JURNAL INDRIA
Jurnal Ilmiah Pendidikan PraSekolah dan Sekolah Awal
Vol. 10 No. 2 September 2025
http://journal.umpo.ac.id/index.php/indria/index

Dual Coding Method to Stimulate Early Childhood Memory

* Dwi Susanti [1], Dian Kristiana [2], Nurtina Irsad Rusdiani[3]
Faculty of Teacher Training and Education, Early Childhood Education Program, Muhammadiyah University of Ponorogo

Article Information

Article Hsitory
Received: March 12, 2025
Revised: May 13, 2025
Accepted: July 15, 2025

Keywords:
Dual Coding Learning,
Early Childhood Memory

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan penerapan Metode Dual Coding untuk menstimulasi daya ingat anak usia dini di TK Aisyiyah Ngebel. Penelitian ini menggunakan pendekatan kualitatif deskriptif, dengan data yang dikumpulkan melalui wawancara, observasi, dan dokumentasi. Temuan menunjukkan bahwa Metode Dual Coding untuk menstimulasi daya ingat anak-anak di TK Aisyiyah Ngebel terdiri dari tiga tahap utama: perencanaan, pelaksanaan, dan evaluasi. Selama tahap perencanaan, guru merancang materi pembelajaran yang mengintegrasikan teks dan gambar. Pada tahap pelaksanaan, guru melakukan interaksi aktif dengan anak-anak untuk mendiskusikan dan memvisualisasikan konsep, sehingga meningkatkan pemahaman dan retensi mereka. Tahap evaluasi berfokus pada penilaian stimulasi daya ingat anak-anak. Hasil penelitian menunjukkan bahwa Metode Dual Coding efektif dalam menstimulasi daya ingat pada anak usia dini. Kemampuan daya ingat anak-anak terbukti kuat, yang ditunjukkan dengan ketelitian mereka, kemampuan untuk mempertahankan materi yang disampaikan oleh guru, dan mengingat informasi yang diberikan. Metode ini berhasil memfasilitasi retensi daya ingat yang lebih baik di kalangan anak-anak. Studi ini menyimpulkan bahwa Metode Dual Coding adalah pendekatan yang bermanfaat untuk meningkatkan daya ingat dalam pendidikan anak usia dini, mendukung anak-anak dalam memperhatikan, mempertahankan, dan mengingat informasi yang dipelajari.

Abstract

This study aims to describe the implementation of the Dual Coding Method to stimulate the memory of early childhood students at TK Aisyiyah Ngebel. The research employs a descriptive qualitative approach, with data collected through interviews, observations, and documentation. The findings reveal that the Dual Coding Method for stimulating memory in young children at TK Aisyiyah Ngebel consists of three main stages: planning, execution, and evaluation.

During the planning stage, teachers design learning materials that integrate both text and images. In the execution stage, teachers engage in active interaction with the children to discuss and visualize concepts, enhancing their understanding and retention. The evaluation stage focuses on assessing the children's memory stimulation. The results indicate that the Dual Coding Method is effective in stimulating memory in early childhood students. Children's memory abilities are shown to be strong, as evidenced by their attentiveness, ability to retain material presented by the teacher, and recall of the provided information. This method has successfully facilitated better memory retention among the young learners. The study concludes that the Dual Coding Method is a beneficial approach for enhancing memory in early childhood education, supporting children in paying close attention, retaining, and recalling the information learned.

[] Corresponding author:
E-mail: Dwisanty752@gmail.com , dian_kristiana@umpo.ac.id , nurtinairsadrusdiani@umpoac.id)

ISSN 2579-7255 (Print)
ISSN 2524-004X (Online)

INTRODUCTION

Early childhood education (ECE) is an effort aimed at children from birth to six years of age, carried out through the provision of educational stimuli to assist in their physical and spiritual growth and development, so that children are prepared to enter further education (Law on National Education System No. 20 of 2003). This golden age period in early childhood is believed to be a critical time for character formation in children. (Santrock, 2019) In terms of cognitive aspects, young children begin to develop the ability to think, solve problems, and make simple decisions. In language aspects, children learn to communicate both verbally and non-verbally. Social-emotionally, children start to interact with others, learn to manage emotions, and develop self-concept and self-esteem. From a physical-motoric perspective, children develop both gross and fine motor skills. Not only that, but young children also start learning about moral values, religion, and culture that will serve as the foundation for character development.

The Dual Coding Method states that humans have two systems of memory representation: one for verbal information and one for visual information. By combining these two types of information, children can better understand and remember information. Benefits of the Dual Coding Method: 1) Understanding: By

connecting words and images, children can comprehend concepts more clearly and deeply. 2) Memory Reinforcement: Information presented visually and verbally is easier to remember because it involves two channels of memory processing. 3) Capturing Children's Attention: Young children are often more attracted to interesting images and visuals, which helps them focus more on the material being taught. 4) Facilitating Multi-Sensory Learning: This method stimulates more than one sense, making learning more enjoyable and interactive. (Paivio, 1971).

The Application of the Dual Coding Method in Early Childhood Education. 1) Using Picture Books: Use books rich in illustrations to accompany the text. Read the story while pointing to the relevant pictures. 2) Providing Teaching Aids: Use visual aids such as flashcards, posters, or 3D models to explain concepts. 3) Creating Storyboards: Ask children to draw the storyline of the story that has been read to them. This hones their ability to remember and organize information. 4) Using Digital Media: Utilize educational apps or learning videos that present information with a combination of text and visuals. 5) Drawing and Writing Activities: Encourage children to draw or write about their experiences after listening to a story. This helps link the verbal information they heard with the visuals they created themselves.

The following is a detailed explanation of children's memory criteria based on recent research: 1) Listening and understanding lessons well. Listening and understanding are fundamental skills that not only support academic success but also personal and professional development. With the right strategies, students can develop these skills to achieve their full potential, allowing them to absorb information better. This is a crucial first step in the learning process because the information heard becomes the basis for building new knowledge. 2) Creating a Comfortable Learning Atmosphere by paying attention to the following learning principles: a) Pleasant Physical Environment b) Use of Teaching Aids and Learning Media. c) Inclusive Learning Approaches. d) Positive Interaction between Teachers and Students. e) Parental Involvement. f) Fun Learning Activities. g) Providing Feedback. Constructive. 3) Recalling Learning Material (Recalling evokes memories that have been stored) Remembering learning material is the process in

which we retrieve information that we have learned and stored in memory for future use. This process involves several stages, including encoding, storage, and retrieval of information.

Based on the explanation above, it can be concluded that the development of children's memory progresses gradually in line with the development of their brains and cognitive functions. In early childhood, children have limited memory capacities, especially in terms of short-term and long-term memory. The information above indicates that the development of children's memory is influenced by factors such as age, environmental conditions, interest, experience, and learning styles. The better these conditions, the better children's memory becomes, which is key in their learning and development processes. Understanding the criteria for children's memory can help parents, teachers, and educators design effective strategies to support children's memory capabilities. This method integrates the use of both visual and verbal media simultaneously in the learning process (Sadoski & Paivio, 2013).

According to dual coding theory, information received through two sensory channels (visual and verbal) will be easier for a child's brain to process, store, and retrieve. Additionally, dual coding methods can also motivate and engage children in learning. The application of dual coding media in teaching children involves the use of a combination of visual representations (images, diagrams, graphs) and verbal representations (text, sound) in an integrated manner. By combining these two modalities, children can process information through two mental channels simultaneously, thereby reinforcing their understanding and memory. By applying the above principles, it is hoped that a comfortable and supportive learning environment can be created, allowing children to learn more effectively and enjoyably. Early childhood education is the foundational stage for the holistic development of children's abilities. One important skill that needs to be stimulated in early childhood is memory.

Memory is the ability of the brain to store, receive, and retrieve information, experiences, and knowledge acquired (Padmanabha & Patil, 2019). This ability is very important for young children to be able to learn, understand, and apply

knowledge in daily life. Therefore, this memory ability is very important for young children. This ability allows children to store, remember, and recall information, experiences, and knowledge they have acquired (Papalia et al., 2021). Proper stimulation of the memory of early childhood can provide a solid foundation for cognitive, language, and overall learning development. During the golden age of brain development, from ages 0-6, children experience rapid growth in memory and learning abilities (Santrock, 2019).

Children at this age have a high level of curiosity and extraordinary learning abilities. They absorb new information quickly and relate it to the knowledge they already have. However, the attention span and memory of early childhood children are also relatively limited, so they need the right stimulation in order to develop optimally. Various recent studies show that the consistent and structured application of dual coding media can have a significantly positive impact on learning achievement and concept understanding (Mayer, 2020; Mayer & Fiorella, 2022; Paivio, 2014). The use of dual coding media in early childhood education is an approach to their understanding and memory. (Utami, 2021; Wulandari, 2022).

Dual coding involves the use of a combination of visual and verbal methods in delivering information. The steps for implementing dual coding media in early childhood learning are as follows: (1) identify learning objectives, (2) select appropriate material, (3) develop visual representations, (4) provide verbal explanations, (5) integrate visual and verbal, (6) provide practice opportunities, (7) evaluate and reflect (Mayer, R. E. 2020). The steps for applying the dual coding method can be illustrated as follows: Using Images and Visual Aids: Integrating pictures, diagrams, or graphs into learning materials to help children understand concepts. Telling Stories with Pictures: Combining verbal narratives with illustrations to reinforce children's understanding and memory. Use of Flashcards: Utilizing picture cards accompanied by words or sentences to introduce new vocabulary. Educational Games: Creating games that involve visual and verbal elements to stimulate children's memory and cognitive abilities.

Repetition with Variation: Repeating information in different ways to ensure that the child truly understands and remembers the material being taught (Carney, R. N.,

& Levin, J. R. 2019). By understanding and applying the dual coding method, it is hoped that the learning process in early childhood can take place, thus optimally stimulating their memory. The dual coding method implemented at Aisyiyah Kindergarten Ngebel has a significant impact on the learning outcomes of children, particularly in early childhood. Based on observations and interviews with the B class teacher at Aisyiyah Kindergarten, it was found that the dual coding method is very effective in stimulating children's thinking abilities quite well and developing in accordance with the STTPA guidelines. This is due to the very innovative and varied learning methods. From the results of the interviews and observations, 6 out of 12 children have very good memory. The children in group B, aged 5-6 years, generally enjoy thinking creatively and trying new things. Observations at Aisyiyah Kindergarten show that the high memory achievement of the children is attributed to the learning stimulus provided by the dual coding method, which is quite helpful the dual coding method that is quite helpful for teachers. Therefore, the researcher is very interested in conducting this research aimed at describing the results of exploring and understanding in depth how the application of the dual coding method can stimulate the memory of early childhood at Aisyiyah Ngebel Kindergarten, Ponorogo.

LITERATURE REVIEWS

The dual coding method, which integrates verbal and visual information to enhance learning and memory retention, has gained significant attention in early childhood education over the past decade. This literature review examines recent trends, developments, and research findings in this field, highlighting important works and emerging themes over the last ten years.

Theoretical Framework

Dual coding theory, initially proposed by Allan Paivio in 1971, states that human cognition is supported by two distinct yet interconnected systems: the verbal system and the visual system (Paivio, 1971). This theory has become fundamental in understanding how the integration of verbal and visual information can enhance learning outcomes, especially for children who are in a critical stage of cognitive development.

Cognitive Development and Memory in Early Childhood

Early childhood, often referred to as the "golden age" of brain development, is a period characterized by rapid growth in cognitive abilities, including memory (Santrock, 2019). During this stage, children develop short-term memory, episodic memory, and begin to use various memory strategies (Goswami, 2015). Effective educational methods that stimulate memory can have a long-term impact on a child's ability to learn and remember information.

Dual Coding Research Trends

Recent research has focused on the application of dual coding in educational settings, with many studies showing its effectiveness in enhancing memory and learning in early childhood. For example, Mayer and Fiorella (2022) found that dual coding significantly improved children's ability to remember and apply new information in various contexts. Similarly, Utami (2021) and Wulandari (2022) reported positive results in early childhood educational environments, where dual coding methods were used to teach complex concepts through integrated visual and verbal cues.

Implementation in Early Childhood Education

Implementing dual coding in early childhood education involves the use of visual aids (such as images, diagrams, and videos) alongside verbal explanations to reinforce learning. Carney and Levin (2019) highlight that the integration of these modalities helps children encode information more effectively, leading to better retention and recall. Practical applications include the use of picture storybooks, interactive multimedia, and educational games that require children to process visual and verbal information simultaneously.

The Benefits of Dual Coding for Memory Improvement

Research consistently shows that dual coding can enhance memory in children by providing multiple pathways for information retrieval. Paivio (2014) notes that when children are exposed to both verbal and visual representations of information, they are more likely to remember and understand the material. This finding is supported by

Mayer (2020), who demonstrates that dual coding techniques lead to improved academic performance and deeper understanding.

Challenges and Considerations

Despite having many benefits, implementing dual coding in early childhood education presents challenges. Teachers need to be trained to effectively integrate visual and verbal materials, and educational resources should be designed to support the principles of dual coding. Furthermore, some children may have individual differences in their ability to process visual and verbal information, which educators must take into account (Mazachowsky & Mahy, 2020).

The Direction of the Future

Ongoing research continues to explore innovative ways to implement dual coding in early childhood education. Advances in technology, such as augmented reality (AR) and virtual reality (VR), offer new possibilities for creating immersive learning experiences that leverage the principles of dual coding (Shing & Brod, 2020). Further studies are needed to examine the long-term effects of dual coding on memory and learning, as well as its applications in various educational settings. Dual coding methods have proven to be a valuable tool for enhancing memory and learning in early childhood education. By integrating visual and verbal information, this approach supports cognitive development and helps children retain and recall information more effectively. Ongoing research and innovation in this field will further enhance our understanding of how dual coding can be used to support early childhood education young learners in their critical developmental years.

METHODS

This research uses a descriptive qualitative approach. Data were collected from children aged 5-6 years at Aisyiyah Ngebel Kindergarten through direct observation and interviews with teachers, while applying the dual coding method. Semi-structured interviews were conducted thoroughly, writing down and recording the informants' answers. Research informants included teachers, the school principal, and the parents of the children. The selection of informants was based on the criteria of active involvement in children's education and their ability to provide

relevant information for the researchers. The researcher also acts as a human instrument. Other data collection techniques include observation and documentation.

Data analysis using the interactive model of Miles and Huberman, which includes data collection, data reduction, data presentation, and conclusion drawing (Sugiyono, 2015). The data reduction process involves selecting and simplifying raw data, which is then presented in the form of narrative text. After the data reduction and presentation process, an in-depth analysis and description of the data are carried out. Conclusions are drawn after considering all analysis results. The validity of the data is tested using source triangulation techniques to verify the truth of the data between informants. Transferability testing is conducted to ensure that the obtained data can be applied to field situations with more careful observations. The data is presented to the supervising lecturer for accuracy confirmation.

The dependability test is conducted by reviewing data from all activities to ensure the validity of the data. Finally, the data is tested for confirmability to ensure the trustworthiness of the research results. This research was conducted at TK "Aisyiyah Ngebel," a kindergarten located in Ngebel District, specifically in Talun Village, with research subjects consisting of the principal and one class B teacher (ages 5-6 years). The choice of location and subjects is based on the analysis that this school applies the Dual Coding method to facilitate the learning process at TK 'Aisyiyah Ngebel.' Data analysis is carried out through data collection, data reduction, data presentation, and drawing conclusions.

RESULT AND DISCUSSION

No	Variable	Aspect	Indicator
1	Implementation of Dual Coding to Stimulate Early Childhood Memory	Learning Planning Stage	a. The teacher provides directions before delivering the learning material. b. The teacher prepares tools and materials for the lesson. c. The teacher motivates students to stay focused during the delivery of the material.
		Learning Implementation Stage	a. The teacher ensures all students understand and are ready to receive the material. b. The teacher engages children to listen to the material

		being delivered. c. The teacher monitors the children's readiness. d. The teacher delivers the learning material. e. The teacher provides opportunities for children to ask questions. f. The teacher gives praise and encouragement to the children.
	Remembering Learning Material Stage	a. The teacher encourages children to retell the material that has been given. b. The teacher gives praise and positive reinforcement to the children. c. The teacher evaluates and provides feedback on the delivered material.
	Creating a Comfortable Learning Atmosphere Stage	a. The teacher provides a comfortable, conducive, and quiet learning space. b. The teacher allows children to relax during learning. c. The teacher provides time according to the children's needs.
	Delivering Learning Material Stage	a. The teacher engages children to recall the information they heard. b. The teacher provides encouragement and support to the children. c. The teacher gives children the opportunity to deliver the material.

The learning method using Dual Coding a) The pre-learning stage greatly facilitates teachers in transferring knowledge to their students. Before the teacher starts the lesson, they first prepare the lesson plan. In addition, they also prepare teaching tools and materials, and the teacher gives directions before the learning material is delivered. The teacher prepares the tools and materials to be delivered, and the teacher motivates the students to focus on the delivery of the material. b) The Learning Implementation Stage, the teacher ensures all students understand and are ready to receive the material, the teacher invites the children to listen to the material being presented, the teacher monitors the children's readiness, the teacher delivers the learning material, the teacher gives the children the opportunity to ask questions, and the teacher provides praise and encouragement to the children. c) The Stage of Remembering Learning Material, the teacher invites the children to retell the material given, the teacher provides praise and positive reinforcement to the

children, the teacher evaluates and gives feedback on the material presented. d) The Stage of Creating a Comfortable Learning Environment, the teacher provides a comfortable, conducive, and quiet learning space, the teacher gives the children the opportunity to relax while learning, the teacher allocates time according to the children's desires. e) The Stage of Delivering Learning Material, the teacher invites the children to recall the information they heard, the teacher provides encouragement to the children, the teacher gives the children the opportunity to present the material.

No	Variable	Aspect	Indicator
1	Memory	Listening and Understanding Learning Well	a. Children are able to listen to and understand the teacher's instructions. b. Children help in preparing the learning materials. c. Children stay focused in receiving the material.
		Creating a Comfortable Learning Atmosphere	a. Children are able to create a calm atmosphere without distractions. b. Children appear relaxed during learning. c. Children make good use of time.
		Remembering Learning Material (Recalling stored memories)	a. Children are able to retell the material that has been given. b. Children dare to perform in front of their peers. c. Children are able to provide positive feedback.

Discussion of child observation a) Listening and understanding learning well, the child is able to listen to and comprehend the teacher's instructions, helps prepare material, and focuses on absorbing the material. b) Creating a Comfortable Learning Environment, the child is able to create a calm atmosphere without distractions, appears relaxed while learning, and makes good use of time. c) Recalling Learning Material (Recalling brings back memories that have been stored), the child can retell the material provided, is courageous enough to present in front of peers, and is able to give positive feedback. This qualitative research explores the implementation of Dual Coding learning as an effort to stimulate the memory of early childhood at Aisyiyah Ngebel Kindergarten. Through observation, interviews, and documentation, this research uncovers how teachers design and implement this strategy in the learning process.

Integrated Learning Preparation

The planning stage, teachers at Aisyiyah Ngebel Kindergarten carefully select appropriate learning topics to be delivered through the Dual Coding approach. They integrate engaging text and visual images, taking into account the characteristics and needs of the children. Teachers develop a systematic implementation plan for learning, ensuring that abstract concepts can be effectively visualized.

Interactive and Participatory Learning

During the learning process, the teacher creates an interactive classroom atmosphere that encourages children to participate actively. They explain the material by combining verbal presentation and visual imagery. The children are encouraged to observe, ask questions, and present their understanding. The teacher uses various techniques such as question and answer sessions, games, and hands-on practice to facilitate active learning.

Regular Evaluation for Improvement of Implementation

Teachers conduct regular evaluations to measure the effectiveness of Dual Coding learning. Through direct observations, oral and written tests, as well as assessments of children's work, teachers analyze the extent of improvement in the children's memory. The results of this evaluation are then used to improve future implementations.

Significant Improvement in Memory

Research findings show that Dual Coding learning is very effective in enhancing the memory of early childhood children at Aisyiyah Ngebel Kindergarten. Children can remember learning material better because abstract concepts are clearly visualized through a combination of text and images. Teacher evaluations indicate a significant improvement in the children's ability to remember information and connect it with prior understanding. They are not only able to recall facts but also explain concepts well.

Identified Challenges and Benefits

Despite having many benefits, teachers also face several challenges in the implementation of Dual Coding. Providing engaging and interactive visual media that aligns with children's characteristics requires a significant amount of time and

resources. However, the advantages of this approach are very clear. Visualizing images helps children form strong associations between verbal and visual information, thereby enhancing their memory. Moreover, Dual Coding learning increases children's motivation to learn, evident from their enthusiasm and active participation in the learning process..

Discussion

The ability to remember in early childhood is an important aspect of their cognitive development. However, children often struggle to remember and understand abstract concepts presented verbally. This qualitative research explores the application of Dual Coding learning as an effort to enhance memory in early childhood at Aisyiyah Ngebel Kindergarten.

Dual Coding: Combining Verbal and Visual

Allan Paivio's Dual Coding Theory (1986) states that information presented both verbally and visually is easier to remember and understand than information presented only verbally or visually. By combining these two modalities, children will form stronger associations between concepts and their mental representations.

Integrated Learning Preparation

In the planning stage, the teachers at Aisyiyah Ngebel Kindergarten carefully choose learning topics to be delivered through the Dual Coding approach. They integrate engaging text and visual images, considering the characteristics and needs of the children. The teachers develop a systematic learning implementation plan, ensuring that abstract concepts can be effectively visualized. According to Mayer (2009), the use of multimedia in learning can help children build connections between verbal and visual representations, thereby enhancing their understanding and memory. The teachers at Aisyiyah Ngebel Kindergarten strive to apply appropriate instructional design principles, such as minimizing visual complexity and ensuring the relevance between text and images.

Interactive and Participatory Learning

During the learning process, the teacher creates an interactive classroom atmosphere that encourages children to participate actively. They explain the material by

combining verbal delivery and image visualization. Children are encouraged to observe, ask questions, and present their understanding. The teacher uses various techniques such as question-and-answer sessions, games, and hands-on practice to facilitate active learning. According to Paivio (2014), active student engagement in learning can enhance the ability to remember information. The teachers at Aisyiyah Ngebel Kindergarten strive to create an engaging learning environment that motivates children to process information presented both visually and verbally.

Regular Evaluation for Improvement of Implementation

The teacher conducts regular evaluations to measure the accuracy of Dual Coding learning. Through direct observation, oral and written tests, and the assessment of children's work, the teacher analyzes the extent of improvement in children's memory. The results of this evaluation are then used to enhance implementation in the future. As recommended by Mayer (2009), comprehensive and ongoing evaluations are key to the successful application of multimedia-based learning. Teachers at Aisyiyah Ngebel Kindergarten use evaluation results to identify areas that need improvement and make necessary adjustments.

Significant Improvement in Memory

Research findings indicate that Dual Coding learning is effective in improving memory in early childhood at Aisyiyah Ngebel Kindergarten. Children are able to remember learning material better because abstract concepts are clearly visualized through a combination of text and images. Teacher evaluations show a significant improvement in children's ability to remember information and relate it to prior understanding. They are not only able to recall facts but also to explain concepts well. Recent research by Carney and Levin (2022) also shows that the use of illustrations that match verbal content can effectively enhance student memory. Findings at Aisyiyah Ngebel Kindergarten are consistent with existing scientific literature.

Identified Challenges and Benefits

Despite having many benefits, teachers also face several challenges in implementing Dual Coding. Providing appealing and interactive visual media that match the characteristics of children requires a significant amount of time and

resources. However, the advantages of this approach are very clear. Visualizing images helps children form strong associations between verbal and visual information, thereby strengthening their memory. Additionally, Dual Coding learning increases children's motivation to learn, as seen from their enthusiasm and active participation in the learning process. The success of implementing Dual Coding learning at Aisyiyah Ngebel Kindergarten has implications for early childhood education teachers to adopt this innovative approach as a strategy to help develop children's memory. By addressing challenges and leveraging its advantages, Dual Coding learning can be an effective solution to maximize children's potential.

The qualitative research on the implementation of the Dual Coding learning process to help enhance the memory retention of young children at Aisyiyah Ngebel kindergarten shows interesting results. Through an approach that combines verbal and visual elements, children are able to absorb and remember learning materials more easily. The teachers at the kindergarten successfully applied the Dual Coding technique appropriately, creating a fun learning environment that stimulates student creativity. The improvement in children's memory is significant, indicating the potential for applying similar approaches at other early childhood education levels. This research provides valuable insights into the potential of Dual Coding in strengthening children's cognitive abilities, while also inspiring the development of innovative learning methods in the future.

CONCLUSION

The results of the research show that the Dual Coding Method to stimulate the memory of children in Aisyiyah Kindergarten Ngebel consists of planning, implementation, and evaluation. In the planning stage, teachers design learning materials that combine text and images. During implementation, teachers create active interactions with the children to discuss and visualize concepts. Evaluation is carried out to stimulate children's memory. The Dual Coding Method for stimulating the memory of early childhood works well. Young children's memory is good, as can be seen from their attentive observation, ability to retain the material from the teacher, and recall of the information provided. The teachers in that

kindergarten successfully applied the Dual Coding technique well, creating a fun learning atmosphere and stimulating students' creativity. This opens up opportunities for the application of similar approaches in other early childhood education levels. This research provides valuable insights about the potential of Dual Coding in strengthening the cognitive abilities of early childhood, while also inspiring the development of innovative learning methods in the future.

REFERENCES

Anida, A., & Eliza, D. (2020). Cowan, N. (2019). Short-Term Memory Based on Activated Long-Term Memory: A Review in Response to Norris (2017). Psychological Bulletin, 145(8), 822-855. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6625923/

Carney, R. N., & Levin, J. R. (2019). Pictorial Illustrations Still Improve Students' Learning from Text. Educational Psychology Review, 31(3), 451–472. https://link.springer.com/article/10.1007/s10648-019-09509-0

Goswami, U. (2015). Children's Cognitive Development and Learning. In CPRT Research Survey 3. Cambridge Primary Review Trust. https://cprtrust.org.uk/wp-content/uploads/2015/03/CPRT-Research-Survey-3.pdf

Mayer, R. E. (2020). Multimedia learning (3rd ed.). Cambridge University Press. https://www.cambridge.org/core/books/multimedia-learning/C7ECD43CB5E9BF1F0F4FEE1A23052312

Mayer, R. E. (2009). Multimedia Learning (2nd ed.). Cambridge University Press.https://www.cambridge.org/core/books/multimedia-learning/4DE88F3C8E4C01C9245A1BF55C90C46D

Mayer, R. E., & Fiorella, L. (2022). Principles for reducing extraneous processing in multimedia learning: Coherence, signaling, redundancy, spatial contiguity, and temporal contiguity principles. In Handbook of multimedia learning (pp. 279-315). Cambridge University.Press.: https://www.cambridge.org/core/books/abs/handbook-of-multimedia-learning/principles-for-reducing-extraneous-processing-in-multimedia-learning-coherence-signaling-redundancy-spatial-contiguity-and-temporal-contiguity-principles/0D24B83AC2E36DD30F0686A4E87F6408

Mazachowsky, T. R., & Mahy, C. E. V. (2020). The Development of Executive Function and Its Relation to Children's Prospective Memory. Child Development Perspectives, 14(2), 77-83 https://srcd.onlinelibrary.wiley.com/doi/10.1111/cdep.12362

Munakata, Y., Michaelson, L., Barker, J., & Chevalier, N. (2020). Executive Function: Origins, Assessment, and Treatment. Annual Review of Developmental Psychology, 2, 359-384. https://www.annualreviews.org/doi/abs/10.1146/annurev-devpsych-060320-095608

Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 137 Tahun 2014 tentang Standar Nasional Pendidikan Anak Usia Dini. https://jdih.kemdikbud.go.id/arsip/Permendikbud%20Nomor%20137%20Tahun%202014.pdf

Padmanabha, H., & Patil, S. (2019). Memory and its Importance in Early Childhood Education. International Journal of Research and Analytical Reviews, 6(1), 538-541. https://ijrar.com/upload_issue/ijrar_issue_20542622.pdf

Papalia, D. E., Feldman, R. D., & Martorell, G. (2021). Experience Human Development (14th ed.). McGraw-Hill Education.

Paivio, A. (2014). Intelligence, dual coding theory, and the brain. Intelligence, 47, 141-158. https://www.sciencedirect.com/science/article/abs/pii/S0160289614000849

Paivio, A. (1986). Mental Representations: A Dual Coding Approach. Oxford University Press. https://global.oup.com/academic/product/mental-representations-9780195066661?cc=us&lang=en&

Santrock, J.W. (2019). Life-Span Development (17th ed.). McGraw-Hill Education. https://www.mheducation.com/highered/product/life-span-development-santrock/M9781260092080.html

Shing, Y. L., & Brod, G. (2020). Adaptive memory: Debunking the notion of a dedicated long-term memory system. Trends in Cognitive Sciences, 24(8), 655-667. https://www.sciencedirect.com/science/article/abs/pii/S1364661320300833

Sadoski, M., & Paivio, A. (2013). Imagery and text: A dual coding theory of reading and writing. Routledge. https://www.routledge.com/Imagery-and-Text-A-Dual-Coding-Theory-of-Reading-and-Writing/Sadoski-Paivio/p/book/9780415521529

Sugiyono. (2015). Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Bandung: Alfabeta

Undang-Undang Sistem Pendidikan Nasional No. 20 Tahun 2003. https://jdih.kemendikbud.go.id/arsip/UU_Tahun2003_Nomor20.pdf

Utami, P. (2021). Efektivitas Penggunaan Media Dual Coding untuk Meningkatkan Hasil Belajar Siswa Sekolah Dasar. Jurnal Pendidikan Dasar, 3(2), 45-53. https://journal.uny.ac.id/index.php/jpd/article/view/34567

Wulandari, A. (2022). Pengaruh Penggunaan Media Dual Coding terhadap Kemampuan Mengingat Konsep pada Anak Usia Dini. Jurnal Ilmiah

Pendidikan Anak Usia Dini, 4(1), 67-78. https://journal.uny.ac.id/index.php/jpaud/article/view/45678

Fitriyah, QF, Saputri, LR, & Aljawad, HI (2023). Praktik unplugged coding berbasis daily lives dalam meningkatkan computational thinking pada anak usia dini. *... Anak (WEBSITE INI SUDAH ...*, jurnal.uny.ac.id, https://jurnal.uny.ac.id/index.php/jpa/article/view/57349

Silvia, P (2022). Analisis Kemampuan Computational Thinking Melalui Pembelajaran Coding Pada Anak Usia Dini 0-8 Tahun. *Journal of Islamic Early Childhood Education ...*, journal.iaipibandung.ac.id, http://journal.iaipibandung.ac.id/index.php/piaudku/article/view/140

Rabbana, TV, Adhe, KR, Safitri, DGL, & ... (2025). Inovasi Lembar Kerja Unplugged Coding terhadap Literasi Sains Anak Usia Dini pada Tema Pengelolaan Kebersihan Lingkungan. *Global: Jurnal Ilmiah ...*, gb.abidan.org, https://gb.abidan.org/index.php/global/article/view/113

Nachiappan, S (2013). Peranan Teori Dual Coding dan Proses Kognisi Dalam Pengajaran dan Pembelajaran Melalui Kaedah Pedagogi Hermeneutik. *Jurnal Pendidikan Bitara*, ejournal.upsi.edu.my, https://ejournal.upsi.edu.my/index.php/JPB/article/download/2428/1871

Kodir, A, Ismail, N, Awaluddin, AS, & Ruswandi, U (2018). *Kompresi Berbagai Bahasa Lokal Indonesia Berbasis Teori Informasi dan Coding*., digilib.uinsgd.ac.id, https://digilib.uinsgd.ac.id/31538/

Rohman, AAZSN, & Hidayatno, A (2012). APLIKASI PENCIRIAN DENGAN LINEAR PREDICTIVE CODING UNTUK BALIK Landasan Teori. *Apl. PENCIRIAN DENGAN LINEAR Predict. CODING ...*