

STEAM-Based Learning Through Magnetic Book: Efforts to Introduce Science Inquiry for Early Children

Munawar, Muniroh^{1*} Roshayanti, Fenny² Sugiyanti³

¹Universitas PGRI Semarang

²Universitas PGRI Semarang

³Universitas PGRI Semarang

*Corresponding author. Email: munirohmunawar@upgris.ac.id

ABSTRACT

Application of STEAM (Science, technology, engineering, art, and Mathematic) in Early Childhood Education is a form of an educational revolution that integrates various fields of Science Technology Engineering Art Mathematics in one child's play activities. The STEAM approach supports the development of children's scientific inquiry and equips children with the ability to design the process of how a tool works. This research is a part of the KIT STEAM research development in learning in Early Childhood Education aimed at introducing scientific inquiry early on. The application of magnetic books in learning is analyzed by qualitative methods. 3 groups of students from Early Childhood Education Institutions were involved in this study. Data collection techniques were carried out through observation, interviews, and documentation that were analyzed by triangulation. The results showed that the use of the magnetic book theme "Myself" as KIT STEAM in learning in Early Childhood Education/kindergarten provided opportunities for students to explore, analyze and create. Students could practice doing their discoveries through the activities of manipulating various manipulative pieces. The various manipulative pieces were designed to stimulate students to think at a higher level with the assistance of inquiry questions from the teacher. Student thinking results could be seen from the placement of manipulative pieces of images placed on the page (magnetic sheet).

Keywords: STEAM based learning, magnetic book, science inquiry, early children

1. INTRODUCTION

Based on data from the Ministry of Education and Culture in 2017, the total of gross enrollment rate (APK) or pure participation rate (APM) of children aged 3 to 6 years is 19,234,500 children. Various studies have proven that Early Childhood Education is very helpful in children's school readiness (Gautama, 2018), both scholastic and also non-scholastic abilities. [1] But reality on the ground does not apply that. Early Childhood Education institutions are still oriented towards the preparation of scholastic abilities which is not about pre-literacy but they tend to focus on the achievement of read-write-count ability through student worksheets. Referring to the Circular of the Directorate General of Elementary Education of the Ministry of National Education number 1839 / C.C2 / TU / 2009 regarding the implementation of Kindergarten education and admission of new elementary school students, there are some irregularities in the implementation of Early Childhood Education, one of which is the prohibition of read-write-count at Early Childhood Education, but the rule is violated. [2] Learning at Early Childhood today should adjust the 21st century competency framework, in which in life and career, initiative and independent abilities, have social and cultural skills, productive and accountable, and leadership and responsibility are needed. [3] 21st Century competence can be developed at Early Childhood through science inquiry process or scientific approach in learning, in

which children in learning are stimulated by scientific thinking through observing, asking, reasoning, gathering information and communication. With this science inquiry process, Early Childhood is honed to use higher cognitive levels such as analyzing, evaluating and creating something to become a work. Lately STEAM (Science Technology Engineering Art Mathematics) is seen as an approach to preparing 21st century generations, which aims to stimulate creativity, prepare children in a world of work full of innovation and invention. With STEAM, children are stimulated to explore, investigate, encourage their curiosity and make conclusions about: how something works, how to build and develop designs. STEAM also gives children the opportunity to learn to express their understanding in creative ways. This is a form of positive work attitude stimulation. Learning must be conditioned so that children not only do the work (paper and pencil test) but through constructive play with a scientific inquiry approach, children create something. Meanwhile abroad, such as Australia, America, Korea, STEAM has been applied in learning. Children are empowered to act as learning agents creating a work through specific projects according to the theme. Based on the background, it is necessary to conduct research related to the development of STEAM at Early Childhood learning. The problem in this study is: How is the effort to introduce science inquiry to early childhood through steam-based learning using magnetic books?

2. THEORETICAL REVIEW

The 2013 Early Childhood curriculum promotes the development of constructivism learning that is more flexible in its implementation so as to provide space for children to develop their potentials and talents. Delivering early childhood who is ready to continue education is not only limited to the child's ability to read, write and count, but also in all aspects of developments. The implementation of a scientific approach at Early Childhood learning actively stimulates children to be able to observe, ask questions, gather information, reason, and communicate, whether related to themselves, the environment, or events. The Early Childhood curriculum uses thematic learning with a scientific approach that will provide meaningful and enjoyable learning for children. Early childhood is always full of curiosity about what is around. This knowledge can be explored by exploring the environment by playing. According to Smilansky (1968) every child must experience a lot of playing experience [4]. Meanwhile Piaget and Smilansky put forward the stages of playing at Early Childhoods, as follows: a. Functional Play, b. Constructive Play, Make-Believe Play, d. Game with Rule [5]. Regarding learning, Vygotsky put forward several principles, namely: students learn through joint interactions with adults or more capable friends, children will be able to learn concepts well if they are in the ZPD (zone of proximal development). Scaffolding is a child given a complex problem, difficult, and realistic, and then given sufficient assistance in solving the students' problems [6]. The constructivist perspective at Early Childhood learning leads to the construction of knowledge by children through an interactive and dynamic process [7]

Scientific inquiry at early childhood must consider four characteristics related to how children think and learn, namely: a. Children as theory builders, b. Children need to build a basis of physical knowledge, c. Children become more independent and autonomous, both intellectually and morally, d. Children as social creatures that can be influenced and influence others [8], [9]. Today, constructive learning is carried out with the approach of Science, Technology, Engineering, Arts, and Mathematics (STEAM) [10]. The development of STEAM is an integration of STEM learning (Science, Technology, Engineering, and Mathematics) with art (Art) [11]. The integration of art in STEM learning produces a new acronym, namely STEAM (Science, Technology, Engineering, Art, and Mathematics). The art aspect generally leads to creativity. Science and art complement each other because science provides methodological equipment in art and art provides a creative model for the development of science [12]. Every aspect of STEAM becomes a defender in early childhood learning with the following characteristics: (1) Science, is about maintaining curiosity and curiosity. (2) Technology is for tools, for example crayons and pencils are tools used by young children. (3) Engineering starts with identifying the problem then think of a solution and try it. (4) Art, adding art and giving children the opportunity to illustrate STEM concepts in creative and imaginative ways, expressing ideas

about the world through music and dance, communicating with descriptive language, making markers, making graphics, and building models. (5) Mathematic, trains children to have mathematical thinking including comparing, sorting, working with patterns, and identifying shapes [13]. The application of the STEAM approach to learning has been carried out by various countries [14], [15], [16], [17]. Through STEAM children ability are trained to solve problems so they can hone their creativity. There is a relationship between the problem solving process with cognitive abilities and creativity [18], as shown in Figure 1.

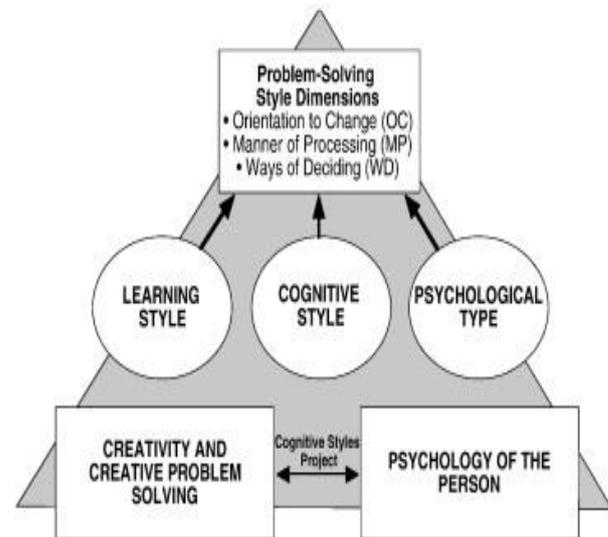


Figure 1 A relationship between the problem solving process with cognitive abilities and creativity.

To accommodate STEAM in Early Childhood learning, media is needed as a constructive playing tool. Media is an intermediary tool in the learning process [19]. Through the media, students can gain experience from an event either directly or indirectly [20]. Media in the form of constructive play tools can initiate problem solving activities, cognitive abilities and children ability to socialize [21], [22]. Some experts have stated that the development of child custody depends on how often children are in an environment that is intentionally created with the help of the media so that it allows all children to build experience in investigation and

problem solving [22], [23], [24]. Meanwhile Scientific Inquiry brings children to the scientific process through the activities of collecting and analyzing data, checking hypotheses and theories that reflect the nature of knowledge formation [24], [25], [26]. Introduction Media to scientific inquiry becomes very important for children to learn problem solving in everyday life [27]. This media is used when children are involved in playing activities whether playing roles, beams, literacy or arts. Various media in the form of constructive tools have been developed today such as BEAM, LEGO, 4DFrame etc. But today, many constructive game tools that refer to STEAM in accordance with thematic learning in Early Childhood are not developed yet.

3. RESEARCH METHOD

The application of STEAM-based magnetic book learning in Early Childhood used qualitative methods. The data collection techniques were observation, interviews and documentation, while data analysis through triangulation.

4. RESULT AND DISCUSSION

The theme of Myself was developed in the form of Interactive Book Magnetic. The magnetic books provide opportunities for children to explore, analyze and create their own inventions provided with manipulative pieces to use with this book. These types of books have a high educational value for children. There are 3 sub themes in Myself theme, namely: 1). Package 1 is about Who am I? It consists of topics: a) what is my name ?; b) this is my face; c) I am a boy or girl; d) how tall and heavy am I?; e) what is my favorite. Various manipulative pieces can be placed on the page to arrange the picture. In addition, in the backyard on each sheet, there is an empty sheet so that children are given the opportunity to create their own. 2) Package 2 is about my body? It consists of topics: a) how do my limbs look like? How does my body work? How do I see, hear, smell, taste, and feel? How do I take care of my body? This magnetic book with sub-themes of my body facilitates children to explore, investigate (extend) about the topics discussed in this textbook. Various manipulative pieces can be placed on the page to arrange pictures according to the sentences of the questions asked. In addition, in the backyard on each sheet, there is an empty sheet so that children are given the opportunity to create their own. 3) Package 3 is about my goals? It consists of topics: a) When was I born ?; b) Where was I born; c) What is the layout of my school; d) What are my goals? Various manipulative pieces can be pasted on the page to arrange the picture.

STEAM-based magnetic book can develop scientific inquiry skills in children, including: 1) the ability to ask questions; 2) problem identification ability; 3) ability have the opportunity to develop habits and behaviors that will serve them in achieving academic abilities. Besides developing models; 4) ability to plan and conduct investigations; 5) data interpretation capabilities; 6) mathematical and computational thinking abilities; 7) ability to build explanations; 8) problem-solving ability; 9) argumentative ability; 10) ability to evaluate and communicate. [28]

Early childhood are able to be involved in STEAM investigations when they are guided by skilled and knowledgeable teachers [29]. By engaging in STEAM activities, children begin to develop self-control, memory, attention, and the ability to plan with others. This executive ability, as a basis for problem solving is used to develop future academic abilities [30].

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Play-based learning activities were designed for children to experience and imagine the concept of "small" as used in chemistry, moving from the visually experienced level of "small" towards more imaginative understandings. Data were collected through visual ethnography. Analyses of six vignettes of conversations between children and the teacher illustrate development of children's understanding of the focus concept. Emergent science is a terminology first used by Siraj-Blatchford (2001) to describe a science perspective for early years education. This perspective considers that science activities are socially situated, driven by exploration of scientific phenomena and positive engagement. This is in effort to provide countries with accurate guidelines and measures for implementation in educational institutions, hospitals, and crowded areas. At the beginning of summer until the beginning of the autumn, the situation with coronavirus infection has stabilized. However, during the initial outbreak of the infectious diseases, the epidemiological situation around the world rapidly deteriorated. 250 thousand children are taught in the traditional format in schools with up to 180 children. This is 7.3 % of the total population. In General, 24 % of students study in the traditional format. Generally, we consider distance learning to be a convenient and at the same time useful form of learning. Maybe four walls are enemies for some people, but not for us. STEM/STEAM learning applies meaningful maths, science, and technology content to solve real-world problems through hands-on learning activities and creative design. "STEAM is more than just the traditional science technology engineering arts and maths subjects on their own they're opportunities where subjects combine to form interesting new subjects such as bio engineering and biotechnology," explains John Durant, MIT Adjunct professor. Adding the "A" to the STEM subject areas.