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Application of the Tracking Game to Improve the Cognitive Ability of Children Aged 5–6 Years

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Abstrak

Kemampuan kognitif merupakan fondasi penting bagi kesiapan belajar anak usia dini, namun di banyak Taman Kanak-Kanak stimulasinya masih bersifat klasikal sehingga sebagian anak belum optimal mengenal bentuk, bilangan, dan pola. Penelitian ini bertujuan meningkatkan kemampuan kognitif anak usia 5–6 tahun melalui penerapan permainan mencari jejak di TK Al-Ikhlas Pudak, Kecamatan Kumpeh Ulu, Kabupaten Muaro Jambi. Penelitian menggunakan desain Penelitian Tindakan Kelas (PTK) model Kemmis dan McTaggart yang dilaksanakan dalam dua siklus, masing-masing meliputi tahap perencanaan, tindakan, observasi, dan refleksi, didahului tahap pra-siklus. Subjek penelitian adalah lima anak Kelompok B beserta guru kelas. Data dikumpulkan melalui lembar observasi kemampuan kognitif (20 butir berskala BB–MB–BSH–BSB), pedoman wawancara guru semi-terstruktur, dan angket skala Likert lima poin (15 pernyataan), kemudian dianalisis secara deskriptif kualitatif dan kuantitatif sederhana dengan triangulasi teknik dan sumber. Hasil penelitian menunjukkan peningkatan ketuntasan kognitif (kategori BSH dan BSB) dari 38% pada pra-siklus menjadi 64% pada siklus I, dan mencapai 84% pada siklus II, melampaui indikator keberhasilan 80%. Rata-rata skor angket pada siklus II sebesar 4,38 termasuk kategori sangat efektif. Aspek bentuk-warna-ukuran-pola berkembang paling menonjol, sedangkan aspek pemecahan masalah memerlukan penguatan scaffolding guru. Penelitian menyimpulkan bahwa permainan mencari jejak efektif meningkatkan kemampuan kognitif anak usia dini dan layak dijadikan kegiatan rutin.

Kata Kunci: permainan mencari jejak; kemampuan kognitif; anak usia dini; penelitian tindakan kelas.

Abstract

Cognitive ability is a crucial foundation for early childhood learning readiness, yet in many kindergartens its stimulation remains classical, leaving some children suboptimal in recognizing shapes, numbers, and patterns. This study aims to improve the cognitive ability of children aged 5–6 years through the implementation of the tracking game at TK Al-Ikhlas Pudak, Kumpeh Ulu District, Muaro Jambi Regency. It employed a Classroom Action Research (CAR) design based on the Kemmis and McTaggart model, conducted in two cycles—each comprising planning, action, observation, and reflection—preceded by a pre-cycle phase. The subjects were five children in Group B and their classroom teacher. Data were collected through a cognitive observation sheet (20 items on a BB–MB–BSH–BSB scale), a semi-structured teacher interview guide, and a five-point Likert questionnaire (15 statements), then analyzed descriptively using technique and source triangulation. The results show an increase in cognitive mastery (BSH and BSB categories) from 38% in the pre-cycle *to 64% in cycle I, reaching 84% in cycle II, exceeding the 80% success indicator. The mean questionnaire score in cycle II was 4.38, classified as highly effective. The shape-color-size-pattern aspect developed most prominently, while problem solving required stronger teacher scaffolding. The study concludes that the tracking game effectively improves early childhood cognitive ability and is suitable as a routine activity.*

Keywords: *tracking game; cognitive ability; early childhood; classroom action research.*

Introduction

Early childhood education represents a golden age that strongly determines the quality of an individual's development in subsequent life stages. Within this age range, all of a child's potential—physical, social-emotional, language, and especially cognitive—develops very rapidly and is highly sensitive to environmental stimulation. Cognitive ability encompasses a child's capacity to recognize general knowledge and science, understand the concepts of shape, color, size, and pattern, recognize numbers and number symbols, and solve simple problems. Mastery of these skills in early childhood has been shown to be an important predictor of later academic success and child well-being [1], [2].

Young children's cognitive functioning is closely linked to executive function, a set of mental processes that enable children to focus attention, inhibit impulses, hold information in working memory, and shift focus flexibly [3]. Executive function develops gradually from early childhood and forms the foundation for higher-order thinking [4]. Consequently, cognitive development in the preschool period must be deliberately and structurally designed rather than simply left to develop naturally [5].

A number of studies affirm that play is a natural mechanism for children's cognitive maturation because it allows thinking to extend beyond the limits of concrete experience [6]. Play-based learning that is purposefully designed by educators can foster children's executive function and core cognitive skills [7], [8]. Recent systematic reviews and meta-analyses report that educational games contribute positively to the cognitive, social, and learning-motivation development of young children [9], [10]. Game-based interventions, both conventional and digital, have also been shown to improve preschool executive function [11], [12].

One potential form of play is the tracking game. This game requires children to follow marks or trails, recognize directions, remember clues, count objects, match number symbols, and solve problems when a trail is broken. Prior research shows that tracking-game media can develop the cognitive aspects of young children, with up to 80% reaching the well-developed category [13], improve literacy ability [14], and sharpen visual-spatial intelligence [15]. Maze-based games have even been shown to train children's logic, patience, concentration, and ability to focus attention [15], [16].

Although these findings are promising, most prior studies focus on motor, literacy, or numeracy aspects separately, and few measure the improvement of cognitive ability comprehensively based on the Child Development Achievement Level Standards (STPPA). Moreover, the results of play interventions on cognitive function are not always consistent across studies [17], so empirical evidence is needed in specific local contexts with a design that allows continuous improvement. Initial observation at TK Al-Ikhlas Pudak revealed that cognitive stimulation remained classical: children tended to passively receive the teacher's explanations, some did not yet recognize letters and number symbols, and they easily forgot the sequence of instructions. This condition forms the basis for the urgency of action.

Based on the above, this study aims to improve the cognitive ability of children aged 5–6 years through the application of the tracking game at TK Al-Ikhlas Pudak using a Classroom Action Research design. The novelty of this study lies in the integrated measurement of four cognitive aspects referring to the STPPA of Permendikbud No. 137 of 2014, combined with a cyclical approach that allows refinement of the intervention between cycles based on teacher and researcher reflection.

Research Method

This study employed a Classroom Action Research (CAR) design adopting the Kemmis and McTaggart spiral model. This model was chosen because it emphasizes the cyclical nature of improving instructional practice through four repeated stages—planning, action, observation, and reflection—thereby enabling the teacher to act as both researcher and agent of change [18], [19]. The study was conducted in two cycles and preceded by a pre-cycle stage to capture the initial condition of the children's cognitive ability. The research flow is presented in Figure 1.

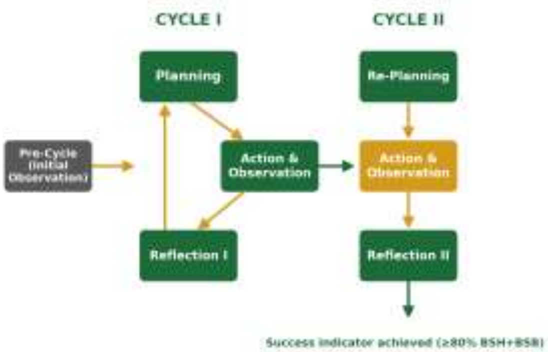

Figure 1. Classroom Action Research Flow of the Kemmis and McTaggart Model

Source: Adapted from Kemmis and McTaggart [18]; processed by the researcher (2026)

Subjects and Research Setting

The study was conducted at TK Al-Ikhlas Pudak, Kumpeh Ulu District, Muaro Jambi Regency, Jambi Province, during the even semester of the 2025/2026 academic year. The research subjects consisted of five Group B children aged 5–6 years (Fahri, Shafa, Faiz, Nahdia, and Abi) together with the classroom teacher, who served as the main collaborator and key informant.

Action Procedure

Each cycle consisted of two meetings. In the planning stage, the researcher and teacher developed daily lesson plans, prepared the trail media (arrow marks, geometric-shape symbols, number cards, and concrete objects), and set achievement indicators. In the action stage, the teacher implemented the tracking game: children followed a series of posts, recognized directions and the patterns of marks, counted and matched objects with number symbols, and solved problems when a trail was broken. The observation stage was carried out simultaneously with the action using observation sheets. The reflection stage evaluated achievements and obstacles as the basis for improving the next cycle. In cycle II, improvements focused on adding game variations so that children would not become bored and on strengthening teacher scaffolding in the aspect of remembering clues.

Data Collection and Analysis Techniques

Data were collected through three complementary instruments. First, a cognitive ability observation sheet containing 20 items with four achievement categories, namely Not Yet Developing (BB), Beginning to Develop (MB), Developing as Expected (BSH), and Developing Very Well (BSB), referring to the four cognitive aspects of the STPPA. Second, a semi-structured teacher interview guide of ten questions to explore the teacher's perceptions. Third, a five-point Likert questionnaire consisting of 15 statements ranging from Strongly Agree (5) to Strongly Disagree (1).

Qualitative data analysis was carried out through the stages of data reduction, data display, and conclusion drawing [20]. Observation and questionnaire data were processed descriptively using the percentage formula in Equation 1 and the mean score in Equation 2. Data validity was ensured through technique triangulation (observation, interview, documentation) and source triangulation (teacher and researcher) [20], [21].

$$P = (f / N) \times 100\% \quad (1)$$

$$\bar{X} = (\Sigma x) / n \quad (2)$$

where P is the percentage of mastery, f is the frequency of the BSH and BSB categories, N is the total number of observations, $\bar{X}$ is the mean questionnaire score, Σx is the sum of scores, and n is the number of items. The study is declared successful if at least 80% of observations reach the BSH or BSB category [22].

Findings and Discussion

1. Pre-Cycle Condition

The results of the initial observation showed that the children's cognitive ability was still low. Of 100 observations (20 items × 5 children), only 38% reached the BSH and BSB categories, while the rest were in the BB and MB categories. Children tended to have difficulty recognizing repeated patterns, matching the number of objects with number symbols, and remembering the sequence of clues. This condition formed the basis for implementing the action using the tracking game. The research framework is presented in Figure 2.

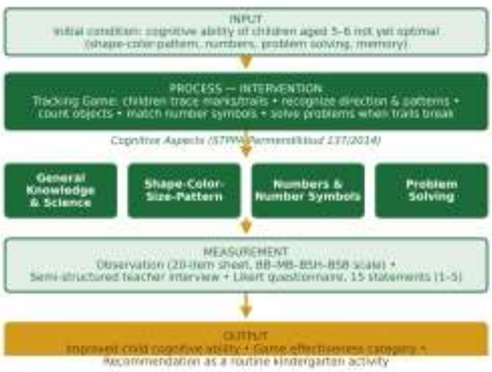

Figure 2. Research Framework
Source: Processed by the researcher (2026)

2. Cycle I Results

In cycle I, the tracking game began to be applied across two meetings. The observation results showed an increase in cognitive mastery to 64%. The recapitulation of the category distribution in cycle I is presented in Table 1.

Table 1. Distribution of Cognitive Development Categories in Cycle I

No	Development Category	Frequency	Percentage (%)
1	Not Yet Developing (BB)	10	10.0
2	Beginning to Develop (MB)	26	26.0
3	Developing as Expected (BSH)	38	38.0
4	Developing Very Well (BSB)	26	26.0
	Total	**100**	**100.0**

Source: Processed primary data (2026)

Although there was an improvement, the achievement of 64% did not yet meet the 80% success indicator. Joint reflection with the teacher identified two main obstacles: some children still easily forgot the symbols they had passed, and the game variation was still limited so that some children began to feel bored. These findings are consistent with the literature stating that the working memory and executive function of young children are still developing gradually and require directed adult support [7], [11]. On this basis, improvements were designed for cycle II.

3. Cycle II Results

In cycle II, the game was varied by adding new post challenges, using a more diverse range of concrete objects, and strengthening teacher scaffolding in the form of guiding questions while children recalled clues. The observation results showed that cognitive mastery increased to 84%, exceeding the success indicator. The recapitulation of the category distribution in cycle II is presented in Table 2.

Table 2. Distribution of Cognitive Development Categories in Cycle II

No	Development Category	Frequency	Percentage (%)
1	Not Yet Developing (BB)	4	4.0
2	Beginning to Develop (MB)	12	12.0
3	Developing as Expected (BSH)	41	41.0
4	Developing Very Well (BSB)	43	43.0
	Total	**100**	**100.0**

Source: Processed primary data (2026)

4. Between-Cycle Comparison

The comparison of cognitive mastery (combined BSH and BSB) from the pre-cycle to cycle II is presented in Table 3 and visualized in Figure 3. A consistent and significant increase is evident at each stage.

Table 3. Improvement of Cognitive Mastery Between Cycles

No	Stage	Mastery (BSH+BSB) %	Increase (%)
1	Pre-Cycle	38.0	–
2	Cycle I	64.0	26.0
3	Cycle II	84.0	20.0

Source: Processed primary data (2026)

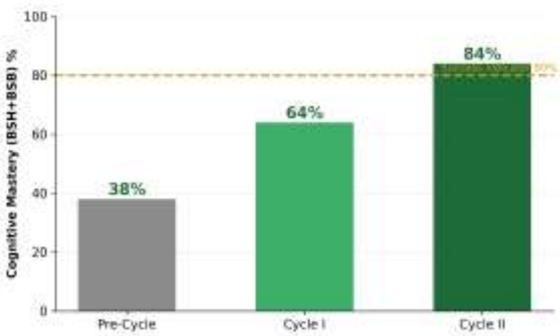

Figure 3. Improvement of Cognitive Mastery Between Cycles
Source: Processed primary data (2026)

When viewed per STPPA cognitive aspect, an increase occurred in all four aspects, as presented in Table 4 and Figure 4. The shape-color-size-pattern concept aspect obtained the highest achievement in cycle II, while the problem-solving aspect, although it increased the most sharply, remained in the lowest position.

Table 4. Cognitive Ability Achievement per STPPA Aspect Between Cycles (%)

No	Cognitive Aspect	Pre-Cycle	Cycle I	Cycle II
1	General knowledge & science	42	68	86
2	Shape-color-size-pattern	45	70	90
3	Numbers & number symbols	35	60	80
4	Problem solving	30	55	78

Source: Processed primary data (2026)

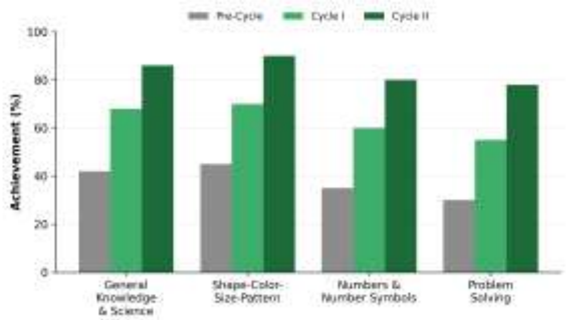

Figure 4. Cognitive Ability Achievement per STPPA Aspect Between Cycles
Source: Processed primary data (2026)

5. Questionnaire and Interview Results

The Likert-scale questionnaire completed by the teacher at the end of cycle II for the 15 statements produced a mean score of 4.38. Based on the scoring guideline, the range 4.21–5.00 falls into the Highly Effective category. A summary of the questionnaire results on key indicators is presented in Table 5.

Table 5. Summary of Effectiveness Questionnaire Results (Selected Indicators)

No	Statement Indicator	Score	Category
1	Children were enthusiastic about the game	5	Highly Effective
2	The game helped recognize shapes & colors	5	Highly Effective
3	Children's memory of clues improved	4	Effective
4	The game trained problem solving	4	Effective
5	Suitable as a routine kindergarten activity	5	Highly Effective
	Overall mean (15 items)	**4.38**	**Highly Effective**

Source: Processed primary data (2026)

The interview results reinforced the quantitative findings. The teacher stated that the children were very enthusiastic about the game, able to distinguish shapes by color and size, and that some had begun to recognize vowels through this activity. The teacher also acknowledged that initially the children easily forgot the symbols they had passed and thus required guidance, but this condition improved after game variations were added in cycle II. The convergence of the three data sources—observation, questionnaire, and interview—strengthens the validity of the findings through triangulation.

6. Discussion

The improvement in children's cognitive ability from 38% to 84% confirms that the tracking game is effective as a means of cognitive stimulation. This effectiveness can be explained through several mechanisms. First, the tracking game requires children to observe marks carefully, classify shapes and colors, and order objects—activities that directly train visual discrimination and classification abilities. This aligns with the finding that play with open-ended materials drives qualitative change in children's core cognitive skills [23]. Second, the challenge-and exploration-based nature of the game fosters curiosity and intrinsic motivation, which according to the literature are optimal conditions for early childhood learning [9], [24].

The highest achievement in the shape-color-size-pattern aspect indicates that the concrete visual media used were highly suited to children's preoperational stage of thinking. Conversely, the relatively lagging achievement in the problem-solving aspect underscores that higher-order executive function abilities require more intensive and sustained scaffolding [3], [7]. The sharp increase in this aspect in cycle II (from 55% to 78%) demonstrates that directed teacher intervention—in the form of guiding questions and varied challenges—can accelerate the development of problem-solving ability. This finding supports the view that the effectiveness of play on executive function depends heavily on the design and mediation of adults, rather than the play activity itself alone [17], [25].

Practically, the results of this study make an important contribution to early childhood educators: routine classroom activities can be transformed into meaningful learning experiences by carefully designing the rules of the game without having to replace the curriculum [25]. The tracking game, which utilizes simple and contextual media, has proven to be applicable at low cost yet with a real impact on children's cognitive development. Thus, this study both reinforces and extends prior empirical evidence [13], [14] by adding a cyclical dimension that shows how continuous improvement can maximize the impact of the intervention.

Conclusion

This classroom action research concludes that the application of the tracking game is effective in improving the cognitive ability of children aged 5–6 years at TK Al-Ikhlas Pudak, Kumpeh Ulu District, Muaro Jambi Regency. The children's cognitive mastery increased from 38% in the pre-cycle to 64% in cycle I, and reached 84% in cycle II, exceeding the 80% success indicator, with a mean questionnaire score of 4.38, classified as highly effective. The shape-color-size-pattern recognition aspect developed most prominently, while the problem-solving aspect increased the most sharply owing to strengthened teacher scaffolding. The implication of this study is the need to make the tracking game a routine activity that is periodically varied, as well as to strengthen the teacher's mediating role in higher-order thinking aspects. Further research is recommended to use an experimental design with a larger number of subjects and a comparison group to test the generalizability of the findings.

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