The development of creative thinking problem solving abilities for early childhood from the full STEM Education model

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Abstract. The purpose of this research was to study changes in creative problem solving abilities of early childhood and to compare changes in creative problem solving skills of early childhood before and after receiving from conceptual activities STEM Education Theory. The population and the sample group used in this research were male and female early childhood aged between 5-6 years studying in kindergarten 2, 2nd semester, academic year 2017, Soonthornwattana School, Nai Mueang Subdistrict, Mueang District, Chaiyaphum Province. The sample group can be selected from a specific model. The population has come in the following steps. Specify 1 classroom type, 1 classroom, 37 classrooms, and organize activities according to STEM Education theory. For a period of 8 weeks, 5 days a week, a total of 40 times. The instrument used in this research is Plan to organize activities according to STEM Education and creative observation skills. The results showed that early childhood who have been organized activities according to STEM Education's theoretical concepts have developed more creative problem solving skills, with an average score of 14.63 and after the event will have a score of 24.27. When considering each aspect of the experiment, it was found that early childhood have creative problem-solving skills. Which has higher scores each week Shows that early childhood who have organized activities according to STEM Education's theoretical concepts have higher creative problem-solving skills which is in accordance with the assumptions set forth.

Key words: development of problem solving abilities, STEM Education's theoretical concepts

Introduction. Training for learners to use various thinking skills, which is an important basis for students to have creative thinking skills. Teaching and learning management that gives students enthusiasm and creative thinking ability. Is to emphasize by considering the consistency with the purpose. The content and age of the learner is important as a method of learning by using problem-based learning, it is a learning management process that focuses on providing students with problem-solving skills in a process with their own steps and reasons. By starting from defining problems and focusing on problems as a base, planning for solving problems. Assuming data collection proof of information data analysis and summarization results in the students having the skills to learn to solve problems systematically. In solving problems using various process skills which the learner will be the operator of both problems and problems conclusion according to their own interests. Learning management using problems as a base is a technique that focuses on learners and is caused by the cooperation of small groups of students. Recommendations encourage students to see problems and solve problems on their own. Due to problems that arise as a real problem with learners, it stimulates learning and develops problem solving skills to create new knowledge from self-learning. Wachara
Laoruangdee (2007: 94-95), which is fresh with Chantana Pagbongkoch (2011: 1) said that thinking is the starting point for people to express themselves in a good, useful and creative way, able to brush the barrier of various problems. Thinking helps people to be effective, which is important to lead the country to progress. And from the report of the assessment of the management of early childhood development for 3-5 years of the National Education Commission, said that early childhood education is lacking in the quality of children's learning methods, such as learning by allowing children to memorize only encourage children to use thinking from younger. Let the child sit with him all day. Providing a fixed teaching curriculum, accelerating teaching, reading, writing, and calculating beyond the level of children's ability to give freedom of expression do not let children speak. To sit quietly. Teachers have misunderstandings about how children are learning. Importantly, the learning styles that teachers practice on a regular basis are emphasizing that the child is a defensive person who acts as a teacher or imitates only, causing the child to not be able to think by himself. Due to the lack of cognitive ability, teaching, thinking is very important today. Many countries around the world have turned their attention and seen the importance of teaching, thinking and development success depends on the quality of people because education is the heart of human development. Which is consistent with the National Economic and Social Development Plan No. 11 (2012-2016) that focuses on the development of people to be quality and the center of intellectual development Emotional-mind Social and physical aspects of early childhood (Office of the National Education Commission, 2008: 8).

STEM Education management is an integrated learning management of 4 disciplines including Science Technology, Engineering and mathematics (Sirinpha Kitkuekul, 2015, Nor. 201-202) With the strength of the engineering design process integrated with science, mathematics and technology learning management in the core curriculum of Thailand. STEM Education activities emphasizing the issues or situations that are near the student may be a problem. Events or occupations that can be seen in the community are linked to science and mathematics content. Create opportunities for Students use science knowledge Math learned in class. And knowledge about technology, find methods or develop work pieces to solve problems creatively or situations presented by teachers. This kind of learning management helps students see the benefits of science and mathematics knowledge that students use in class. In addition, it is the ability to solve complex problems. However, science content, mathematics and situations that teachers define must be consistent with the indicators in the level that students are studying and must consider the learning methods and learning abilities of students in each age. (Seksan Sansornpisut, 2015) Which pushed STEM Education occurs in a concrete, holistic way in the school. School administrators must be serious. Encourage all concerned teachers to be aware of the importance of education and must have proper knowledge and understanding about STEM Education (IPST, 2015, P. 38).

The basis of STEM Education is derived from the concept of many educators, which is the basis of learning by STEM Education, derived from the progressive theory of John Dewey. In a book named (The School and Society) that believes that children learn well from action or leaning by doing. Children learn from project work, problem solving, work alone, and group work asking and answering problems which the concept of Dewey concluded that children learn by themselves in a social context in which the child's interest is motivated in learning. The teacher was inspired to study and recommended that the children search more than the child inspectors. Physical, mental, emotional, social developments are essential to intellectual development. To be created according to the creative ideas related to STEM Education because in STEM teaching, students are designed to think to solve problems and create new things in learning. Creativity is a feature of people in the 21st century. Creativity will be able to can do and develop new things in the world. Thinking outside the box in order for the world to have innovations or inventions with new ideas occurring. Creative people tend to have high self-confidence, self-reliance, risk-taking, energy, enthusiasm, adventure, curiosity, flexible, playful and humorous (Guilford and Torance, 1960).

Therefore, the researcher is interested in studying from the problems and the principles of teaching and learning by using problem-based learning methods, showing that it is a learning management that results in the learners creating new knowledge, creating thinking processes. Self, intellectual,
emotional, social, and physical participation also develop skills that are essential to life. Especially to help develop learners' learning in learning material for early childhood may cause competition, causing various problems STEM Education activities, which are activities that children will practice by themselves, are interesting activities. With the aim of studying the effects of organizing activities to develop creative problem-solving abilities for early childhood from the form of activities organized according to the STEM Education theory concept or not. And the results of this study will be a guideline for teachers and early childhood education personnel to choose and consider activities that promote the ability to think and solve creative problems of early childhood more appropriately and effectively.

**Research objectives**

1. To study the creative thinking problem solving ability of early childhood before and after receiving activities according to STEM Education theory.
2. To compare creative thinking and problem solving abilities of early childhood before and after receiving activities according to STEM Education theory.

**Method**

**Population and sample**

**Population used in research**

The sample in this research are early childhood aged between 5 - 6 years studying in kindergarten 2, 2nd semester, academic year 2018, Soonthorn Wattana School, Nai Mueang Subdistrict, Mueang District, Chaiyaphum Province under the Office of Primary Educational service area 1, 72 persons, 2 classrooms.

**Sample group used in research**

The sample that in this research are early childhood aged between 5 - 6 years studying in kindergarten 2, 2nd semester, academic year 2018 of Soonthorn Wattana School, Nai Mueang Subdistrict, Mueang District, Chaiyaphum Province under the jurisdiction of the Office of Primary Education Area, total of 37 persons, 1 class room, which can be obtained by selecting a sample group that is specific.

**Variables used in the study**

The initial variable is activities based on the STEM Education theory theory.

The dependent variable is creative thinking and problem solving ability, divided into 4 areas as follows: Access to problems, Thinking of a solution, Selection and preparation of problem solving Planning, solving problems

**Method.** The research is divided into 2 parts: objectives.

**Part 1 Creating a plan to organize full-scale teaching and learning activities for STEM Education.**

1.2 Studying teaching and learning, STEM Education, with educational procedures and analysis from relevant theoretical and research papers.
1.3 To create a plan to organize teaching and learning activities, STEM Education, determine objectives, content, activities, learning materials and evaluation.

**Part 2: Creating behavior observation forms, creative problem solving skills.**

2.2 Study of research papers related to creative thinking, problem solving ability and creative problem-solving ability measuring tools of Rungthip Sornsingh (2017) Apichai Laopidet (2013)
Sunashcha Suphathamawit (2014). To be a guideline for creating an observation form for creative thinking and problem solving.

2.3 Conducting the observation form for the question which is the situation in organizing STEM Education activities in 12 items as follows:

- Access to 3 issues
- Thinking of 3 solutions
- Selection and preparation of 3 solutions
- Planning solutions 3 plan

Research tools
1. Plan to organize teaching and learning activities for STEM Education.

Research result
In this study the researcher proposed the results of data analysis in the following order.

1. Study the problem-solving skills of early childhood before and after receiving activities to organize teaching and learning activities for STEM Education.

Table 1: Study of creative problem-solving skills of early childhood before and after receiving teaching-learning activities for STEM Education.

<table>
<thead>
<tr>
<th>N</th>
<th>full score</th>
<th>before learning</th>
<th>After learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>36</td>
<td>19.21</td>
<td>28.10</td>
</tr>
</tbody>
</table>

From Table 1, early childhood children have the ability to think and solve problems creatively. It was found that the average score after organizing STEM Education activities was higher than before the teaching and learning activities for STEM Education was 28.10.

2. Compare creative thinking and problem solving abilities of early childhood before and after receiving STEM Education teaching activities.

Table 2 Comparison of creative problem solving skills of early childhood before and after receiving STEM Education teaching activities

<table>
<thead>
<tr>
<th>period of time</th>
<th>N</th>
<th>( \bar{x} )</th>
<th>S.D.</th>
<th>t</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before learning</td>
<td>37</td>
<td>19.21</td>
<td>2.07</td>
<td>27.73*</td>
<td>.000</td>
</tr>
<tr>
<td>After learning</td>
<td>37</td>
<td>28.10</td>
<td>2.28</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .0.05

From Table 2. Shows that early children have the ability to solve creative problems. After organizing activities higher than before the activities with statistical significance at the level of .05, indicating that organizing teaching and learning activities for STEM Education makes early children more creative in problem solving skills.

Changes in the provision of teaching and learning activities for STEM Education helps early childhood to change their ability in creative problem solving skills as shown in Table 3.
Table 3 Creative Problem-Solving Skills of early childhood receiving STEM Education Teaching Activities.

<table>
<thead>
<tr>
<th>Creative problem solving skills</th>
<th>̅x</th>
<th>Change of score</th>
<th>Percentage of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before learning</td>
<td>19.21</td>
<td>8.86</td>
<td>35.33</td>
</tr>
<tr>
<td>After learning</td>
<td>28.10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of the analysis according to Table 3 can be seen that after organizing teaching and learning activities for STEM Education, early childhood education, creative problem-solving skills can be increased from the original percentage.

Table 4. The results of comparison of creative problem solving skills in the areas of early childhood before and after organizing teaching and learning activities for STEM Education.

<table>
<thead>
<tr>
<th>Creative problem solving skills</th>
<th>̅x</th>
<th>S.D</th>
<th>Level comments</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to problems</td>
<td>3.91</td>
<td>0.52</td>
<td>Much</td>
<td>4</td>
</tr>
<tr>
<td>Thinking of a solution</td>
<td>4.23</td>
<td>0.75</td>
<td>The most</td>
<td>1</td>
</tr>
<tr>
<td>Selection and preparation of problem solving</td>
<td>4.02</td>
<td>0.58</td>
<td>Much</td>
<td>3</td>
</tr>
<tr>
<td>Planning, solving problems</td>
<td>4.10</td>
<td>0.67</td>
<td>Much</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>4.21</td>
<td>0.41</td>
<td>Much</td>
<td>(4)</td>
</tr>
</tbody>
</table>

From Table 4, it was found that the average score of problem-solving skills for early childhood children who had received experience organizing the nine square grid movement activities before and after studying the overall aspect is equal (x̅ = 4.21, S.D = 0.41) respectively, when considered as the average score of each aspect, respectively, high to low, equal to the thinking of problem solving method (x̅ = 4.23, SD = 0.75). The problem solving plan is equal (x̅ = 4.10, SD = 0.67). The selection and preparation of the solution is equal to (x̅ = 4.02, SD = 0.58) and the aspect of access to problems (x̅ = 3.91, SD = 0.52) respectively.

The purpose of this research was to study and compare creative problem solving skills of early childhood receiving teaching-learning activities for STEM Education before and after organizing activities based on the results of the research, who have been teaching activities for STEM Education. Before and after the experiment, there was a significant difference in creative problem solving skills at the level of .05 which was consistent with the hypothesis of this research showing that Early childhood who received nine square movements and rhythmic activities helping children to be able to solve problems more creatively and change.

Suggestions from research
1. Suggestions for applying research results

1. STEM Education activities are organized in a variety of processes. The purpose of learning management according to the STEM Education guidelines is to encourage learners to love and appreciate the value of science, technology, engineering and mathematics. See that those subjects are close to those that can be used every day. Must be collected and selected for learning content for early childhood.

2. STEM Education teaching activities create familiarity to children first because children are not familiar with activities, which during the first week may do activities that do not achieve the goal as expected. We should give time to children to familiarize themselves first as follows: should allow time for children to adjust to create familiarity before organizing teaching activities for STEM Education, which is always included in the content of learning management.

2. Suggestions for further research

1. Increase the selection of plans for experience in accordance with social and cultural contexts for organizing STEM Education teaching activities in order to have more knowledge and complete in accordance with the development of early childhood in 4 areas.

2. In this research, the researcher organized a variety of activities. There is a difference of ability and experience in organizing STEM Education activities. Therefore, such activities can be used to extend the previous knowledge related to the performance of early childhood towards STEM Education management. Through the activities of all 6 main activities of early childhood will have more different educational results.

3. The duration of this research has a better time to see changes. It may not be enough to make use of supplementary methods to increase creative thinking skills of early childhood. In the next research, it may take a period of 1 semester or 1 academic year. The results may be more obvious.

Reference

[9] Veridian E-Journal. (3)6,774-757