ICEE-2

Analysis of Teacher's Readiness in Implementing Learning Based on Science Technology Engineering and Mathematical in Children of Early Age

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Abstract. This essay draws data from several studies that have been carried out some previous research that discusses the teaching beliefs in Science in Engineering and Mathematical Technology (STEM). This essay aims to express some opinions of early childhood education teachers about implementing STEM in terms of high and low economic backgrounds. This essay uses a systematic literature review method. A total of 8 related journal articles that examine STEM in children and articles taken from 2010 to 2018 are used as sources to be reviewed. The belief of early childhood teachers in implementing a learning innovation is still rarely done, this arises because there is still a lack of understanding of teachers related to learning innovations that always develop in accordance with the times. Teachers' teaching experience and their awareness of the importance of science, technology, engineering and mathematics and the way in which science, technology, engineering and mathematics teaching are integrated play different roles in teaching in the classroom. The results of the analysis carried out there are differences in beliefs and awareness revealed between teachers in schools with a high economic background and a low economy related to teacher beliefs in implementing STEM learning in early childhood. The findings of this analysis support the need for professional improvement that can increase teacher understanding of the importance of STEM in early childhood.

Keywords: STEM, belief, implementation

INTRODUCTION ~ Science Technology Engineering and Mathematics (STEM) has become one of the learning models developed in the era of the industrial revolution 4.0. Education in the current era is carried out to produce students who are able to choose 21st century skills (Saavedra & Opfer, 2012). The results of the 21st century education process students are required to possess skills such as critis, creative, communicative and collaborative skills that have existed since decades ago, but in the era of the industrial revolution 4.0 more encouraged teachers to do learning that stimulates children to have the ability at each stage education (Bybee & Fuchs, 2006, p. 350; Rotherham & Willingham, 2009, p. 20).

Learning Science, technology, engineering, and mathematics education (STEM) is considered capable of training students in improving educational attainment that supports 21st century skills. The intended learning is an integrated approach that is able to teach science and technology-based techniques and mathematics in kindergarten to class. 12 (Bybee, 2010). This opinion is in line with several previous studies which show that the initial STEM experience (defined as preschool through third grade) plays an important role in increasing children's knowledge, skills and dispositions needed for future work and preparing students for economics that demand solutions innovative for complex problems (see Aronin and Floyd, 2013; Chesloff, 2013;

DeJarnette, 2012; New, 1999). For example, Chesloff (2013) argues that STEM education must begin in early childhood because "the core of the STEM concept is curiosity, creativity, collaboration, critical thinking - highly sought after by children" (p. 27).

Achieving this education can increase opportunities for economically disadvantaged families - especially in Science, Technology, Engineering and Mathematics (STEM). Unfortunately, students from low-income family backgrounds are far less likely to get STEM-based learning in schools. The many structural obstacles and preparation of STEM in schools such as environmental factors, the willingness of teachers in schools, systemic prejudice based on social class creates a feeling that the only way to help involve the large-scale changes needed to schools and communities is by the distribution of STEM-based learning (Christopher S. Rozek et al., 2018).

Although STEM learning has been justified in a number of studies and government policies, the views of early childhood teachers (3-8 years) in teaching STEM are still considered to be a marginal mismatch in their application (Parette et al., 2010). The presumption of STEM mismatch in early childhood has caused early childhood teachers to avoid teaching STEM and thus fail to develop their confidence to teach subjects related to STEM education in the classroom (Brown, 2005; Fenty and Anderson, 2014; East, 2012). Factors of teacher trust in implementing STEM learning can be attributed to teacher readiness which is seen as a "predictor of significant change in practice" (Lang, 1992: 301). Teachers' readiness to teach has specific elements, including knowledge, attitudes, and interests which are important components that directly contribute to the effectiveness of creating and applying teaching methods (Jusoh, 2012; Lang, 1992). Lang (1992: 301) conducted a study of teacher readiness - which he defined as "teacher awareness about curricular intentions and their reactions shown by interests, motivations, willingness, and attitudes and knowledge activated in the school context" - and found that teachers with affirmative views of their knowledge, attitudes, and interests in computer use indicate a high level of computer readiness.

METHOD

The systematic literature review method was used in this study to critically assess how academics innovate to develop STEM learning methods in early childhood education. Systematic literature review is a method for selecting and analyzing research results in an organized and systematic manner. Systematic reviews use transparent procedures to find, evaluate, and synthesize relevant research results. In short, a systematic literature review involves reviewing publications in accordance with predetermined criteria.

A systematic review of the literature uses an explicit methodological process to produce evidence synthesis. In this study the researcher recognized the influence of the subjectivity of the researcher in interpretation, as well as the limitations of the information provided by the authors of the original papers. To make the review more systematic, the formulation of the problem is used as a guide for the literature review. The formulation of the problem in this study is How to foster teacher readiness in implementing STEM learning and what approach is used in implementing STEM learning

A. Data Sources

The review carried out in this study focuses on the publication of Engineering Science and Mathematic Technology. Researchers are aware that publications on Engineering Science and Mathematic Technology can appear in various levels of education. However, the researchers focused on a large number of publications on Science Technology engineering and Mathematic on the level of early childhood education, the results of preliminary studies and a careful review of the selection of article titles.

The researcher's search was limited in 2010 to 2019. To make the search for these criteria easier, using keywords to search for titles, abstracts or keywords from journal articles. Besides being based on searching using keywords, researchers also conducted searches based on references from libraries that have been found with the same criteria.

B. Data Selection

Done by searching for publications using keywords to produce 28 related publications. The selection of potential publications that are relevant to our topic is done by reading the publication titles and obtaining 8 publication titles from the process. This publication article is then read in depth and classified based on the innovation of the instrument developed. 8 out of 28 publication documents.

DISCUSSION

Researcher's analysis of several articles conducting open surveys about the importance of STEM in early childhood education has revealed several emerging themes. One of the themes is that participating teachers tend to believe that STEM early childhood education is very important and in line with development to build the basis of concepts, knowledge, and skills related to STEM subjects. This finding is in line with previous research claims that concepts and skills learned from birth to the age of 8 years are significant precursors for the learning and school achievement of subsequent children (Chesloff, 2013; Lind, 1999; New, 1999).

Other themes are related to the positive role of STEM in employment and global competitiveness, parental involvement, and gender disparities in STEM education. These themes are also in line with findings

from previous studies on the topic Bagiati et al., 2010; Bybee and Fuchs, 2006). For example, issues relating to gender disparities in STEM education have been examined in previous research, focusing on the stereotypical challenges that science, technology, engineering, and mathematics are male domains and provide parental, school, and social support to women in learning STEM based (Pajares, 2005; Seymour and Hewitt, 1997). Although the majority of participating teachers support the idea that STEM early childhood education is a significant basic component, it should be noted that around 30 percent of them do not believe in the appropriateness and importance of early STEM education.

There are a number of free questions that some researchers do that discuss what teachers might face in STEM-based teaching in early childhood, of the questions that arise there are several themes namely, (a) lack of time to teach STEM, (b) lack of instructional resources, (c) lack of professional development, (d) lack of administrative support, (e) lack of knowledge about STEM topics, (f) lack of parental participation, and (g) teacher reluctance to collaborate. In addition, some teachers refer to the difficulties they face in meeting the diverse needs of their students, including different levels and learning disabilities and the level of cognitive development. These themes are in line with findings in previous research on STEM education (Brown et al., 2011; Gebbieet al., 2012; Lang, 1992; Lind, 1999). On the issue of collaboration, Brown et al. (2011) suggested the need for collaboration in schools about STEM education when teachers had not been trained outside their content area about issues related to STEM education. Regarding the problem of difficulties with meeting the diverse needs of students, Lind (1999) shows that teachers must adjust or adjust activities to accommodate the strengths and needs of each child.

RESULTS

As shown in some of the literature of this article, there is a positive relationship between the level of PAUD teachers' trust in STEM teaching readiness and their awareness of the importance of STEM education and the challenges they may face in teaching STEM. An important implication of this literature is the need for professional development practices that will enhance teachers' understanding of the importance of STEM early childhood education, as well as their knowledge of STEM disciplines and the challenges they may face in teaching STEM. Of course, as some articles point out, teachers who have beliefs about teaching STEM can also experience challenges when they actually teach STEM in their classrooms (Chesloff, 2013; DeJarnette, 2012). However, with proper and equitable training throughout all schools, both schools and teachers will be better equipped to anticipate and overcome these challenges. So that it can evenly implement STEM-based learning in

schools regardless of economic background.

The conclusion, is that the methodology used in this study to investigate the heterogeneity of teacher beliefs about readiness to teach STEM and the differential effects of teacher related factors can be useful for empirical researchers in the STEM education field and other fields. . Also, teacher beliefs and teacher related variables (eg teacher attitudes and in-depth content knowledge) must be considered when designing professional STEM teacher development and pre-service STEM teacher training programs. Furthermore, given the positive effects of teachers' beliefs on their teaching decisions (Borko and Shavelson, 1990; Thompson, 1992), further research is needed to investigate how these effects can be transferred in the context of STEM teaching in early childhood classes.

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