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The Development of Scientific Learning Model Based Steam and Loose Parts to Boost Students‘ Cognitive Ability

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Abstract: Education is an important part of human life that cannot be ignored. Education is a conscious and planned effort to create a learning process and atmosphere that enables students to actively reach their potential. The results of the research are that 1) The needs of teachers and students for a scientific learning model are those that can connect knowledge with real practice, the learning model needed is also assisted by game media. The need for teacher and student learning models can encourage students to think critically and analyze problems independently and be able to stimulate children's cognitive development; 2) The design of the STEAM-based and loose parts scientific learning model consists of steps that are easy and can be implemented including observation, questioning, association, experimentation, and reporting activities. The learning model is also combined with loose parts of learning media to stimulate children in analyzing problems to encourage cognitive development. Product validation and improvement are carried out by the directions of learning expert lecturers and linguists; 3) The scientific learning model based on STEAM and lose parts is feasible to use to improve cognitive abilities, based on the cognitive development of children experiencing an increase after using the developed learning model. In experimental classes, one and experiment, two, and experiment 3 children's cognitive abilities increased; 4) The scientific learning model based on STEAM and lose parts have been proven to be effective in increasing students' cognitive abilities, this is based on the average value of the cognitive abilities of children from the experimental class who both use the development of scientific learning models based on Steam and Lose Parts, have cognitive abilities relatively increased children compared to the control class.

Keywords: Development, Scientific Learning, Steam and Loose, Cognitive Ability

1. Introduction

Education is an important part of human life that can never be abandoned. Education is a conscious and planned effort to create a learning process and atmosphere so that students can actively develop their potential (Kurniawan, 2015). Education is very important to prepare a complete human being who is intelligent, independent, and responsible (Axmedov et al., 2021). Education is one of the demands of the times to create a reliable generation of the nation. The purpose of Indonesian education is to create a generation of people who are capable, insightful, faithful, devoted to God Almighty, and have good knowledge (Sujana, 2019).

Education is closely related to the learning process in schools. Learning is an interaction between educators and students in the school environment by using various means such as learning models, learning methods, and learning media (Jayul & Irwanto, 2020). In learning, it is inseparable from an educator or teacher who will play an important role in the running of the learning process. An educator is someone whose job is to transfer knowledge to his students. An educator is required to have the ability to guide teaching and learning activities, to be able to create a comfortable learning atmosphere so that it does not make students or students bored in participating in learning (Qomaria, 2020).

Education in Indonesia is carried out through various levels, pathways, and types of education. The education level consists of basic education, secondary education, and higher education (Raharjo, 2013). At the basic education level, it consists of Early Childhood Education (PAUD), Kindergarten (TK), Al-Quran Education Park (TPA/TPQ), Elementary School (SD), and Madrasah Ibtidaiyah (MI). Kindergarten or often referred to as TK is one of the education aimed at early childhood. Early childhood is children aged 0-6 years who are in the process of growth and

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development. At this time children will experience extraordinary growth and development so it is the right time to learn. Children at an early age are in the golden age, which means a child has the best potential to develop.

2. Literature Review

The learning process and stimulation given to children must be able to maximize all of the child's five senses using a learning approach that is following the child's world. One approach that can be used is the scientific approach. The scientific approach is a learning process designed in such a way that students actively construct attitudes, knowledge, and skills competencies through the stages of observing, asking, gathering information, reasoning, and communicating (Directorate General of PAUDNI, 2015: 15).

The application of a scientific approach in the learning process in Early Childhood Education also supports the cultivation of core competencies that must be possessed by children with various learning activities through play that is carried out in the Early Childhood Education unit. These qualities contain an overview of the main competencies which are grouped into competencies of spiritual attitudes, social attitudes, knowledge, and skills (Nurani, 2015).

The application of the scientific approach according to Utami & Murti (2019) through 5 stages or activities including 1) observing, namely presenting real objects or objects from the themes discussed to be observed by children using all their senses; 2) questioning, namely providing opportunities for all children to ask things that interest them about the topic under discussion; 3) collecting information, namely conducting simple experiments to prove the questions posed by children and collecting information on the topics discussed from various sources; 4) reasoning, namely discussing to make conclusions about the topics discussed and combining the knowledge that the child already has with the new knowledge gained; 5) communicating, namely communicating the knowledge obtained both through language/stories and also the results of the work.

The scientific approach is one approach to building a way of thinking so that children have reasoning abilities that are obtained through the process of observing to communicating the results of their thoughts. According to Ishak, Rahmat, & Zubaidi (2020) is based on Piaget's thinking which says that "Children learn by building their knowledge through the experiences they gain." Vygotsky argues that "The environment, including other children or adults and the media, is very helpful for children in learning to enrich the child's experience. For this reason, the 2013 PAUD curriculum carries out children's learning methods so that they have attitude, knowledge, and skill competencies which are the results of the investigation (investigation) of children in their environment.

Early childhood with an age range of 4-6 years, is in the process of growing and developing, experiencing changes in learning abilities by mastering higher levels in aspects of movement, thinking, feeling, and interacting both with others and with objects in their environment (Bakken, Brown, & Downing, 2017). It is a challenge for early childhood to have thinking skills that not only apply what has been understood but are also able to analyze, evaluate and even synthesize a problem to get the best solution. This is what makes it important to prepare early childhood to respond to changes that occur by having 21st-century skills.

A study conducted by ATC21S (Assessment & Teaching of 21st Century Skills), which consisted of 250 researchers from 60 world institutions, divided 21st-century skills into 4 categories, namely: creativity, critical thinking ability, and collaboration ability. Collaboration) is also the ability to communicate (Communication). Graduate competency standards based on 21st-century learning competencies as stated in Minister of Education and Culture Regulation No. 21 of 2016 emphasize the ability of students to explore information from various sources, formulate problems, analytical thinking skills, cooperation, and the ability to collaborate in solving problems (Purnamasari et al., 2020).

To face the demands of the 21st century, someone who has thinking skills can apply the knowledge obtained and process it to find solutions and even find answers to problems that arise. When the problem is too complex and unresolved, it becomes the basis for the need for high-level thinking skills to solve it. The need for integration of skills in learning programs will support children to acquire and master skills explicitly, so that life does not encounter many difficulties with children's ability to adapt to new situations, be able to solve their problems, express ideas, and reflect on how children's efforts influence others. In the future, children are expected to be able to give a positive reaction to the inevitable changes around them and solve problems that arise.

Constructivism is a widely supported learning theory that rests on the idea that students construct their knowledge within the context of their own experiences (Clark, 2018). STEAM's focus is on creating i.e. the final product and the manufacturing process. The manufacturing process is more important than the final product because in the process there are aspects of exploration, creative thinking, engineering design, creative expression, evaluation, and redesign (Perignat & Katz-Buonincontro, 2019). In the process, the STEAM model can teach children to process through observing, playing, recognizing patterns, and practicing creative thinking skills as well as collaboration and communication skills between children in completing a task or project given by the teacher (Sochacka, Guyotte, & Walther, 2016). In addition, in the process children are required to think creatively and critically about new things that are obtained by children. Children are also encouraged to solve problems with teachers and peers (Arumugam, Kway, & Mohamed Isa, 2019).

One learning approach that integrates several scientific disciplines for early childhood is learning with the STEAM approach (Science, Technology, Engineering, Art, Mathematics). STEAM is explained by Purnamasari,

Handayani, & Formen (2020). as a learning approach that can stimulate children's curiosity and motivation to have problem-solving skills, collaboration, learning independently through project-based learning, challenge-based learning, and research.

According to Amelia & Nuraeni (2021) STEAM-based learning is a development of the 2013 curriculum which stimulates children to have the skills to think, cooperate, communicate and collaborate with others. Early childhood education (PAUD) is growing from time to time, most of the success of the learning process is determined by educators using student-centered learning methods.

One of the more trending methods is the STEAM-charged learning method (Science, Technology, Engineering, Art, and Math). The application of the STEAM-charged method provides time for early childhood to think more broadly in problem-solving when learning activities take place, where children will have meaningful learning experiences (Musayyadah, Pusparini, & Anggara, 2019). STEAM learning is one of the learning innovations in Indonesia. STEAM learning is applied at various levels of education. Early childhood requires a stimulus to use mental operations and good logical thinking (Agustina et al., 2020).

Stimulus is very necessary for children's development and the media is a tool that can be used as an intermediary in stimulating all aspects of development in early childhood both aspects of moral and religious values, physical and motor aspects, language aspects, social-emotional aspects, cognitive aspects, and artistic aspects. In stimulating the developmental aspects of early childhood, it must be adjusted to the age and stages of development because every child, even though they are of the same age, sometimes has a different stage of development. To stimulate all aspects of early childhood development cannot be separated from learning media because early childhood learning is done through playing using learning media, both real media, audio media, visual media, environmental media, and audiovisual media, so that learning activities in children effective early age.

The selection of loose parts media is also one that is obtained from the child's closest environment where the concept according to research conducted by Nurjanah (2019) reinforces that open loose items are very easy to find in the natural environment without spending money but provide a place for children to express creativity in using free material objects so that children have the freedom to experiment and explore.

The theory of loose parts was first developed by Nicholson in 1971 based on the desire to provide a place for children to channel creativity using natural materials that can be manipulated, scanned, and re-created as well as objects or goods that are easy to find. According to Casey & Robertson (2016) loose parts create richer environments for children to play, giving them the resources they need to do what they need to do. Children's needs are playing according to the rights of children that must be met. Play is important for health and well-being and promotes the development of creativity, imagination, self-confidence, self-improvement, and physical, social, cognitive, and emotional strengths and skills so that the full potential of children develops. That is the main reason for choosing the media that will be used in developing children's creativity.

Loose parts media are media based on natural materials which, according to Gull et al. (2019) are called natural materials because they originate and are prepared from the surrounding environment. When children explore directly in the environment enriching creative ideas, curiosity tries to find them by optimizing the child's five senses. The staged strategy, starting from the personal, the driving force, the process, and the product observed by the teacher, is expected to be able to develop children's creativity more optimally (Safitri et al., 2021).

Loose parts play activities are the right solution that effectively increases children's creativity when children explore experimenting indirectly already interacting with themselves according to the child's wishes and interacting with their environment to find self-satisfaction in the opinion of Montolalu (2008) creativity is developed by giving children the opportunity to freely participate in their activities. express themselves, find their alternative to solve problems, and there is openness and self-satisfaction when playing activities.

According to Munandar in Dere (2019) the creativity that children get by utilizing loose materials around is a combination of the knowledge that the child has acquired has been recreated and combined with his ideas as a form of combining the experience and knowledge of the child. According to Siantajani in Prameswari & Lestaringrum (2020) the items that are found will greatly help the achievement when children play. Through removable materials, children can convey their ideas, that is the real loose parts of media.

The development of creativity which is carried out by playing loose parts is also carried out by Imamah & Muqowin (2020) who emphasize that creativity is stimulated appropriately by playing this because the teacher becomes a facilitator in stimulating and encouraging the development of children's creativity. Will give birth to an idea, process, and product that can be modified or new because it utilizes a flexible imagination.

Playing has freedom, and flexibility and provides new experiences, as creative entertainment where children will decide the various problems they face when given to play with various media and there are no examples from the teacher. The teacher only invites children to explore their previous experiences.

Activities carried out by children while playing, by asking questions also characterize the characteristics of creative children (Mulyati, 2013) when children are independent and concentrate on doing tasks for a relatively long time, children manipulate materials by exploring, answering questions with a variety of creative answers themselves. is a feature of the game. Children can create creative ideas from experience when interacting with the surrounding environment, simple when completing a play, either alone or in groups, which will increase creativity skills from an

early age. Loose parts play emerges as a recent issue in creative learning (Shabrina & Lestariningrum, 2020) hereby emphasizes that creative learning is learning with loose parts media which will be done in a fun way.

Safitri & Lestariningrum (2021) argues that loose parts give children the freedom to choose what they want in terms of the flexibility of the materials used during exploration. Exploration is an activity that contains in-depth observations, according to Pamilu in Heldanita (2018) creative ideas will appear automatically from exploration of something where the opportunity given to children optimizes their five senses through seeing, understanding, feeling, and finally they can convey The results of the process become simple conclusions according to the stages it has.

This is emphasized by Krogh & Slentz in Wahyuningsih et al. (2019) activities that raise creativity are activity designs that make children's curiosity develop because curiosity is carried out with enthusiasm and a sense of wanting to keep trying because of the thirst for learning about something new. Strengthened by Nurjanah (2020) loose parts will not only support the development of children's creativity but will also bring children closer to their environment.

In addition, the opinion of Fauziah (2018) confirms that the design of learning activities with natural material-based media will make playing activities in children's learning interesting and varied which will increase children's creativity because they explore more various playing tools from the natural-based environment. Children will be stimulated in creative thinking and also use their fantasies and imaginations which will stick in the child's memory because it is done by playing voluntarily and having fun.

Playing loose parts is expected to have benefits for children, especially in the next life. This is in line with Munandar's opinion in Susanto (2014) that the benefits of achieving creativity in children will allow an individual to improve his quality of life. Developments in knowledge and technology demand the creation of contributions of creative ideas, fresh ideas, and discovering new things that are useful for society is certainly not instant but must be stimulated from an early age so that individuals from an early age will have the concept of creating not depending on the creations of others. Besides that, playing loose parts makes children accustomed to being creative. At the same time utilizing cheap, easy-to-obtain, and of course environmentally friendly materials that support children's learning.

Research conducted by Lestariningrum & Wijaya (2020) also revealed that the results of playing loose parts have effectiveness in cognitive development in problem-solving where of course the study of a child using the thinking process in solving problems is also one of the developments of creativity because there is no one definite command in solving problems. play activities, but children will play with various ideas of their imagination using objects around them. When the theme is playing, the child will also become an excellent observer, maybe he will find another idea after seeing his friend's work because the thought process of a child who has his uniqueness needs to be motivated first by his peers and the parents of the teacher nearby.

The results of the research presented by the researchers gave rise to an original result of children working using loose parts materials which were facilitated by the teacher in preparing and arranging play equipment. According to Runco and Jaeger in Kusumawardani et al. (2018) originality is a main and basic value in the concept of creativity which is balanced with the value of appropriateness and benefits for the development needs of children. The process of preparing to play loose parts as part of the learning process where according to Sadiman in Kusumawardani et al. (2018) is an effort as a form of manipulation of various learning resources so that the learning process in students runs effectively by providing the widest opportunities. in children doing activities independently.

Based on the results of observations made at the Pembina Pamotan State Kindergarten, it is known that children's cognitive abilities in learning and problem solving, especially in activities that show exploratory and probing activities, show a creative attitude in solving problems that are still lacking due to monotonous learning and the lack of media used. in learning. So that children are less motivated and feel bored or bored in learning because of the lack of media or because the methods used are not updated. In response to this, educators should develop learning methods that are appropriate for their era by using media that are already available in the environment around where students live.

Studying the problems above, the authors are interested in developing a scientific learning method based on STEAM with loose part media available in the child's environment. By using materials around the environment, it is hoped that learning will be closer to the child's environment and be able to improve children's cognitive abilities.

3. Methodology

This research is a development type with ten steps of implementation referring to the theory of Borg and Gall, namely Research and information collecting; Planning; Developing preliminary form of product, Preliminary field testing, Main product revision; Main field testing; Operational product revision; Operational field testing; Final product revision; Dissemination and implementation. According to Borg and Gall. This study aims to find, formulate, improve, develop, produce, and test the effectiveness of products, models/methods, services, and procedures of course which are superior, new, effective, efficient, productive, and meaningful. The research location is in Kindergarten, Pamotan District, Rembang. The technique of extracting data is using interviews of teaching material needs, questionnaires of teaching material needs, learning observations, and pretest-posttest. The instrument test uses validity and reliability test techniques. Prerequisite test using normality test, homogeneity, and T-test.

4. Findings

4.1 Needs Analysis of STEAM-Based and Loose Parts-Based Scientific Learning Model Development to Improve Cognitive Ability of State Kindergarten Students of Pamotan Rembang

The results of the observations show that the scientific learning of children needs to make more innovative changes, it is necessary to develop a technical learning model. Based on the results of interviews with kindergarten teachers in Pamotan sub-district, all respondents lead to the creation of a scientific learning model that is integrated between learning models and learning media. The desired learning model is a model that can connect scientific concepts with simple practice in the form of playing so that learning does not seem abstract and can be more fun while the desired learning media is learning media that is easy to install and remove, reassembled and can be used repeatedly and media learning that can require children to think logically. The results of the questionnaire also show that the desired learning model can encourage an increase in children's cognitive abilities. The learning model is made with a game so that learning becomes more interesting.

4.2 STEAM-Based and Loose Parts Scientific Learning Model Development Design to Improve Cognitive Ability in State Kindergarten Students of Pamotan Rembang Supervisors

The design of this learning model is divided into several steps starting from preparation, implementation, and evaluation. at the implementation stage, it is designed according to the steps of the STEAM learning model (Science, Technology, Engineering, Art, and Mathematics). then to perfect the learning model, then use the media in the form of loose parts. After the product is finished, the next step is the material and language validation test. The total score obtained from expert validation regarding the learning model presented in the form of a book got a score of 92 with an average final score of 3.28. Based on the guidelines for classifying the final grades, it is known that the developed teaching materials are categorized as very good (B). Expert lecturers or learning model validators conclude that the learning model can be used without revision. However, expert lecturers provide suggestions so that the resulting learning model is even better. the average score obtained for validation on aspects of the STEAM-based scientific learning model in the very good category, on the language aspect in the very good category. This shows that the learning model developed is in the very good category. Nevertheless, the researchers received suggestions for the development of the teaching material media that the researchers produced. Researchers receive suggestions from the validators that will be used by researchers as a guide to improving the products that researchers produce. Thus, the resulting product can be of even better quality.

The next step after the product was developed, namely, the scientific learning model based on STEAM and loss path was submitted to the validator lecturer, then it was revised according to the suggestions given to improve the learning model. There was an improvement in the product as a result of the suggestions given by the validator lecturer. The validator's suggestion is more towards changing the language and slightly changing the appearance of the cover visual design. In addition, changes also occur in the title of the book. At first, the title only said "Scientific learning model guidebook" then on the changes to the validation results added the words "STEAM-based and Loose Part. There is a change in the inner cover following the advice of the researcher, namely the color combination to make it look more attractive, but in general, the editorial word form on the inner cover is still the same then there are also changes to the font size where the change takes a larger font size intended to make it easier to read. read. The foreword is a response from the author on the completion of the learning model product. On this preface page, editorially, the language does not experience significant changes, only a few typos in words, then on the touch of color some changes are more interesting, not only dominated by white. This change is intended to generate interest in reading by the teacher before further understanding the technique of using scientific learning models. This table of contents page describes the overall content of the scientific learning model. there are no significant changes, there are only a few typos. However, in this change, there is an addition of colors and images. to make it more attractive.

The contents of this instructional model manual consist of several chapters including chapter one on early childhood education and scientific learning. then in chapter two, it is the standard of achievement of early childhood development. In chapter three, the contents are scientific-based learning steps. Chapter four the benefits of STEAM and loose part learning models and chapter five is closing. Overall, the content of this book is still the same as the editorial because the steps of scientific learning based on STEAM and loose part learning media have been confirmed by the validator lecturer, only that there are additional colors and images. In addition, before the revision, the page number contained the author's name, while the revised author's name was omitted and replaced with the word "Early Childhood Scientific Learning."

This page tells about the author's biography, there is no language editor and suggestions from the validator lecturer specifically in this biography. it's just that overall, it's the same as the other pages, namely that there are additional color combinations and simple images that give it an appeal.

4.3 Feasibility of Development of Steam and Loose Parts-Based Scientific Learning Model to Improve Cognitive Ability in Kindergarten Children in Pamotan District, Rembang Regency

There is a difference in the average score between the pretest and posttest. The results of children's cognitive abilities before being introduced to the development of a scientific learning model based on steam and loose parts (Pretest) obtained an average score of 50.0 on the criteria for starting to develop. Then after being introduced to the development of a scientific learning model based on steam and loose parts (Posttest), children's cognitive abilities obtained an average score of 78.0 on the criteria for developing as expected. The results of the small-scale trial above with the achievement of a validity level of 76.6%, the development of a scientific learning model based on steam and loose parts to improve cognitive abilities in Kindergarten children in the Pamotan District, Rembang Regency does not need to be revised to be tested in the field on a larger scale . However, comments and suggestions from respondents on small-scale trials on open-ended questions will be taken into consideration to improve the learning model so that the development of learning models will be better.

In interviews with teachers after using the development of scientific learning models based on steam and loose parts in small-scale trials, the conclusion is that teachers get innovative and creative learning materials, then the teacher states that the design in developing the learning model is very interesting, teachers and children feel the benefits in learning to use the development of this learning model, besides that the language used in the development of scientific learning models based on steam and loose parts is clear and easy to understand and easy to apply to children.

In large-scale trials, it is known that the cognitive abilities of children aged 5-6 years in group B at Pembina kindergarten school Pamotan as experimental class 1, the results of the pretest obtained an average value of 50.0 then after using the development of a scientific learning model based on Steam and Loose Parts (Posttest) got an average score of 80.7. In experimental class 2, namely group B in Aisyiyah BA, the pretest results got an average score of 50.3 then after using the development of scientific learning models based on Steam and Loose Parts (Posttest) the average score was 80.3. As for experimental class 3, namely group B in Pertiwi kindergarten school, the pretest results got an average score of 50.7 and after using the development of scientific learning models based on Steam and Loose Parts (Posttest) the average score was 80.0.

These results prove that the development of a scientific learning model based on Steam and Loose Parts is feasible to use in learning. Based on the children's cognitive abilities that increased after being given treatment using the development of a scientific learning model based on Steam and Loose Parts.

4.4 The Effectiveness of Developing Steam and Loose Parts-Based Scientific Learning Models to Improve Cognitive Ability in Kindergarten Children in Pamotan District, Rembang Regency

The results of the paired sample statistics show that the cognitive abilities of the experimental class children (Pembina kindergarten school, Aisyiyah kindergarten school, and Pertiwi kindergarten school) are learning by using the development of scientific learning models based on Steam and Loose Parts, kindergarten school the coaches get a posttest score of 80.7; the posttest score in Aisyiyah kindergarten school was 80.3 and the posttest score at Pertiwi kindergarten school was 80.0. These results can be interpreted that the average value of the cognitive abilities of children from the experimental class both in Pembina Kindergarten, Aisyiyah Kindergarten, and Pertiwi Kindergarten which both use Steam and Loose Parts-Based Scientific Learning Model Development, have relatively the same cognitive abilities of children,

Meanwhile, when compared with the average value of children's cognitive abilities in the control class at Ketangi Kindergarten, namely learning without using the development of scientific learning models based on Steam and Loose Parts, the posttest score was 56.0. This result is lower than the experimental class. So, it can be said that children who are given learning using the development of scientific learning models based on Steam and Loose Parts have better cognitive abilities than children who are not given learning using the development of scientific learning models based on Steam and Loose Parts.

5. Discussion

The scientific learning model based on STEAM and loose parts are suitable to be used to improve the cognitive abilities of the Pembina kindergarten school Pamotan Rembang students, based on the cognitive development of children who experienced an increase after using the developed learning model. In experimental classes, one and experiment, two, and experiment 3 children's cognitive abilities increased.

Based on the results of the small-scale trial above with the achievement of a validity level of 76.6%, the development of a steam and loose parts-based scientific learning model to improve cognitive abilities in Kindergarten children in the Pamotan Sub-district of Rembang Regency does not need to be revised to be tested in the field on a larger scale. big. However, comments and suggestions from respondents on small-scale trials on open-ended questions

will be taken into consideration to improve the learning model so that the development of learning models will be better.

In interviews with teachers after using the development of scientific learning models based on steam and loose parts in small-scale trials, the conclusion is that teachers get innovative and creative learning materials, then the teacher states that the design in developing the learning model is very interesting, teachers and children feel the benefits in learning to use the development of this learning model, besides that the language used in the development of scientific learning models based on steam and loose parts.

The results of this study indicate that the scientific learning model based on STEAM and assisted by the Loose Parts media developed can improve children's cognitive abilities and this is to the Directorate General of Early Childhood Education (2015: 15) that the learning process and stimulation are given to children must be able to maximize all of the child's five senses using an approach to learning that is appropriate to the child's world. One approach that can be used is the scientific approach. The scientific approach is a learning process designed in such a way that students actively construct attitudes, knowledge, and skills competencies through the stages of observing, asking, gathering information, reasoning, and communicating.

The application of a scientific approach in the learning process in Early Childhood Education also supports the cultivation of core competencies that must be possessed by children with various learning activities through play that is carried out in the Early Childhood Education unit. These qualities contain an overview of the main competencies which are grouped into competencies of spiritual attitudes, social attitudes, knowledge, and skills (Nurani, 2015).

Then the scientific learning steps developed in this study are also in line with the theory of applying the scientific approach according to Utami & Murti (2017) namely through 5 stages or activities including (1) observing, namely presenting real objects or objects from the themes discussed to be observed by children using all his senses; (2) questioning, namely providing opportunities for all children to ask things that interest them about the topic under discussion; (3) collecting information, namely conducting simple experiments to prove the questions posed by children and collecting information on the topics discussed from various sources; (4) reasoning, namely discussing to make conclusions about the topics discussed and combining the knowledge that the child already has with the new knowledge gained; (5) communicating, namely communicating the knowledge obtained both through language/stories and also the results of the work.

Research conducted by Lestariningrum & Wijaya (2020) also revealed that the results of playing loose parts have effectiveness in cognitive development in problem-solving where of course the study of a child using the thinking process in solving problems is also one of the developments of creativity because there is no one definite command in solving problems. play activities but children will play with various ideas of their imagination using objects around them. When the theme is playing, the child will also become an excellent observer, maybe he will find another idea after seeing his friend's work because the thought process of a child who has his uniqueness needs to be motivated first by his peers and the parents of the teacher nearby.

The results of the research presented by the researcher gave rise to an original result of children working using loose parts which were facilitated by the teacher in preparing and arranging play equipment. According to Runco and Jaeger in Kusumawardani et al. (2018) originality is a main and basic value in the concept of creativity which is balanced with the value of appropriateness and benefits for the development needs of children. The process of preparing to play loose parts as part of the learning process where according to Sadiman in Kusumawardani et al. (2018) is an effort as a form of manipulation of various learning resources so that the learning process in students runs effectively by providing the widest opportunities. in children doing activities independently.

Cognitive abilities of children aged 5-6 years in group B at Pembina Pamotan State Kindergarten as experimental class 1 pretest results obtained an average value of 50.0 then after using the development of scientific learning models based on Steam and Loose Parts (Posttest) got an average score 80.7. In experimental class 2, namely group B in Aisyiyah BA, the pretest results got an average score of 50.3 then after using the development of scientific learning models based on Steam and Loose Parts (Posttest) the average score was 80.3. As for experimental class 3, namely group B in Pertiwi kindergarten school, the pretest results got an average score of 50.7 and after using the development of scientific learning models based on Steam and Loose Parts (Posttest) the average score was 80.0.

The scientific learning model based on STEAM and loose parts have been proven to be effective in increasing cognitive abilities in students, this is based on the average value of the cognitive abilities of children from the experimental class both in Pembina kindergarten school, Aisyiyah kindergarten school, and Pertiwi kindergarten school which both use the development of scientific learning models Based on Steam and Loose Parts, the children's cognitive abilities were relatively improved compared to the control class.

Based on the results of paired samples statistics, it is known that the cognitive abilities of the children in the Experiment class (Pembina kindergarten school, Aisyiyah kindergarten school, and Pertiwi kindergarten school) are learning by using the development of scientific learning models based on Steam and Loose Parts. the posttest score in Aisyiyah kindergarten school was 80.3 and the posttest score at Pertiwi kindergarten school was 80.0. These results can be interpreted that the average value of the cognitive abilities of children from the experimental class both in Pembina Kindergarten, Aisyiyah Kindergarten, and Pertiwi Kindergarten which both use Steam and Loose Parts-Based Scientific Learning Model Development, have relatively the same cognitive abilities of children.

Meanwhile, when compared with the average value of children's cognitive abilities in the control class at Ketangi Kindergarten, namely learning without using the development of scientific learning models based on Steam and Loose Parts, the posttest score was 56.0. This result is lower than the experimental class. So, it can be said that children who are given learning using the development of scientific learning models based on Steam and Loose Parts have better cognitive abilities than children who are not given learning using the development of scientific learning models based on Steam and Loose Parts.

Early childhood with an age range of 4-6 years, is in the process of growing and developing, experiencing changes in learning abilities by mastering higher levels in aspects of movement, thinking, feeling, and interacting both with others and with objects in their environment. It is a challenge for early childhood to have thinking skills that not only apply what has been understood but are also able to analyze, evaluate and even synthesize a problem to get the best solution. This is what makes it important to prepare early childhood to respond to changes that occur by having 21st-century skills.

To face the demands of the 21st century, someone who has thinking skills can apply the knowledge obtained and process it to find solutions and even find answers to problems that arise. When the problem is too complex and unresolved, it becomes the basis for the need for high-level thinking skills to solve it. The need for integration of skills in learning programs will support children to acquire and master skills explicitly, so that life does not encounter many difficulties with children's ability to adapt to new situations, be able to solve their problems, express ideas, and reflect on how children's efforts influence others. In the future, children are expected to be able to give a positive reaction to the inevitable changes around them and solve problems that arise.

The STEAM learning model that is proven in the experimental class can improve children's cognitive abilities in line with the theory that the STEAM model can teach children to process through observing, playing, recognizing patterns, and practicing creative thinking skills, as well as collaboration and communication skills between children in completing a task or project given by the teacher (Sochacka et al., 2016). In addition, in the process children, are required to think creatively and critically on new things that are obtained by children. Children are also encouraged to solve problems with teachers and peers (Arumugam et al., 2019).

One learning approach that integrates several scientific disciplines for early childhood is learning with the STEAM approach (Science, Technology, Engineering, Art, Mathematics). STEAM is explained by Purnamasari et al. (2020) as a learning approach that can stimulate children's curiosity and motivation to have problem-solving skills, collaboration, learning independently through project-based learning, challenge-based learning, and research.

According to Amelia & Nuraeni (2021) STEAM-based learning is a development of the 2013 curriculum which stimulates children to have the skills to think, cooperate, communicate and collaborate with others. Early childhood education (PAUD) is growing from time to time, most of the success of the learning process is determined by educators using student-centered learning methods.

Stimulus is very necessary for children's development and the media is a tool that can be used as an intermediary in stimulating all aspects of development in early childhood both aspects of moral and religious values, physical and motor aspects, language aspects, social-emotional aspects, cognitive aspects, and artistic aspects. In stimulating the developmental aspects of early childhood, it must be adjusted to the age and stages of development because every child, even though they are of the same age, sometimes has a different stage of development. To stimulate all aspects of early childhood development cannot be separated from learning media because early childhood learning is done through playing using learning media, both real media, audio media, visual media, environmental media, and audiovisual media, so that learning activities in children effective early age.

Researchers in addition to developing a scientific learning model based on the STEAM model also use loose parts media materials. Loose part media during the research was quite capable of being a means for children to introduce concepts more clearly through the practice of playing a loose part. This shows that the selection of loose parts media is also one that is obtained from the child's closest environment where the concept according to research conducted by (Nurjanah, 2019) reinforces that open loose items are very easy to find in the natural environment without incurring costs but providing a container for children to pour. creativity in using free material objects so that children have the freedom to experiment and explore.

6. Conclusion

Based on the results of the study entitled "Development of STEAM-Based and Loose Parts Scientific Learning Models to Improve Cognitive Ability of State Kindergarten Students of Pamotan Rembang, the following conclusions can be drawn: 1) Analysis of the needs for developing scientific learning models. The needs of teachers and students for a scientific learning model that can connect knowledge with real practice, besides that the learning model needed is also assisted by game media. The need for teacher and student learning models can encourage students to think critically and analyze problems independently and be able to stimulate children's cognitive development. 2) Design of scientific learning model development. The scientific learning model design based on STEAM and loose parts consists of easy and implementable learning model steps including observation, questioning, association, experimentation, and reporting activities. The learning model is also combined with loose parts of learning media to stimulate children in analyzing simple problems to encourage cognitive development. Product validation and improvement are carried out

under the direction of learning expert lecturers and linguists. 3) Feasibility of developing scientific learning models. The scientific learning model based on STEAM and loose parts are suitable to be used to improve the cognitive abilities of the public kindergarten school Pembina Pamotan Rembang students, based on the cognitive development of children who experienced an increase after using the developed learning model. In experimental classes, one and experiment, two, and experiment 3 children's cognitive abilities increased. 4) The effectiveness of the development of scientific learning models. The scientific learning model based on STEAM and loose parts have been proven to be effective in increasing cognitive abilities in students, this is based on the average value of the cognitive abilities of children from the experimental class both in Pembina kindergarten school, Aisyiyah kindergarten school, and Pertiwi kindergarten school which both use the development of scientific learning models Based on Steam and Loose Parts, the children's cognitive abilities were relatively improved compared to the control class.

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Conflict of Interest

The authors declare no conflicts of interest.

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