared augmented reality-based virtual manipulatives with physical manipulatives among preschool children and found differences in geometric shape recognition outcomes across instructional conditions. Their findings highlight the potential of interactive representations while emphasizing the importance of

exposing children to variations in geometric shapes. Accordingly, learning media should provide opportunities for children to connect visual characteristics with meaningful concepts rather than simply memorize familiar images.

Although previous studies have examined tangrams, computer-assisted learning, geometry pouches, and three-dimensional media, much of the available research has focused on children aged 4–6 years or instructional approaches that differ from audio-supported flashcards. Evidence specifically examining Talking Flashcards for geometric shape recognition among children aged 3–4 years remains limited within the studies reviewed. Unlike conventional visual flashcards, Talking Flashcards provide both images and spoken shape names, potentially supporting children's ability to connect visual recognition with verbal identification. However, the contribution of this audio-visual combination requires empirical examination rather than being assumed to produce superior outcomes.

Children's geometric recognition can be supported through different forms of instructional representation and learning activities. O'Rear et al. (2023) found no meaningful differences between pictorial representations and physical manipulatives in preschool children's shape-identification performance, suggesting that visual representations can be useful for assessing geometric knowledge. Meanwhile, Uttal et al. (2013) demonstrated through a meta-analysis that spatial abilities can be improved through training. These findings

support the educational relevance of developmentally appropriate visual and interactive learning materials, although they do not establish the superiority of any particular medium.

Previous investigations have also emphasized the use of learning media and instructional activities to introduce early mathematical concepts. Rahayu et al. (2019) explored smart pocket cards combining pictures and numbers to support mathematics learning in kindergarten. Similarly, Ögütçen and Akman (2022) examined preschool children's perceptions of geometric shapes, highlighting the importance of understanding children's geometric recognition abilities. These studies provide a broader foundation for examining Talking Flashcards as an alternative medium for introducing basic geometric shapes to children aged 3–4 years.

Therefore, this study aimed to examine changes in geometric shape recognition abilities among children aged 3–4 years following the implementation of Talking Flashcard media at KB Fi Dhilalil Qur'an, Banyuwangi. Specifically, the study focused on three indicators: naming, identifying, and grouping basic geometric shapes. The findings are expected to provide practical insights into the use of audio-visual learning media as an alternative instructional resource for supporting early geometric understanding in early childhood educational settings.

Methods

This study employed a quantitative approach using a pre-experimental one-group pretest–posttest design to examine changes in

geometric shape recognition among children aged 3–4 years following the implementation of Talking Flashcard media. The design involved assessing children's abilities before and after the learning intervention without a control group. This approach enables the identification of changes in learning outcomes, although causal interpretations remain limited by the absence of a comparison group (Knapp, 2016).

The study was conducted at KB Fi Dhillalil Qur'an, Kaliputih Village, Genteng District, Banyuwangi Regency, East Java, during April–May 2026. The participants consisted of 13 children aged 3–4 years, selected through total sampling because all children in the target population were included. The intervention involved learning activities using Talking Flashcards, which combined visual representations of basic geometric shapes with audio recordings of their corresponding names. Children's geometric shape recognition abilities were assessed before and after the intervention.

Data were collected through participant observation using an observation sheet covering three indicators: (1) naming geometric shapes, (2) identifying geometric shapes, and (3) grouping geometric shapes. Each indicator was assessed using a four-point developmental rating scale: Not Yet Developed (1), Beginning to Develop (2), Developing as Expected (3), and Very Well Developed (4). The observation instrument was subjected to expert validation before implementation. Photographs and videos were also used to document learning activities.

Data were analyzed using descriptive and inferential statistics. Descriptive analysis was conducted to compare mean pretest and posttest scores, while the Shapiro–Wilk test was used to assess normality (Shapiro & Wilk, 1965). A paired-samples t-test was employed to examine differences between pretest and posttest scores at a significance level of .05. The statistical analysis focused on determining whether children's geometric shape recognition scores changed significantly following the implementation of Talking Flashcard media.

Result and Discussions

This study examined geometric shape recognition among 13 children aged 3–4 years at KB Fi Dhilalil Qur'an, Banyuwangi, before and after the implementation of Talking Flashcard media. Children's abilities were assessed using three indicators: (I) naming geometric shapes, (II) identifying geometric shapes, and (III) grouping geometric shapes. Each indicator was evaluated using a four-point developmental assessment scale: Not Yet Developed (1), Beginning to Develop (2), Developing as Expected (3), and Very Well Developed (4).

The individual pretest and posttest scores are presented in Table 1.

Table 1. Pretest and Posttest Scores of Geometric Shape Recognition

No .	Participan t	Pre I	Pre II	Pre III	Pre Total	Pos t I	Pos t II	Pos t III	Post Total
					1				1

1	AIRA	1	2	3	6	3	3	4	10
2	JENA	2	2	3	7	3	3	4	10
3	NAIRA	1	2	3	6	3	3	4	10
4	AQIL	1	2	3	6	2	3	4	9
5	ADHUM	2	2	3	7	3	3	4	10
6	ATIYA	1	2	3	6	2	3	4	9
7	ZYAN	1	2	3	6	2	3	4	9
8	CEISYA	2	3	3	8	3	4	4	11
9	BAIM	1	1	3	5	2	2	4	8
10	ASYRAF	1	1	2	4	2	2	3	7
11	ELMA	1	2	3	6	2	3	4	9
12	GAFFI	2	2	3	7	3	3	4	10
13	VANO	1	1	2	4	2	2	3	7
	Mean	1.3	1.8	2.8	6.00	2.46	2.85	3.85	9.15
		1	5	5					

Note. I = naming geometric shapes; II = identifying geometric shapes; III = grouping geometric shapes. Participant identifiers follow the original dataset.

As shown in Table 1, all 13 participants demonstrated higher posttest scores than pretest scores. The overall mean score increased from 6.00 to 9.15, representing an improvement of approximately 3.15 points. Among the three indicators, naming geometric shapes showed the highest proportional increase (87.8%), followed by identifying geometric shapes (54.1%) and grouping geometric shapes (35.1%). Although the grouping indicator exhibited the smallest proportional

improvement, it also had the highest initial mean score (2.85), indicating that children had comparatively stronger abilities in this area before the intervention.

Before conducting the inferential analysis, the Shapiro–Wilk test was performed to examine the distributions of pretest and posttest scores. The results are presented in Table 2.

Table 2. Normality Test Results

Assessment	Kolmogorov–Smirnov Statistic	<i>p</i>	Shapiro–Wilk Statistic	<i>p</i>
Pretest	0.269	.011	0.900	.132
Posttest	0.219	.089	0.885	.084

Note. N = 13 for both assessments. Values are reproduced from the original statistical output.

The Shapiro–Wilk test produced significance values of .132 for the pretest and .084 for the posttest. Both values exceeded the significance level of .05, indicating no statistically significant evidence of non-normality in the two score distributions when examined separately. However, for paired-samples analysis, the relevant normality assumption concerns the distribution of within-participant differences. A separate examination of these differences indicated a departure from normality; therefore, the paired-samples t-test results should be interpreted cautiously.

Descriptive statistics for the pretest and posttest assessments are presented in Table 3.

Table 3. Descriptive Statistics of Pretest and Posttest Scores

Assessment	Mean	N	Standard deviation	Standard error of mean
Pretest	6.00	13	1.155	0.320
Posttest	9.15	13	1.214	0.337

Table 3 shows that the mean score increased from 6.00 (SD = 1.155) before the intervention to 9.15 (SD = 1.214) afterward. The relatively similar standard deviations indicate comparable dispersion of total scores across the two assessments. These descriptive findings support the observation that participants generally achieved higher geometric shape recognition scores following the learning activities.

The paired-samples t-test results reported in the original analysis are presented in Table 4.

Table 4. Paired-Samples t-Test Results

Paired comparison	Mean difference	SD	SE	95% CI Lower	95% CI Upper	<i>t</i>	<i>d</i> <i>f</i>	<i>p</i>
Pretest – Posttest	–3.154	0.376	0.104	–3.381	–2.927	–30.281	12	< .001

Note. SD = standard deviation of paired differences; SE = standard error; CI = confidence interval.

As presented in Table 4, the paired-samples t-test indicated a statistically significant difference between pretest and posttest scores,

$t(12) = -30.281, p < .001$. The mean difference was -3.154 , with a 95% confidence interval ranging from -3.381 to -2.927 . The negative value resulted from subtracting posttest scores from pretest scores and therefore indicates higher scores following the intervention.

Overall, the descriptive results demonstrate consistent improvements in geometric shape recognition across all participants and assessment indicators. The reported paired-samples t-test also indicated a statistically significant difference between assessments. Nevertheless, the non-normal distribution of paired differences and the absence of a control group require caution when interpreting the statistical findings and attributing the observed improvement specifically to Talking Flashcard media.

The findings revealed an improvement in children's geometric shape recognition following the implementation of Talking Flashcard media, with the mean score increasing from 6.00 to 9.15. This result is consistent with Hamida and Aulina (2021), who reported improvements in geometric shape recognition through tangram activities. Similarly, Azhima et al. (2021) highlighted the potential of flashcards as learning materials for introducing early mathematical concepts, including numbers and geometric shapes. Although these studies employed different instructional approaches, their findings suggest that developmentally appropriate visual and interactive learning materials can support children's early mathematical understanding.

The improvement in children's geometric shape recognition is

consistent with previous research highlighting the potential of interactive mathematical learning activities. Taborda-Osorio and Otálora (2023) found that a game-based intervention produced greater improvements in preschool children's numerical and geometric knowledge compared with a control group. Similarly, Skene et al. (2022), through a systematic review and meta-analysis, reported positive effects of guided play on children's shape knowledge and early mathematical skills. Studies by Matondang et al. (2022) and Riadiah et al. (2025) further discussed the application of flashcards in early childhood cognitive development and foundational mathematics learning. Together, these studies support the relevance of interactive learning activities, although their findings cannot establish the specific effectiveness of Talking Flashcards.

The greatest proportional improvement was observed in naming geometric shapes (87.8%), followed by identifying (54.1%) and grouping geometric shapes (35.1%). The substantial improvement in naming may be associated with the audio feature of Talking Flashcards, which allowed children to hear and repeat the names of geometric shapes. Meanwhile, the smaller proportional improvement in grouping may reflect the relatively high initial scores in this indicator. These findings are consistent with the importance of interactive learning experiences identified by Fisher et al. (2013), who demonstrated that guided play supported preschool children's acquisition of geometric knowledge.

Nevertheless, the present study cannot establish whether the audio

feature was independently responsible for the observed improvement. The relatively greater improvement in naming geometric shapes may also be considered in relation to the role of language during spatial learning. Pruden et al. (2011) identified associations between children's exposure to spatial language and their later spatial abilities. Similarly, Ferrara et al. (2011) found that guided block play encouraged greater use of spatial vocabulary among parents and children. These findings suggest that repeated opportunities to hear, recognize, and use geometric terms may contribute to children's development of shape-related vocabulary. Nevertheless, the present study cannot determine whether the audio component independently produced the observed improvement.

From an educational perspective, Talking Flashcards may serve as a supplementary learning medium for introducing basic geometric concepts to children aged 3–4 years. Teachers can integrate the media into guided play, shape-identification activities, and everyday classroom interactions to encourage children to associate geometric representations with familiar objects. This approach emphasizes active participation rather than passive exposure to visual and auditory information, supporting the development of foundational mathematical understanding.

The educational implications of these findings also emphasize the importance of active engagement. Hirsh-Pasek et al. (2015) proposed that effective educational technologies should promote active, engaging,

meaningful, and socially interactive learning experiences. Accordingly, Talking Flashcards should be integrated with guided conversations, shape-matching activities, and opportunities to identify geometric forms in everyday objects. Such activities may strengthen children's learning experiences beyond simply listening to recorded shape names.

Despite the significant improvement in posttest scores, the findings should be interpreted cautiously because the study involved only 13 participants and did not include a control group. Furthermore, the distribution of paired score differences did not meet the normality assumption for the paired-samples t-test. As emphasized by Knapp (2016), one-group pretest–posttest designs cannot adequately eliminate alternative explanations for observed changes. Therefore, the findings provide preliminary evidence of improved geometric shape recognition following the learning activities rather than definitive proof of a causal effect. Future research involving larger samples, comparison groups, and appropriate statistical procedures is recommended.

Conclusion

This study found that children's geometric shape recognition improved following the implementation of Talking Flashcard media, as indicated by an increase in mean scores from 6.00 to 9.15. The greatest improvement was observed in naming geometric shapes (87.8%), suggesting the potential value of combining visual and auditory elements in early geometry learning. These findings indicate that Talking Flashcards may serve as a supplementary learning medium for

children aged 3–4 years. However, the small sample size, absence of a control group, and limitations of the statistical assumptions restrict causal interpretation. Future research should involve larger samples, comparison groups, and appropriate statistical analyses to further evaluate the effectiveness of Talking Flashcards in early childhood education.

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