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Development of a Scientific-Based Thematic Learning Model to Improve Learning Outcomes for Elementary School Students

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Abstract: This research aims to develop a scientific-based thematic learning model to improve the learning outcomes of elementary school students at MI Ma'arif Cekok. The development model used in this research is research and development (R&D) with the ADDIE development method. In this method, there are five stages, namely (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The research was conducted at MI Ma'arif Cekok in 2023 with data sources of 23 class IV students as the control class and 23 experimental class students. The research results concluded that the scientific-based thematic learning model developed included steps: 1) Introduction and Theme Introduction, 2) Environmental Exploration, 3) Investigation of Student Questions, 4) Experimentation and Observation, 5) Group Discussion, 6) Project Based Learning, 7) Collaboration and Use of Technology, 8) Collaboration between students 9) Evaluation Formative, 10) Reflection and Feedback, is quite effective as a learning model that can improve learning outcomes for SD/MI elementary school students. This research provides an empirical basis for implementing a more effective approach in the learning process at the elementary/MI level, namely by implementing a scientific-based thematic learning model. This development model is quite effective as a learning model that can improve learning outcomes for SD/MI elementary school students. This research contributes to the development of a scientifically based thematic learning model.

Keywords: Thematic Learning, Learning Outcomes, Scientific

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A. Introduction

One of the main challenges faced amidst the dynamics of educational development is creating interesting, meaningful, and relevant learning experiences for students (Fortune & Zebua, 2023). Traditional learning models, which are often completely linear and do not integrate practical experience and independent discovery, can reduce student interest in learning and involvement. This can hurt achieving desired learning outcomes. Apart from that, the use of learning models that do not suit students' needs can also be an obstacle to achieving optimal learning outcomes. Each student has a different learning style, and learning models that only rely on a one-way approach or only focus on transferring knowledge without paying attention to individual student needs can hinder student learning potential. The thematic learning approach has become an attractive

alternative in elementary school learning. Thematic learning emphasizes the integration of various aspects of knowledge in one theme or topic, allowing students to connect and apply the knowledge of elementary school students in meaningful learning for everyday life (Istiqomah & Prastowo, 2022). Although the scientific approach is recognized as having the potential to improve students' understanding of concepts and thinking skills, there is still a lack of development and implementation of learning models that specifically integrate the scientific approach in thematic learning for elementary school-age students.

Elementary school-age students have an important role in the process of learning development as humans. This age range generally involves children aged between 6 and 12 years who are undergoing primary education (Sabani, 2019). The characteristics of elementary school-age children involve various aspects, such as physical, cognitive, social, and emotional development (Hayati, 2021). Viewed from the cognitive aspect, children at this stage begin to develop the ability to think logically and abstractly, as well as understand mathematical and scientific concepts (Marinda, 2020). According to Arifudin, the development of elementary school-age children is that they have high curiosity, an adventurous spirit with a liking for new challenges, and an enthusiastic attitude that stands out (Arifudin et al., 2021). Early childhood teachers/educators are required to provide ample opportunities for children, such as asking questions and talking about and exploring various things that interest them. Educators need to provide varied experiences for children and, if possible occasionally take children to visit certain interesting places that are around the child.

Cognitive ability is an individual's mental ability to process information, understand, remember, think, and complete cognitive tasks. It involves a series of complex processes that enable effective interaction with the surrounding environment (Marinda, 2020). The main aspects of cognitive ability involve comprehension, memory, problem-solving, critical thinking, observation, learning, and creativity. This ability not only influences intellect but also plays an important role in adaptation and success in various life situations. With good cognitive abilities, individuals can improve their performance and interaction with the world around them (Salma Rozana et al., 2020). The thematic learning model appears to be a relevant approach, especially for elementary school-age children. This model allows integration between subjects, facilitates holistic understanding, and stimulates creativity. By adopting this model, learning becomes more contextual and interesting and supports the development of children's cognitive abilities (Sulistya, 2019). So, they not only gain knowledge but can also apply and understand concepts in real-world contexts. The thematic learning model creates an environment that strengthens children's cognitive abilities, forming a solid foundation for their intellectual and social growth.

Scientifically based thematic learning is a learning approach that emphasizes integration between subjects and linking them to the context of everyday life (Rhosalia, 2017). As a holistic form of learning, this approach is designed to build deeper and more

relevant understanding for students. This scientifically based thematic learning process not only provides a better understanding of science but also integrates learning with real experience and strengthens cross-subject skills.

Science is a way of systematically discovering nature, mastering knowledge, facts, concepts, principles, and discovery processes and having a scientific attitude (Ibrahim, 2014). Another opinion expressed by Sujana defines science as a series of concepts and conceptual schemes that are related to each other, grow as a result of a series of experiments and observations, and can be observed and tested further (Sujana & Jayadinata, 2018). The aim of science learning in early childhood is to instil and develop scientific knowledge, skills, attitudes, and values. The process skills that children must have include observing, classifying, interpreting observation results, conducting experiments, concluding, communicating, and applying acquisitions, all of which are reflected in each learning objective (Desstya, 2014).

Based on interviews with several teachers at MI Ma'arif Cekok, it was explained that the science learning process for children tends to be teacher-centred, there are not enough direct science experiments, there are minimal media used, learning activities are less interesting, children's ability is less in grasping and remembering topics. Discussion over a long period shows that children do not have the opportunity to develop skills and are not involved much in learning.

One very important element in the teaching and learning process is the learning model used. Teachers must be able to determine discussion topics and package learning in a fun way so that children are motivated in learning activities (Syarif et al., 2022). The learning process should be child-centred so that children can improve their thinking abilities. Children are directly involved in learning activities, and teachers provide media that attracts children's attention. This is by the Government Regulation (PP) Number. 19 (2005) concerning National Education Standards, which states that the learning process in educational units is carried out in an interactive, inspiring, fun, challenging manner, motivates students to participate actively and provides sufficient space for initiative, creativity, and independence by their talents, interests, and physical and psychological development of students.

This fact states that it is necessary to develop a learning model that can increase interest and motivation in children, especially in introducing scientific concepts to elementary school/MI elementary school-age children, 6-12 years, namely the development of a scientific-based thematic learning model. The choice to develop this model is because the scientific learning model is a learning approach that emphasizes exploration, observation, and scientific investigation (Abdullah, 2014). This approach encourages students to be actively involved in the learning process, observing phenomena, asking questions, planning and conducting experiments, and making conclusions based on the evidence found. The scientific learning model focuses on developing critical thinking skills, scientific thinking abilities, and student creativity. Students not only receive information, but they also engage in the construction of their knowledge through direct experience. By

adopting this model, education not only provides factual knowledge but also teaches students how to think and solve problems scientifically. According to Pratiwi, she concluded that there was an influence of the application of the scientific learning model on integrated thematic learning outcomes in class IV students at SD Negeri 1 Surabaya (Pratiwi Dwi, 2018). However, it is different from what the researchers will do, namely, developing a scientific-based thematic learning model for elementary school-age students at MI Ma'arif Cekok Babadan Ponorogo.

B. Method

The development model used in this research is research and development (R&D) with the ADDIE development method. According to (Sugiyono, 2016) Research and Development (R&D) is a type of research used to produce a product. The method used in this research is a development model with the ADDIE approach, according to Branch. In this method, there are five stages, namely (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. Meanwhile, according to Branch, the R&D research method has five steps, known as the ADDIE approach, which stands for Analysis, Design, Development, Implementation, and Evaluation (Branch, 2010). The following is a picture of the stages of R&D research using the ADDIE approach method.

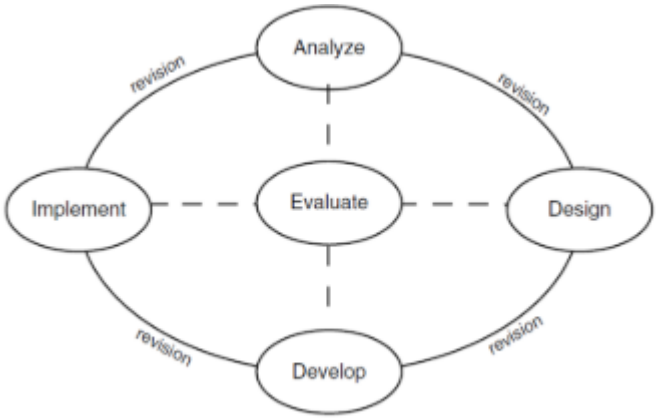

Figure 2. Steps for R&D Research Using the ADDIE Approach According to Branch (Branch, 2010)

The research was carried out at MI Ma'arif Cekok, Babadan, Ponorogo. The limited sample of test subjects consisted of 23 children, 23 children in the control class, and 23 children in the experimental class. The elementary school thematic learning theme that will be examined in this research is getting to know the main parts of animals and plants around the house and school. Indicators to be achieved include: (1) identifying objects based on their properties; (2) describe the main parts of animals and plants around the house and school; (3) describe the main parts of animals and plants around the house and school; (4) classify the main parts of animals and plants around the house and school; (5) recognize the main parts of animals and plants around the house and school; (6) show

exploratory and probing activities about the main parts of animals and plants around the house and school; (7) solve simple problems in everyday life about the main parts of animals and plants around the house and school.

This research uses quantitative and qualitative approaches. The data is in qualitative form, namely interviews regarding the learning models that teachers have used in learning at MI Ma'arif Cekok and observations of children's activities in learning. Quantitative data, namely a questionnaire, was used to determine the validity of the scientific-based thematic learning model from expert assessments in the form of assessment scores on the learning model developed, teacher responses to the learning model, and data on learning outcomes through oral questions.

The data collection method in this research involved several techniques, namely: (1) information regarding the learning models usually applied by teachers in introducing science concepts was collected through interviews; (2) teachers' comments and responses were collected using questionnaires or questionnaires; (3) children's learning activities are recorded through observation using observation sheets; (4) validity of the learning model, including input from experts to assess content validity, collected through validation sheets; (5) children's learning outcomes are obtained through oral questions recorded using a checklist.

Qualitative descriptive data analysis was used to evaluate the data and information obtained from the preliminary study. The application of qualitative descriptive analysis aims to gain a comprehensive understanding of student learning activities and teacher responses to scientific-based thematic learning models. The use of qualitative descriptive analysis is also intended to detail deficiencies in scientifically based thematic learning models that have been validated and tested in the field so that these findings can become a basis for revising the model.

C. Results and Discussion

Analysis

The thematic learning model has become a common approach in the world of modern education. This approach emphasizes integration between various subjects within a particular theme or topic, to develop a more holistic and relevant understanding for students (Siahaan et al., 2023). However, in its implementation, several challenges need to be overcome to ensure learning effectiveness. One of the main challenges is the tendency for teacher-centred learning and the lack of opportunities for students to play an active role in the learning process (Yufarika, 2023). Teacher-centred learning tends to create an environment where students are more passive and less motivated to actively engage in learning. Submitting learning material verbally without concrete examples and clear reasons can make concepts abstract and difficult for students to understand. In addition, learning activities that rely on worksheets in textbooks often do not facilitate a fun and interesting learning experience for students. Science experiments are also rarely carried out in learning, this is due to the teacher's lack of ability to design experiments,

the teacher's lack of mastery of technology, and the minimal use of learning media. Science experiments are an effective method for teaching scientific concepts to students because they provide direct and concrete experiences that can strengthen their understanding. The impact of less interesting learning is the low ability of students to understand and remember learning material, as well as the inability of learning to leave a memorable impression on students' memories (Siahaan et al., 2023). In addition, when teachers are more dominant in their active role during learning, students tend to become more passive and more interested in their activities or playing with peers rather than being involved in the learning process, which should build their knowledge and understanding. Therefore, changes need to be made in the thematic learning approach so that it pays more attention to the role of students in the learning process. One way that can be done is to increase interaction between teachers and students, as well as provide opportunities for students to actively participate in learning activities (Yulianti, 2022). Apart from that, it is also important to provide a variety of learning resources and utilize technology to support more interactive and fun learning. The use of learning media, such as learning videos, computer simulations, or educational games, can increase students' interest and motivation in learning. Science experiments must also be integrated more actively in learning to provide concrete learning experiences and strengthen understanding of scientific concepts. Apart from that, there is a need for training and support for teachers in developing their abilities in designing and implementing interactive and interesting learning. Such training may include the use of technology, student-centred learning design, and innovative learning strategies. By making these changes, it is hoped that thematic learning can be more effective in improving students' understanding and skills, as well as helping them to become active, creative, and independent learners. This will have a positive impact not only on students' academic results but also on their personality development and critical thinking skills. So, learning can be a meaningful experience and build a strong foundation for students' future success.

Based on observations at MI Ma'arif Cekok, the learning carried out so far has implemented a thematic learning model. However, learning activities often rely on worksheets in textbooks from certain publishers that have been provided by the institution. Science experiments are rarely carried out due to teachers' lack of ability to design experiments, teachers' lack of mastery of technology, and minimal use of learning media. Learning is not interesting for children and tends to be boring and monotonous, so their ability to understand and remember learning material is relatively low, and learning does not leave a lasting impression on children's memories. As a result, when teachers are more dominant in their active role during learning, children become more passive and more interested in their activities and playing with other friends. The research results reveal that learning that does not involve students in deep and constructive learning will limit students' opportunities to develop critical thinking and problem-solving in increasing learning success and achievement (Yuniarsi & Sapri, 2022)

Design

Scientific-Based Thematic Learning Model Design is a learning approach that combines thematic concepts with the principles of the scientific method. In this context, "thematic" refers to the integration of various subjects under one particular theme, while "scientific" emphasizes a scientific approach that encourages exploration, observation, and inquiry (Istiqomah & Prastowo, 2022).

Figure 1. Stages of the Scientific Based Thematic Learning Model with references (Anggraeni, Yogi, 2022)

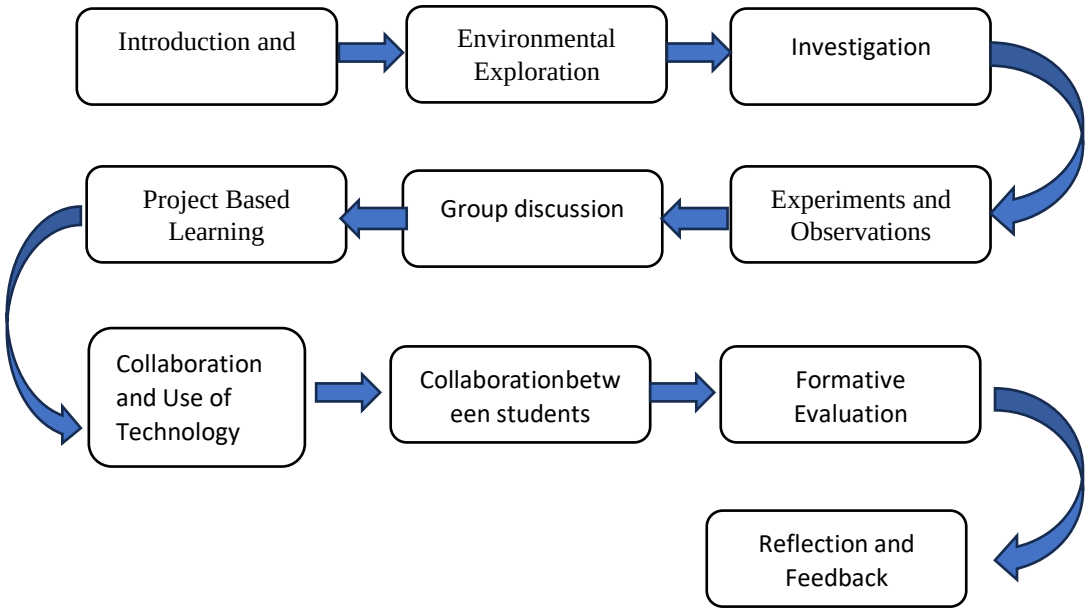

Figure 2. Stages of Scientific-Based Thematic Learning Model Design

The main characteristics of the Scientific-Based Thematic Learning Model Design are as follows: Thematic integration means the central theme or learning topic is chosen carefully, and learning material from various subjects is integrated with the context of that theme. For example, an "Energy" theme may include aspects of science, mathematics, language, art, and more. Scientific Approach means the learning process emphasizes the scientific method, which involves observation, formulating questions, planning experiments, collecting data, analyzing data, and drawing conclusions. Students are invited to think critically and creatively, developing scientific thinking skills. Student Involvement means learning focuses on students as active subjects, not just as recipients of information. Students are allowed to investigate, explore, and participate in learning activities. Teachers act as facilitators, guiding students in their learning process. Contextual Connection means that learning is linked to students' daily lives and the real world. The material is taught in a context that is meaningful for students so that they can see the relevance and application of the concepts studied. The use of Technology and Media means that teachers use technology and learning media to support the delivery of material, making learning more interesting and interactive. The use of media, including visual experiments or simulations, can help clarify scientific concepts. Formative Evaluation means that evaluation is carried out in a formative manner, providing continuous feedback to students to help them understand and improve their understanding of scientific concepts. The evaluation process involves direct observation, student portfolios, and thematic projects. The aim of the scientific-based thematic learning model is that the learning carried out provides new knowledge (discoveries) or new things to children so that children understand the subject matter more easily, learning is more memorable and interesting, and learning is long-lasting in the child's memory. This is Thorndike's opinion in Amsari 2018, revealing that good learning outcomes are supported by a growing sense of enjoyment towards what is being studied (Amsari, 2018).

Development

The syntax or structure of a scientifically based thematic learning model can vary depending on school policy, the curriculum used, and teacher preferences. However, here are some general elements that often appear in scientific-based thematic learning models: 1) Determining a Central Theme, selecting a central theme or topic that will be the focus of learning. This theme usually includes concepts that can be integrated from various subjects. 2) Learning Plan: Create a learning plan that includes learning objectives, learning activities, required resources, and evaluation methods. This plan may include a series of scientific questions or problems that students will explore. 3) Subject Integration, aligning the curriculum with various subjects that are relevant to the central theme. Identify key concepts that can be integrated so that students can see the connections between various fields of study. 4) Exploration Activities learning activity plans that encourage students to explore, observe, and investigate certain themes or topics. Providing challenges or projects that spark students' curiosity. 5) Teacher Guidance, the role of the teacher as a guide or facilitator, helping students in the exploration and

investigation process. Provides necessary guidance, answers questions, and supports students in the development of scientific skills. 6) Utilization of Resources: use of additional resources, such as books, audio-visual materials, technology, and local or guest resources that can support students' understanding of the theme. 7) Practical Activities involving students in practical activities, such as experiments, field observations, or practical projects related to a central theme. 8) Formative Evaluation, the use of formative evaluation, either through direct observation, assignments, or thematic projects, to understand the extent to which students achieve learning goals. 9) Reflection and Feedback, an opportunity for students to reflect and provide feedback on their learning. The reflection process may involve class discussions, reflection journals, or project presentations. This syntax creates a holistic and integrated framework for scientifically based thematic learning, allowing students to actively engage in scientific exploration through engaging thematic contexts.

Scientific learning on the theme "Recognizing the Main Parts of Animals and Plants Around the Home and School" for elementary school-age children can be directed using a scientific-based approach. Here are some steps you can take: 1) Introduction and introduction to the theme, starting by providing an introduction to the learning theme, namely how we can get to know the main parts of animals and plants around the house and school. Ask students simple questions to arouse their curiosity. 2) Environmental Exploration: Invite students to explore the area around the house and school to identify various types of animals and plants. Record and document their findings through drawings, notes, or observations. 3) Investigating Student Questions allows students to ask questions about the main parts of the animals and plants that students encounter. Guide students in designing experiments or simple investigative activities to answer student questions. 4) Experiments and Observations: carry out simple experiments or observations related to the main parts of animals and plants. For example, students can observe leaves, flowers, or animal body parts with a lens and record what they see. 5) Group Discussion facilitates group discussions to allow students to share their findings and understanding. Encourage them to ask additional questions and make connections between different types of animals and plants. 6) Project-Based Learning: Invite students to create creative projects depicting the main parts of animals or plants. This project can be a poster, model, or short presentation. 7) Collaboration and Use of Technology: utilize technology, such as educational videos or interactive applications, to strengthen students' understanding of the main parts of animals and plants. 8) Collaboration between students can also be implemented to improve the learning experience. 9) Formative Evaluation: Carry out formative evaluation through teacher observation and student reflection. Use open-ended questions or light assignments to measure students' understanding of the concepts being taught. 10) Reflection and Feedback: Invite students to reflect on what they have learned and how the learning experience influenced their understanding. Provide positive feedback and direction for further development. Engaging students in

active learning, exploration, and inquiry will help them better understand the major parts of animals and plants while gaining valuable scientific skills.

Implementation

The scientific-based thematic learning model can be said to be successful in introducing science concepts to elementary school students because it meets the criteria for research success, which involves increasing student learning outcomes, increasing student learning activities, and positive responses from teachers to learning models (Ain & Huda, 2018). This research involved a limited number of trial samples, namely 23 children in the control class and 23 children in the experimental class. The learning outcomes of children in the experimental class, with a total of 23 children, averaged 45.38 for the pretest and 80.75 for the posttest. The learning outcomes of children in the control class with 30 students averaged 68.52 for the pretest and 68.47 for the posttest.

Based on these results, both the experimental class and the control class experienced an increase in learning outcomes, but the increase in learning outcomes for the experimental class was greater than for the control class. This is because the experimental class uses a scientific-based thematic learning model, providing opportunities for students to carry out direct and real experiments on the learning themes being studied so that children can participate actively and feel happy in discovering new things. This is Thorndike's opinion (Rosani, 2023), which revealed that good learning outcomes are supported by a sense of enjoyment of what is learned. This research is supported by opinion (Morris, 2019) with the title "Scientific a highly self-directed and constructivist form of learning." This means that discovery learning is a very independent learning model and a form of constructivist learning. The effectiveness and efficiency of discovery learning are observed in a simulated environment, together with the problems that learners may experience. A comparison of the learning outcomes of the control class with the experimental class in recognizing science concepts can be seen in Figure 2.

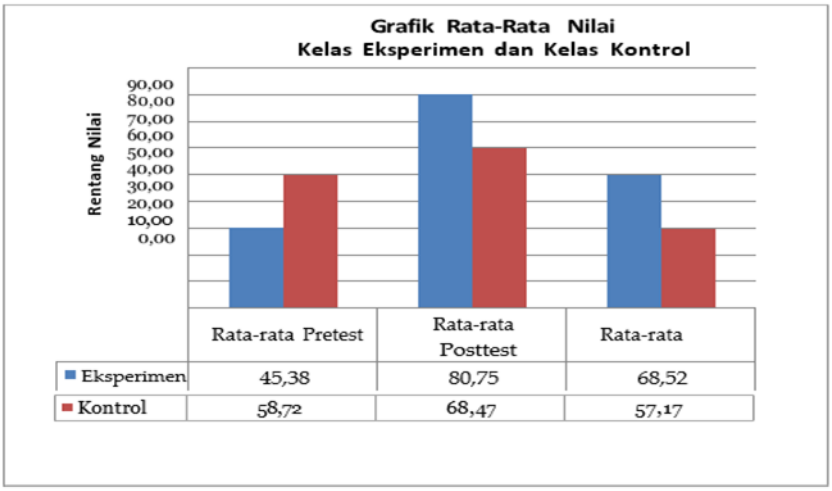

Figure 2. Comparison Chart of Posttest Scores for Control and Experimental Classes

Based on Figure 2, it can be seen that the graph of the results of children's ability to recognize science concepts in the control and experimental classes is very different. It is proven that the use of a scientifically based thematic learning model if implemented continuously, can provide positive feedback and develop learning in a student-centered direction. This is supported by the opinion of (Felder & Brent, 2014), who states that student-centred instruction is an approach that uses active learning, directing students to be responsible in their learning.

Learning using a scientific-based thematic learning model can help students be active, build the courage to carry out trials/experiments, and build the ability and confidence to evaluate the knowledge they have. This is the opinion of Prasetya Rahman et al., who state that scientific learning can motivate children to interact with other friends and actively construct their knowledge (Rachmawan et al., 2022). According to Dadan Suryana, integrated thematic learning is learning that can instil basic knowledge concepts, increase knowledge about facts, and provide interesting learning because the themes presented are very close to children, simple, interesting, and incidental (according to events).

Scientific learning models for elementary school-age children are often adapted to the characteristics and level of students' cognitive development (Nugrahaningsih et al., 2021). The following are the steps of a scientific learning model that can be applied to elementary school-age children: Stimulate curiosity (Engage); create situations or questions that attract children's attention and stimulate their curiosity regarding learning topics, explore concepts (Explore); provide opportunities for children to observe, investigate, and try experiments with certain concepts. Activities can be simple experiments, observations, or practical activities. Concept Explanation (Explain): Provide explanations or further information regarding the concepts observed. Teachers can provide basic information and help children organize their understanding. Elaboration (Elaborate): Provide opportunities for children to develop further understanding through activities that involve applying these concepts in real contexts. This may involve projects, discussions, or other creative activities. Evaluation (Evaluate): Use various forms of evaluation to measure children's understanding. This may include evaluative questions, assignments, or projects that check their understanding of the concepts learned. Reflection (Reflect): Provide time for reflection, where children can think back on what they have learned and how they can relate it to their previous knowledge. Action (Extend); Encourage children to apply the concepts they have learned in the context of everyday life or new situations. This can involve long projects or more in-depth activities.

Evaluation

Based on the steps that have been taken according to the stages in the scientific learning model, data obtained from observations of children's learning activities were analyzed based on the average score. Evaluation of children's learning activities in the experimental class at each meeting showed an average achievement score of 57.17, which indicated that children's learning activities were included in the very active category.

Teacher responses to the scientific-based thematic learning model were obtained from a questionnaire consisting of 5 assessment aspects, namely: (1) the steps of the thematic learning model based on scientific learning; (2) whether the time provided is appropriate; (3) learning atmosphere in the classroom and outside the classroom; (4) implementation of scientific-based thematic learning models; (5) whether a scientific-based thematic learning model can improve children's ability to recognize scientific concepts. The results of teachers' response scores to the scientific-based thematic learning model achieved an average score of 3.8, which is in the "Very Good" category. This shows that the scientific-based thematic learning model can be applied to elementary school/MI elementary school-age children. In line with research conducted by Yulianti, it concluded that the application of scientific learning in science lessons in class IX can increase students' understanding of concepts at SMP Negeri 1 Taliwang (Yulianti, 2022). Other research conducted by Merisa et al. also stated that the implementation of the scientific learning model provides opportunities for students to actively discover facts, concepts, principles, and theories for themselves, so the research conducted obtained results that student learning activity increased from 62.19% in the cycle I became 85.21% in cycle II, the increase in activity also went hand in hand with the increase in student learning outcomes. Thus, for scientific teachers, it is suitable to increase student learning activity. And for future researchers, the limitations in this research can be corrected (Djumhana & Rengganis, 2018).

D. Conclusion

This research aims to develop a scientific-based thematic learning model for grade IV elementary school-age students at MI Ma'arif Cekok Babadan Ponorogo. The research results concluded that the scientific-based thematic learning model developed included steps: 1) Introduction and Theme Introduction, 2) Environmental Exploration, 3) Investigation of Student Questions, 4) Experimentation and Observation, 5) Group Discussion, 6) Project Based Learning, 7) Collaboration and Use of Technology, 8) Collaboration between students 9) Evaluation Formative, 10) Reflection and Feedback, is quite effective as a learning model that can improve learning outcomes for SD/MI elementary school students. This research provides an empirical basis for implementing a more effective approach in the learning process at the elementary/MI level, namely by implementing a scientific-based thematic learning model. This development model is quite effective as a learning model that can improve learning outcomes for SD/MI elementary school students. This research contributes to the development of a scientifically based thematic learning model. This model can be used as a reference for developing learning models at the elementary school level to increase effectiveness in achieving learning outcomes. With a focus on a scientific approach, students not only memorize facts but also develop an understanding of concepts through exploration, observation, and direct experience so that students can have a deeper understanding of the subject matter. Recommendations for teachers are expected to be more creative in

creating learning models for students so that they can create enjoyable learning and achieve the expected learning outcomes.

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