

Application of Steam and Scientific Approaches in Various Learning Models**Alwafa Refinning Anida Setyawan**

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Model**Abstract**

Competitive and productive are the keys to victory to become a developed country, this is the basic capital for the Indonesian people to win the global battle and this has been owned since the time of our ancestors. This study aims to analyze the effectiveness of applying the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach in various learning models and examine its impact on students' creativity, initiative, and innovation. The application of STEAM learning with an integrated implementation with the application of application-based science fields in children's daily lives through a scientific approach, thus enabling learners to create, take initiative, and innovate individually, because STEAM content is learning with cross-disciplinary connections through exploration opportunities so that it is expected that there is a link between science, technology, engineering, arts, and mathematics by utilizing existing facilities in the surrounding environment to solve problems in building positive knowledge.

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E-mail: alwafasetyawan@gmail.com**INTRODUCTION**

Efforts to align Indonesia with developed countries are not easy flipping the palm of the hand, even though the potential is there, it must be accompanied with hard work from now on (Wibianti, 2021) . Competitive and productive are The key to victory in becoming a developed country is capital the basis of the Indonesian nation can win the global battle and this has happened owned since era grandma ancestors We (Joko Widodo: Indonesian Media).

For can face period front Which full with the unknown situation of change, it needs to be questioned is they own trust self And ability Forface it (Sihotang, 2019) . Enable them to survive the waves change towards a Golden Indonesia, a time where Indonesia has become country Which strong And sturdy. The key is source Power We must strengthened early so they can survive (Subyantoro & Suwanto, 2020) . We must be able build generation early Which own trust self And ability to face unknown challenges, thus, they will only be able to survive in the future society. Because what they will face in the future is uncertain Once found previously. So For overcome problem This, He must depend on self Alone For think, Study Alone, And own self-confidence and resilience in facing something that is not is known (Gainau, 2015) . Besides That, Lots problem No can resolved only relying on ourselves, so how to properly convey our thoughts to others, is also an indispensable ability. An educational concept that focuses on aspects of collaboration, directing children to think critically, be creative, innovate and find solutions, which is internationally based and based on Indonesian moral and cultural values. (Saputra et al., 2023) . Whether we realize it or not, the world of education continues to innovate so that if we don't keep up with developments leading to change, we will remain behind in everything.

In line with matter the in on, Which related with learning active, innovative as well as think critical in line with draft learning STEAM (*Science, Technology, Engineering, Art And Mathematics*) where the main concept is that practice is equally important with theory (Kartika, Aroyandini, Maulana, & Fatimah, 2022) . This means you have to use your hands

and the brain to learn. If child only Study theory in in class so child I won't Can compensate for change dynamic world. Main feature STEAM is center learning from various subject different, Where child Can using their hands and brains. Children must practice knowledge Which they learn (Sukmawati & Rakhmawati, 2023) .

Application learning charged STEAM in its implementation in integrate on fields knowledge based on application in life daily child through approach scientific Which possible participant educate become individual Which creative, initiativeand innovative, because STEAM charge is learning with connections cross-disciplinary (Irdalisa, Amirullah, & Dirza, 2022) . Therefore, when a child's gold is over, it should not be delayed For get stimulation optimal. A explosion study in neuroscience and other developmental sciences show us that architecture base brain child built through process sustainable Which started previously born and continues until mature. Like development House, process development started with laying foundations, framing rooms, and wiring electrical systems in a predictable order. Early experiences literally shape and how the brain is built. A strong foundation in the early years increases the likelihood of positive outcomes. The weak will require education, clinical care, or other interventions that are less effective and more expensive than providing important brain-building interactions early in life.

This research aims to analyse the effectiveness of implementing the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach in various learning models and assess its impact on learners' creativity, initiative, and innovation. In addition, this research also aims to identify challenges and opportunities in the implementation of the STEAM approach at various levels of education, examine how the scientific approach can support the development of 21st century skills in learners, and provide practical recommendations for educators in integrating STEAM and scientific approaches in the education curriculum.

The novelty in this research lies in the integrative approach that combines STEAM and scientific approaches holistically in the learning model. This research focuses on the application of the STEAM approach in Indonesia, which has not been widely explored in previous literature, and uses the latest data analysis methods to evaluate the effectiveness and impact of the STEAM approach on learner learning outcomes. The study covers different levels of education, ranging from early childhood education to secondary education, providing a broad perspective on the application of STEAM. In addition, this study develops a new theoretical model that explains the relationship between the STEAM approach, the scientific approach and the development of 21st century skills in learners. It is hoped that this research can make a significant contribution to the development of innovative and effective learning models, as well as provide new insights for educators and policy makers in improving the quality of education in Indonesia.

RESEARCH METHODS

This research uses the literature study method. Literature study is research carried out by researchers by collecting a number of books, magazines, leaflets relating to research problems and objectives.

RESULTS AND DISCUSSION

Understanding STEAM

1. Science Concept

Science comes from the Latin word *scientia* which means "knowledge". So the definition of science is a way of studying certain aspects of nature in an organized, systematic manner and through various standardized scientific methods. (Hidayatullah, 2019) . The scope of science is limited to various things that can be understood by the senses (sight, touch, hearing, touch and taste) or it can be said that science is knowledge obtained through learning and proof. (Izzuddin, 2021) . Indonesian Wikipedia about natural sciences, Science is taken from the Latin word *scientia* which literally means knowledge. Sund and Trowbribe formulated that science is a collection of knowledge and processes. Meanwhile, Kuslan Stone said that science is a collection of knowledge and ways to obtain and use that knowledge. Science is a product and process that can not be

separated. Science in early childhood can be defined as things that stimulate children to increase curiosity, interest and problem solving, giving rise to thoughts and actions such as observing, thinking and linking concepts or events. Science is a problem-solving activity carried out by humans who are motivated by curiosity about the world around them and the desire to understand nature, as well as the desire to manipulate nature in order to expand their desires or needs.

2. Technology concept

Indonesian Wikipedia about technology in general is all the means to provide goods or tools necessary for the continuity and comfort of human life. Humans use technology starting with converting natural resources into simple tools. The term technology itself comes from the Greek, namely *techne* and *logos* (Idrus, 2021). The word *techne* means skill while *logos* means knowledge. So, technology means science that studies skills. Technology in general is science related to tools or machines created to help and make it easier for humans to solve problems or jobs in the world (Erwinsyah, 2016). The use of technology by humans begins with the conversion of natural resources into various kinds of simple tools. In this way, we as adults, teachers and parents, do not need to be afraid if we want to introduce technology to children, because technology needs to be a learning material for them so that they can feel their abilities better, including for young children.

3. Engineering Concept

The engineering aspect in the STEAM approach is the skills a person has to operate tools/objects or assemble things. Bligh (2015) classifies engineering aspects as referring to the application of scientific knowledge and skills in using technology and creating a method that has benefits. (Rahayu, Warlizasusi, & Fakhrudin, 2022). Engineering is a way of doing. Techniques for solving problems, using various materials, designing and creating and building something that can be used.

4. Concept Art (Art)

In general, art is anything created by humans that contains elements of beauty and is able to arouse feelings in themselves and others. Based on this definition, art is a product of beauty, humans try to create something beautiful and can bring pleasure. Herbert Read, art is an expression of pouring out the results of observations and experiences associated with feelings, physical and psychological activities in the form of work (Hasanah, Zaqiah, & Heryati, 2021). Leo Tolstoy, art is an expression of the creator's feelings which are then expressed to other people in the hope that they can feel what the creator feels. Ki Hajar Dewantara, art is the result of beauty so that it can influence the feelings of someone who sees it, and art is a human act that can influence and create beautiful feelings.

5. Mathematical Concepts

According to Indonesian Wikipedia, the word "mathematics" comes from the ancient Greek word *mathema*, which means study, science whose scope is narrowed, and the technical meaning is "mathematical study". The adjective is *mathematikas*, related to study, diligent study, which further means mathematics. According to Reys in Irsyad Farista, mathematics is the study of patterns and relationships, a path or pattern of thought, an art, or language and a tool. According to Russeffendy ET in Revyareza, mathematics emphasizes activities in the world of ratios, rather than emphasizing the results of experiments or observation results. Mathematics is formed because of human thoughts, which are related to ideas, processes and reasoning. Mathematics in PAUD is a learning activity about mathematical concepts through play activities in everyday life and is scientific in nature (Juniati & Hazizah, 2020). Mathematics learning for children needs to be linked to real things, and directly related to human activities. Children learn mathematics through real things first before entering the abstract area of mathematics. These real things take the form of everyday life situations such as the natural surroundings where children play and learn. This is the real place where learning mathematics begins, so that children can carry out mathematical activities which are a learning process, so that children are able to construct mathematical concepts into their cognitive structures through guided discovery.

STEAM is a learning content that uses five sciences, namely knowledge, technology, engineering, art and mathematics, comprehensively and related to each other as a problem solving pattern. The expected end result of implementing the STEAM method is students who take serious risks. Engage in experiential learning, persevere in problem solving, embrace collaboration, and work through the creative process. Tracy Liu, in STEAM is the Future of education, STEAM is an absolute product of theory and practice. STEAM originated in America, and some schools follow the career paths of students who have graduated, then combine various subjects such as science, engineering, engineering and mathematics, and this is how STEM was formed. Later, they also included art subjects, and developed more fully into STEAM. Teachers believe that all these subjects play a major role in the future careers of the students. As a result, students are encouraged to study and combine these various types of knowledge.

Understanding the Scientific Approach

The scientific approach is one approach in building a way of thinking so that children have the ability to reason which is obtained through the process of observing and communicating the results of their thoughts. The scientific approach is a learning process designed in such a way that students build competency in attitudes, knowledge and skills through the stages of observing, asking, gathering information, reasoning and communicating. The scientific approach directs children to develop critical thinking so that children have the ability to reason which is obtained through the process of observing and communicating the results of their thoughts. To develop a critical mindset, learning content is needed that can reflect each activity's relationship to science, technology, implementation techniques, art, and the mathematical side. Therefore, children are still directly involved in every activity so that the changes that occur in the process of one activity during it, children can really record well.

Benefits of a Scientific Approach in Early Childhood

A scientific approach is used when children are involved in play activities (including science learning activities). The benefits of a scientific approach implemented in PAUD are:

1. Encourage children to have the ability to think critically, analyze and have the ability to solve problems.
2. Get a more meaningful learning experience by encouraging children to carry out activities of observing, asking questions, gathering information, reasoning/associating, and communicating.
3. Encourage children to find out from various sources through observation and not just being told.

The Goals of a Scientific Approach to Early Childhood Education

By Dini Leeper (1994) stated that the objectives of a scientific approach to Early Childhood Education are as follows:

1. So that children have the ability to solve the problems they face.
2. Children have mature consideration in making decisions when receiving information or in finding problems.
3. Children are more interested and attracted to appreciate the science found in the natural environment around them, as well as the natural phenomena that occur.
4. Helping children develop a sense of gratitude towards God Almighty for all His creation.
5. Helps foster children's interest in recognizing and studying objects and events in the surrounding environment so that children's insight develops.
6. Develop children's curiosity about everything, especially what happens in their surrounding environment.
7. Helping children to be able to use simple technology, science, technology, engineering, art and mathematics concepts that can be used to solve problems found in everyday life.
8. Helping children to be able to apply various scientific concepts to explain natural phenomena and solve problems in everyday life.

Scientific Approach Series Process

The scientific approach process is a series of finding out by exploring through stages:

1. Observe
Observing means the activity of using all the senses (sight, hearing, inhalation, touch and taste) to recognize the object that is observed. The more senses used in the observing process, the more information will be received and processed in the child's brain. The teacher plays the role of observer and supporter/facilitator, not as the child's instructor. Observing activities can be done together inside or outside the classroom.
2. Ask
Questioning is a thinking process that is driven by a child's curiosity about an object or event. Basically, children are excellent researchers, they are always curious about something their senses perceive. That's why he often asks questions, sometimes the questions are beyond what adults expect. But it is a scientific process that comes from critical thinking.
3. Collect information
Collecting information is done in various ways, for example: by reading books, asking questions and concluding results from various sources. Children like to repeat the same activities but with different ways of playing.
4. Associate
The association process is a child's activity of comparing experiences they have experienced that are related to what they are currently experiencing.
5. Communicate
Children communicating ideas or experiences is not always the same as adults communicating directly verbally. The way children communicate or convey the things they have learned in various ways, either through stories, pictures of other works. The process of communicating is the process of transferring knowledge to new knowledge that children have acquired.

STEAM Approach Strategy with a Scientific Approach to PAUD

Learning should start from an early age, but learning is through playing, not carrying out a phenomenon that is still widely developing in our society, namely learning to write and read and count using numbers that have been designed in such a way. Learning for children must pay attention to the age of the child whose way of learning is still through playing.

Early age is the age where children experience rapid growth and development, so early age is called the golden age. Early age or also known as the golden age is the right time to develop a positive attitude for someone. Therefore, as adults, you must truly understand the needs of children's activities, which should lead to play activities. Playing in a sense contains educational value so mentoring must continue to be provided. This is what differentiates it from adults who do not fully need assistance.

Child age early own characteristics Which different with person mature in behavior. Thus in terms of children's learning too own characteristics Which No The same also with person mature. The characteristics of children's learning methods are a phenomenon that must be understood and used as a reference in planning and implementing learning For child age early. Has Lots draft learning Which has tried out to child age This so that truly can serve every child's curiosity about the problems they face, in particular Which related with surrounding environment. Wrong One his is draft integrated between scientific fields, both in secondary school and at Education Child Age Early, draft learning Which intended is learning STEAM.

STEAM is a collaborative learning content that leads in providing motivation, innovation that can give birth to creative people going to public achievement Which No only strengthen learning in discipline knowledge. But between discipline knowledge through the opportunity to explore the expected connection between science, technology, *engineering*, art, And mathematics with Utilization of existing facilities in the surrounding environment to complete problem in build knowledge Which positive. STEAM it's not about learning Which separate, But How method collaborate or implement all existing components theme the. With say other, participant educate sued For capable analyze and think critically in

processing materials and using them tools in solving existing problems in everyday life in his environment.

To implement what is meant above, several things can be done consideration For done:

1. Creating a friendly, imaginative and child-centered learning environment that supports the implementation of activities and is oriented towards children's creativity and curiosity.
2. Environmental conditions build children's level of health and thinking power which contributes to collective welfare and children's future prosperity.
3. Develop basic science skills in terms of observing, predicting and problem solving by playing with water. As well as other objects that are easily obtained from the environment.
4. Providing parents with the opportunity to be involved in their children's activities at any time to help build their children's playing experience so that they can better understand the activities their children are doing and feel the joy they feel when their children are doing activities comfortably.
5. Writing down their thoughts and ideas is the right way to document a child's growth as information for interested parties.

Other things that can be considered in implementing STEAM learning through a scientific approach include:

1. Providing reinforcement to teaching staff regarding scientific approaches.
2. Providing reinforcement to teaching staff regarding STEAM learning content.
3. Environmental readiness as the main supporting vehicle for implementing a scientific approach through STEAM learning content.
4. Identify themes that are connected to the surrounding environmental conditions to support the implementation of STEAM content.
5. Prepare a plan regarding the activities carried out.
6. Prepare facilities/tools that will be used in carrying out activities.

The reasons that make the environment very important in environment-based teaching and learning interactions are: as a means of learning, the environment is the natural world around the child. So everything around the child is an object to be taught to the child or the environment is a learning target for the child, as a source of learning, the environment is a source of learning, apart from teachers, laboratory books, experts, as a means of learning, the environment is a good learning suggestion. even the natural environment provides materials that do not need to be purchased.

Techniques that can be used in using the natural environment as a learning concept include surveys, camping, field trips, field practice, inviting resource persons, and also in the form of field projects/community service. Based on these techniques, the concept of environmental learning used at the early childhood level tends to only involve surveys, field trips, and inviting resource persons. .

CONCLUSION

Application learning STEAM charged inside integrated implementation with fields knowledge based on application in life daily child through approach scientific , possible participant educate become creative , initiative , and individual innovative , because STEAM content is learning with connection cross discipline knowledge through chance For explore what is expected happen connectivity between science , technology , engineering, arts , and mathematics with utilization existing facilities in the environment around For finish problem in build positive knowledge. STEAM learning with approach scientific This deploy children's play activities sued No only do existing play activities planned before, however child challenged / motivated For make other similar activities with the same purpose . Child motivated for do different activitieswith existing activitiesdone with direct child use tool and media other than those already mentioned prepared. Naturally child expected use tool and existing media surrounding good in class or outsideclass.

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