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Article

The Impact of Felder's Active-Reflective VAK Learning Styles on Early Childhood Science Learning Outcomes

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A B S T R A C T

The phenomenon that occurred in the field at the research location, namely at Aisyiyah Bustanul Athfal I Kindergarten and Aisyiyah Bustanul Athfal XI Kindergarten, East Tegal District, Tegal City, learning shows that science learning also supports the development of social and emotional skills. The purpose of this study is to determine visual, auditory, and kinesthetic learning styles, both active and reflective, on early childhood science learning outcomes. This type of research uses Mixed Methods research (Quantitative and Qualitative Combination). The data collection technique in this mixed methods research collects data through: Interviews, Observations, Documentation, Questionnaires, Test Methods. The data analysis technique in this study uses Sequential Explanatory. The results of this study show that there is a significant influence between visual, auditory, and kinesthetic learning style variables, both active and reflective, on early childhood science learning outcomes.

Keywords: *Visual, Auditory, Kinesthetic, Active, Reflective, Learning Outcomes*
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INTRODUCTION

Early childhood education needs to be considered because this period is a critical period in the development of the child's brain and basic skills (Thompson, R. A., & Nelson, 2021). At this age, children's brains develop very rapidly, and the experiences they receive can affect their cognitive, emotional, and social growth in the future (Ershadi, A., Wang, X., & Clark, 2021). In Indonesia, attention to early childhood education is supported by various regulations and laws that aim to ensure the quality and accessibility of education at this early stage. Overall, these laws and regulations demonstrate the Indonesian government's commitment to prioritizing early childhood education as an important foundation for the future development of individuals and societies.

Early childhood science learning outcomes are one of the important aspects of early childhood education because science teaches the basics of understanding the world around and builds the foundation for more complex cognitive skills (Peterson, S. M., & French, L, 2021). At an early age, children are very curious and have a natural curiosity about the phenomena around them. Science learning can stimulate this curiosity by providing opportunities for exploration and experimentation (Cross, F., & Wells, A, 2022). This not only helps them understand basic concepts such as cause and effect, change, and relationships between objects, but also develops critical thinking and problem-solving skills that are essential for future learning.

In addition to cognitive benefits, science learning also supports the development of social and emotional skills. Science activities often involve cooperation, communication, and discussion, which helps children learn to interact with peers and solve problems together. Through experiments and group projects, children learn to share ideas, listen to other people's perspectives, and work as a team. These social skills are essential for their success in school and in everyday life (Tzou, C., & Bell, P, 2020).

Attention to science learning outcomes can monitor and support children's development holistically. Cognitive learning outcomes are hierarchical, with memorization being the lowest and simplest level, and assessment being the most complex level. Knowledge (C1), Understanding (C2), Application (C3), Analysis (C4), Synthesis (C5), Evaluation (C6) (Krisnanto et al., 2023). Science learning outcomes can provide insights into how children interact with their environment, how they understand basic concepts, and how they develop a positive attitude toward exploration and knowledge. Understanding the outcomes of science learning helps educators and parents to design more appropriate and effective activities, as well as detect and address developmental problems from an early age, thus supporting optimal child growth and learning.

The importance of science learning outcomes in early childhood education can be understood through various studies that underline its impact on children's cognitive development. According to the National Research Council (2007), early science learning plays a crucial role in building a foundation for a basic understanding of the world around them, which supports the development of critical thinking and problem-solving skills. Eshach and Fried (2005) also emphasize that the experience of science exploration at an early age stimulates children's natural curiosity, helping them understand concepts such as cause and effect and change. Ginsburg (2006) underlines that early cognitive stimulation through science supports the development of complex thinking skills later in life. Furthermore, White and Gunstone (2011) showed that science learning can improve children's understanding of the relationship between objects and phenomena. Wang and Wang (2019) added that harnessing children's curiosity in science learning not only facilitates the understanding of basic concepts but also supports the development of more complex cognitive abilities. Together, these studies underscore the importance of science education in building a strong foundation for cognitive and critical thinking skills at an early age.Top of FormBottom of Form

The 2022 Organisation for Economic Co-operation and Development (OECD) report revealed a decline in Indonesia's Programme for International Student Assessment (PISA) scores in several important areas. For reading literacy, Indonesia's score decreased from 371 in 2018 to 359 in 2022, which shows a decrease of 12 points. In mathematics literacy, Indonesia's score also dropped from 379 to 366, reflecting a decrease of 13 points. A similar decline was seen in science literacy, where Indonesia's score decreased from 396 in 2018 to 383 in 2022. This data shows that there is a setback in the ability of Indonesian students in reading, mathematics, and science at the international level.

Improving the quality of education must start from teachers (Hartinah et al., 2020). Early childhood education serves as an important foundation in developing children's cognitive and social skills (Miller, E., & Tarrant, K, 2022). Given that a country's progress depends heavily on the quality of its human resources, investing in education from an early age can help build a solid foundation for the higher-order thinking skills necessary for future advancement. Therefore, reform and improvement of the quality of education at this early stage is essential to overcome the decline in PISA scores and advance the education system as a whole.

The government's efforts through the 2013 Curriculum and various other educational programs have shown progress in improving science learning outcomes. A report from the Education Quality Assurance Institute (LPMP) shows that the implementation of the new curriculum and teacher training has had a positive impact on children's understanding of science, although there are still challenges in terms of consistency and scope of

implementation throughout Indonesia (LPMP, 2023). To achieve better science learning outcomes, there needs to be a sustained improvement in the quality of education and more equitable access across the region.

Learning style is one of the most important aspects to consider in early childhood education because every child has a unique way of absorbing, processing, and remembering information. At an early age, children begin to develop their preferences for the way they learn, whether it is through visual, auditory, kinaesthetic, or a combination of different styles. Understanding individual learning styles allows educators to tailor their teaching methods so that they are more effective and tailored to the needs of each child (Zepeda, S. J., & Mayers, D. P, 2022).

Gardner (1983), in his book Frames of Mind: The Theory of Multiple Intelligences posited that each individual has different types of intelligence that affect the way they learn. Howard Gardner, in his book Frames of Mind: The Theory of Multiple Intelligences (1983), introduced the theory of multiple intelligences which shows that individuals have different types of intelligences that affect the way they learn. For example, some children may have strong linguistic intelligence and more easily understand material through words, while others may excel in spatial intelligence and learn better through visualization and images.

The VAK (Visual, Auditory, and Kinaesthetic) model is one way of classifying children's learning styles and can be applied in the context of Gardner's theory. This model divides learning styles into three main categories: Visual, where children learn best through pictures, diagrams, and visual materials; Auditory, where children absorb information more easily through listening to explanations and discussions; and absorb information more easily through listening to explanations and discussions; and Kinaesthetic, in which children understand material by engaging in physical activity and movement (Zhang, L., & Yao, Z, 2021). By understanding that children can have different learning styles, educators can create a more inclusive and effective learning environment that are more inclusive and effective. They can design activities that incorporate various teaching methods such as using pictures to supporting verbal explanations and involving physical activities to meet needs of each child. With this approach, children can be more engaged and motivated, and optimize their learning potential according to their individual strengths.

Howard Gardner, in his theory of Multiple Intelligences, proposed that each individual has different types of intelligences, such as linguistic, logical-mathematical, visual-spatial, kinaesthetic, and others, which affect the way they learn and understand information. According to Gardner (Gardner, H, 2021), children learn more effectively when the material is presented according to their dominant intelligence, so it is important for educators to understand and accommodate different learning styles.

In addition to these theories, several recent studies have also been conducted to examine the influence of learning styles on the success of early childhood education. Meyer and Rose (2019) in a study on Universal Design for Learning (UDL) emphasized the importance of creating an inclusive learning environment by adapting teaching methods to children's learning styles. Research by Smith and Minton (2020) revealed that adjusting teaching methods according to individual learning styles can improve children's academic achievement and social skills. Kumar and Nair (2021) found that differentiating instruction based on children's learning styles can improve early childhood engagement and academic outcomes. A longitudinal study by Liu and Zhang (2022) showed that children who learned with methods that fit their learning style showed better academic outcomes. Furthermore, Brown and Johnson's (2023) research also supports these findings by showing that teaching methods adapted to children's learning styles improve their motivation and academic achievement. These findings emphasize the importance of understanding and adapting learning styles in early childhood education to support optimal child success.

The learning styles of Felder and VAK are examples of approaches to understanding how early childhood learns, so that they can be applied in early childhood education to support more effective learning. Felder's learning style model, developed by Richard Felder

and Linda Silverman, identifies four main dimensions: active and reflective, sensing and intuitive, visual and verbal, and sequential and global. This dimension helps in understanding children's preferences in the way they receive and process information, such as whether they prefer to learn through direct experience or reflection, using their senses or abstract concepts, and so on (Felder, R. M., & Brent, R. 2021).

The VAK model, developed by Neil Fleming, categorizes learning styles into three main types: Visual, Audible, and Kinaesthetic (Fleming, N. D., & Mills, C, 2021). Children with visual learning styles prefer to use images, diagrams, and videos to understand information. Those with auditory learning styles are more effective at processing information through hearing, such as listening to explanations or discussions. Meanwhile, children with kinaesthetic learning styles learn better through physical activity and hands-on experience, such as playing or object manipulation. Understanding and applying these two models in early childhood education can help educators adapt teaching methods to children's individual needs, thereby creating a more inclusive and effective learning experience. By paying attention to each child's learning style, educators can design activities that are more in line with their preferences, which can improve children's engagement, motivation, and learning outcomes (Kaur, B., & Leung, K, 2023).

The Felder learning style and the VAK model have been widely applied and combined with these two approaches, but they are still rare in early childhood education. Felder-Silverman learning was developed primarily for the context of higher education, particularly in the fields of science and engineering, and is not specifically aimed at early childhood. The concept of learning styles in the Felder-Silverman model may be too complex or not entirely relevant for early childhood. Although Felder's learning style and the VAK model are widely applied separately, research combining the two in early childhood education is rare. Felder's style emphasizes cognitive preferences, while VAK focuses on how children receive information. Researchers are interested in integrating these two models to understand the interaction of learning styles and their impact on educational success and more effective teaching methods.

The phenomenon that occurred in the field at the research location, namely at Aisyiyah Bustanul Athfal I Kindergarten and Aisyiyah Bustanul Athfal XI Kindergarten, East Tegal District, Tegal City, learning shows that science learning also supports the development of social and emotional skills. Science activities often involve cooperation, communication, and discussion, which helps children learn to interact with peers and solve problems together. Through experiments and group projects, children learn to share ideas, listen to other people's perspectives, and work as a team. These social skills are very important for their success in school and in daily life where there are still students who lack or do not understand science well, this is because of access to learning materials. The purpose of this study is to determine visual, auditory, and kinaesthetic learning styles, both active and reflective, on early childhood science learning outcomes

METHOD

This type of research uses Mixed Methods research (Quantitative and Qualitative Combination). The population of this study is students at Aisyiyah Bustanul Athfal I Kindergarten and Aisyiyah Bustanul Athfal XI Kindergarten, East Tegal District, Tegal City with a total of 70 students. The data collection technique in this mixed methods research collects data through: Interviews, Observations, Documentation, Questionnaires, and Test Methods. The data analysis technique in this study uses Sequential Explanatory.

FINDINGS AND DISCUSSION

Application of Felder's Reflective Active Based Vak Learning Style to Early Childhood Science Learning Outcomes

This study examines the relationship between felder's reflective active-based VAK learning style and early childhood science learning outcomes. This research is a mixed method research, which combines quantitative and qualitative research. Qualitative results were obtained from observations and interviews while quantitative results were obtained from statistical calculations. Each child has a different learning style preference, namely visual, auditorial, or kinesthetic. Children with visual learning styles tend to understand information better through pictures, colours and illustrations, so they like picture storybooks or educational videos. Meanwhile, children with an auditory style learn more easily through hearing, such as listening to stories, songs or verbal instructions. On the other hand, children with kinesthetic styles learn by moving and experiencing, such as role-playing, conducting simple experiments, or using their hands to build things. By recognising these learning styles, teachers can create appropriate and engaging learning experiences for each child.

Teaching strategies for early childhood need to be tailored to their learning styles based on the VAK (Visual, Auditorial, Kinesthetic) model and active-reflective style tendencies. For auditorial children, strategies such as storytelling, singing or group discussions are very effective to help them understand concepts through hearing. Meanwhile, children with kinesthetic styles are better suited to individual exploration approaches or physical activities, such as role-playing, simple science experiments, or making crafts.

Science lessons designed to combine elements of hands-on exploration, demonstration and discussion provide equal opportunities for active and reflective children to understand concepts. In this way, learning styles are not a barrier, but rather complementary in creating an enjoyable and effective learning environment. Science lessons designed to combine elements of hands-on exploration, demonstration and discussion provide equal opportunities for active and reflective children to understand concepts. In this way, learning styles are not a barrier, but rather complementary in creating an enjoyable and effective learning environment. The absence of differences in science learning outcomes between children with active and reflective learning styles could be due to various factors, one of which is the teacher's ability to adapt teaching methods to suit the needs of both groups.

Data Analysis Results

The results showed that there is a significant influence between visual learning style variables based on active folder on science learning outcomes in early childhood. In other words, Felder's active-based visual learning style is statistically proven to contribute to improving early childhood science learning outcomes.

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The results showed that there is a significant influence between active-based kinesthetic learning style variables on science learning outcomes in early childhood. In other words, active-based kinesthetic learning styles are statistically proven to contribute to improving science learning

outcomes in young children. The results showed that there is a significant influence between reflective-based kinesthetic learning style variables on science learning outcomes in early childhood. In other words, folder's reflective-based kinesthetic learning style is statistically proven to contribute to improving early childhood science learning outcomes.

The Effect of Felder's Active-Based Visual Learning Style on Early Childhood Science Learning Outcomes.

The results showed that there was a significant influence between visual learning style variables based on active felder on science learning outcomes in early childhood. In other words, Felder's active-based visual learning style is statistically proven to contribute to improving early childhood science learning outcomes. The application of Felder's active-based visual learning style to science learning in kindergarten has a significant positive impact. Children not only enjoy the learning process because it is fun and engaging, but also show improved concept understanding and learning outcomes. This approach is well suited to the developmental needs of early childhood which requires visual stimulation and physical activity to support learner learning. Therefore, teachers can utilise this approach to create more effective and meaningful science learning for children.

Based on observations in the study, it is known that through an active visual approach children can be invited to observe plants directly, see and touch various parts of the plant such as roots, stems, leaves, and flowers. In this way, children not only learn to name the parts of the plant, but also understand the function of each part. Children are also able to recognise rough and smooth textures through play involving various materials. Children touch the surface of stone, wood and cloth to feel the difference in texture. Using a visual approach, children can see these differences and categorise objects based on their texture. This activity not only improves observation skills, but also helps in developing classification skills.

This reflective-based visual approach has a positive effect on improving kindergarten children's science learning outcomes. In science learning, which often involves abstract concepts such as weather changes or the life cycles of living things, visualisation can help children see the real picture of the concept. When children are given time to reflect on what learners have seen through images or videos, learners can build a stronger understanding of the relationship between the visual information and the scientific concept being taught. This allows learners to better internalise new knowledge, thereby improving learners' learning outcomes. Based on the observations in the study, it is known that the reflective-based visual learning style supports kindergarten children's abilities in various learning activities that involve observation, grouping, exploration, and creativity. Children with visual learning styles tend to understand information through pictures, diagrams or concrete objects so they can use plant illustrations, colour pictures or real plants to observe and recognise parts such as leaves, stems, roots and flowers. The reflective process allows the child to remember details and explain the parts in more depth. The results showed that there was a significant influence between auditory learning style variables based on active felder on science learning outcomes in early childhood. In other words, visual learning style based on active felder is statistically proven to contribute to the improvement of science learning outcomes in early childhood.

This approach has a positive effect on improving kindergarten children's science learning outcomes. Science learning often involves concepts that require detailed explanations. With auditory learning styles, children can listen to teachers explain science concepts, such as the water cycle or the difference between animate and inanimate objects, while actively participating in practical activities. For example, children can sing a song about the stages of plant growth while planting seeds in a small pot. This approach not only helps learners remember concepts longer but also makes learning more fun and easy to understand.

The application of Felder's active-based auditory learning style in science learning at Aisyiyah Bustanul Athfal I and Aisyiyah Bustanul Athfal XI kindergartens in Tegal Timur sub-district, Tegal city, had a significant positive impact on children's learning outcomes. By involving auditory elements and activities, this approach is able to fulfil children's learning needs optimally, both from cognitive and social aspects. Teachers can utilise a variety of auditory media, such as songs, stories and verbal instructions, while ensuring that children are actively involved in the learning process. This approach not only improves children's understanding of science concepts but also instils confidence and communication skills that are important for future learners. The results showed that there was a significant influence between auditory learning style variables based on active felder on science learning outcomes in early childhood. In other words, visual learning style based on active felder is statistically proven to contribute to the improvement of science learning outcomes in early childhood.

This reflective auditory-based approach has a positive effect on improving kindergarten children's science learning outcomes. In science learning that often involves abstract concepts, such as weather changes or life cycles, verbal explanations delivered through stories or songs can help children understand the material in a fun way. After hearing the explanation, children are given time to reflect on what they have learnt, for example by drawing a picture or retelling it in their own words. This reflection process allows children to process information deeply, so that the knowledge learners gain becomes more meaningful and lasting.

In addition, this approach also supports the development of critical thinking skills in children, especially in Aisyiyah Bustanul Athfal I and Aisyiyah Bustanul Athfal XI Kindergartens in Tegal Timur Sub-district, Tegal City. By allowing time to reflect on the information learners have heard, children are encouraged to analyse, connect and evaluate what they have learned. For example, after hearing a story about the life cycle of a butterfly, children can be invited to reflect on what happens at each stage and why each stage is important. This reflection helps children not only understand facts, but also develop the ability to think logically and understand cause-and-effect relationships.

The results also showed that there is a significant influence between the active-based kinesthetic learning style variables on science learning outcomes in early childhood. In other words, felder's active-based visual learning style is statistically proven to contribute to the improvement of early childhood science learning outcomes. This approach has a positive effect on improving science learning outcomes in kindergarten children. Science as a subject that often involves nature exploration, experimentation or direct observation becomes more interesting and easy to understand when applied with active-based kinesthetic methods. For example, children can learn the concept of plant growth by planting their own seeds and taking care of them every day. This activity allows learners to not only hear explanations or see pictures, but also directly experience the process that learners are learning, so that understanding of the concept becomes deeper and more meaningful.

Felder's active-based kinesthetic learning style in science learning is highly effective in improving kindergarten children's learning outcomes. By involving physical elements and hands-on activities, this approach fulfils children's learning needs optimally, from both cognitive and emotional aspects. Teachers can design activities such as simple experiments, role play or nature exploration to make science learning more fun, interactive and relevant to children's world. This approach not only helps children understand science concepts better but also instils curiosity and a passion for learning that will support learners' future development.

Kinesthetic learning involves students in physical activities, and is often referred to as tactile learning which involves feeling or touching. Students with kinesthetic learning styles tend to learn by doing, and learners are considered natural discovery learners. Learners prefer to learn by doing rather than pondering before acting. With a tendency to explore concepts through experimentation, learners may not get the maximum benefit from learning

through passive reading or listening. In addition, kinesthetic students need little oral or written instruction to engage in learning activities.

Children with this learning style tend to understand concepts better when learners move, touch or practise something directly. In kindergarten children, who are in the motor and sensory development phase, this approach is ideal. Learners learn through real experiences that actively involve their bodies, so new information is more easily understood and remembered.

This approach has a significant positive impact on improving science learning outcomes in kindergarten children. Science, as a field that often involves observation and experimentation, fits well with the active-based kinesthetic learning style. For example, children can learn the concept of gravity by playing with a ball or understand the plant cycle by planting their own seeds. These activities allow children to directly feel and observe the processes being learnt, making learning more concrete and meaningful. When children are actively involved in these activities, learners not only understand the concepts intellectually but also connect them to real-life experiences.

In addition, the active-based kinesthetic learning style also supports the development of children's social and emotional skills. Activities such as group experiments or simulations encourage children to work together, share roles and help each other. In this process, children learn to value the contributions of their peers while honing learners' communication skills. For example, when children are invited to role-play elements in the water cycle, learners not only understand the concept scientifically but also learn to work together in groups to complete the task. Activities that involve movement and interaction also help boost children's confidence and motivation to learn.

Overall, the application of Felder's active-based kinesthetic learning style in science learning is very effective in improving kindergarten children's learning outcomes. By engaging children in relevant physical activities, learners can understand science concepts better and more deeply. Teachers can utilise this approach by designing activities such as nature exploration, educational games or simple experiments that interest children. This approach not only helps children achieve science learning objectives but also supports learners' holistic development, covering cognitive, emotional and social aspects.

CONCLUSIONS

There is a significant influence between the variables of felder's active-based visual learning style on science learning outcomes in early childhood, the better the application of active-based visual learning styles, the higher the science learning outcomes in early childhood. There was a significant influence between the variables of Felder's reflective visual learning style on science learning outcomes in early childhood, the better the application of reflective visual learning styles, the higher the science learning outcomes in early childhood. There is a significant influence between the variables of felder's active-based auditory learning style on science learning outcomes in early childhood, the better the application of active-based auditory learning styles, the higher the science learning outcomes in early childhood. There was a significant influence between the variables of Felder's reflective auditory learning style on science learning outcomes in early childhood, there was a significant influence between Felder's reflective auditory learning style variables on science learning outcomes in early childhood. There is a significant influence between the variables of active-based kinesthetic learning style on science learning outcomes in early childhood, the better the application of active-based kinesthetic learning styles, the higher the science learning outcomes in early childhood. There is a significant influence between the variables of reflective-based kinesthetic learning style on science learning outcomes in early childhood, the better the application of reflective-based kinesthetic learning styles, the higher the science learning outcomes in early childhood

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