Grade 1 Students' Basic Science Process Skills in the Encouraged Learning Inventory Based on the STEM Education Method

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Abstract

To investigate of an encouraging the basic science process skills (BSPS) for primary students using classroom learning inventory based on the STEM education method in five steps coordinated ways for modifying existing knowledge and skills for being a play also facilitates of STEM-related fields, which include Science, Technology, Engineering, and Mathematics. Instructional design with a sample size of 16 students at the 1st grade level in Rajabhat Mahasarakham University Demonstration School was administered. The instructional design with a *Science Instructional Lesson Plan* based on the STEM education method to invent classroom learning environment on Toys & Devices issue in 12 hours which was reviewed the validity of content and acceptable accuracy quality instrument was examined through administering activities in 70 minutes. The identifying and controlling variable test and training activities were developed. The discrimination value ranged from 0.61 to 0.77. Quantitative criteria were selected in the assessment of the BSPS with the 10-item *Basic Science Process Skills Assessment* (BSPSM) was estimated scale in 3-level scale with the classified discrimination

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from 0.65 to 0.77. The BSPSM had a value of α-reliability as 0.87. Comparisons between students' learning outcomes of their BSPS based on the STEM education and standardized criteria learning at 70%, students' performances evidence statistically significant at the level of .001, differently. The BSPS means ranged from 2.06 to 2.69. Overall on the average mean score as 2.42 (SD = 2.90) also were found at the moderate level. Their scoring performances ranged from 16 to 27, was determined at high level (M = 24.19, SD = 3.00) which affect on the potential their BSPS are encouraged.

Keywords: Encouragement, basic science process skills, primary students, learning inventory, STEM education method

Introduction

An Encouragement of Learning was introduced through the book of Fukuzawa, written as a series of pamphlets from 1872 to 1876. This was around the span of time that Charles Sanders Peirce coined the term 'pragmatism', although he did not officially publish the idea until 1878. These details help to understand the precise nature of the historical connection to Western thought, which is an important part of understanding the influence of Fukuzawa's philosophy. Fukuzawa pointed out that the Western's wealth and power must truly be envied, but must not go so far as to imitate the unequal distribution of wealth among people as well. Thus, even though Fukuzawa's oeuvre reminds us of pragmatism as well as early American democratic thought, he does not blindly celebrate the West. (Rotter, 2013). These closely linked texts illustrate the core tenets of his philosophical outlook: freedom and equality as inherent to human nature, independence as the goal of any individual and nation, and the transformation of the Japanese mind as the key to advancing in a rapidly evolving political and cultural world (Dilworth, 2013).

In this research study was designed for encouragement learning that was more than cheerleading, saying, "You can do it!" And it's more than praising progress, though there is much to be said for using all of these more often. What many students need is *strategic encouragement* applied to them in coordinated ways by all of their educators and pursued systematically and over time (Elias, 2015) in four steps, such as: to establish a rationale for why a task will matter for the student - the more tangible and proximal, the better. To show how the task is related to other tasks with which the student has been successful, or relatively so, to show how specific assets and skills the student has are applicable to working on the task, and to arrange for appreciative check-ins with valued adults or peers as the work progresses to reinforce and sustain the effort. There is also evidence for some kind of learning in some plants (Karban, 2015). Some learning is immediate, induced by a single event (e.g. being burned by a hot stove), but much skill and knowledge accumulate from repeated experiences. The changes induced by learning often last a lifetime, and it is hard to distinguish learned material that seems to be "lost" from that which cannot be retrieved (Schacter, Gilbert, and Wegner, 2011).

Human learning begins before birth and continues until death as a consequence of ongoing interactions between person and environment. Learning may occur as a result of habituation, or classical conditioning, operant or as a result of more complex activities such as *play*, seen only in relatively intelligent animals (Gyms, 2015). Learning may occur consciously or without conscious awareness. Learning that an aversive event can't be avoided nor escaped may result in a condition called learned helplessness (Nolen, 2016). In this research study, to allow choice, encourage primary students to make decisions about how they learn best. Create opportunities for them to pursue their own interests and practice the basic science process skills in a variety of ways to manage cater for different learning styles that it doesn't expect everyone to respond in the same way.

One of the most important and pervasive goals of schooling is to teach students to think. All school subjects should share in accomplishing this overall goal. Science contributes its unique skills, with its emphasis on hypothesizing, manipulating the physical world and reasoning from data. The scientific method, scientific thinking and critical thinking have been terms used at various times to describe these science skills. Today the term "science process skills" is commonly used (Padilla, 1990). Popularized by the curriculum project, Science - A Process Approach (SAPA), these skills are defined as a set of broadly transferable abilities, appropriate to many science disciplines and reflective of the behavior of scientists. SAPA grouped process skills into two types-basic and integrated. In Thailand, the Institute for the Promotion of Teaching Science and Technology (2011) stated in the framework and manual for early childhood science learning that at least 8 science process skills, the basic science process skills, should be handle in early childhood education.

Michael J. Padilla (1990) describes on the basic process skills provide a foundation for learning the integrated skills, these basic science process skills are listed and described below.

Observing - using the senses to gather information about an object or event. Example: Describing a pencil as yellow.

Inferring - making an "educated guess" about an object or event based on previously gathered data or information. Example: Saying that the person who used a pencil made a lot of mistakes because the eraser was well worn.

Measuring - using both standard and nonstandard measures and estimates to describe the dimensions of an object or event. Example: Using a meter stick to measure the length of a table in centimeters.

Communicating - using words or graphic symbols to describe an action, object or event. Example: Describing the change in height of a plant over time in writing or through a graph.

Classifying - grouping or ordering objects or events into categories based on properties or criteria. Example: Placing all rocks having certain grain size or hardness into one group.

Predicting - stating the outcome of a future event based on a pattern of evidence. Example: Predicting the height of a plant in two weeks time based on a graph of its growth during the previous four weeks.

To modify the thinking of science process skills of Padilla (1990) from the 6-type Basic Science Process Skills to the 8-type Basic Science Process Skills, the 2-type Basic Science Process Skills were added (Aydogdu, 2015; the Institute for Promotion of Teaching Science and Technology (2015);

Using space/Time relationships - comprehend the relations between place and time of objects. Example: Transform a two dimensional shape into a three-dimensional one.

Using Number Skills - abilities to identify number, counting, and calculating. Example: Pick up three pencils.

For instructing design of this study the basic skills can be taught and that when learned, readily transferred to new situations. Teaching strategies which proved effective were: (1) applying a set of specific clues for predicting, (2) using activities and pencil and paper simulations to teach graphing, and (3) using a combination of explaining, practice with objects, discussions and feedback with observing. In other words-just what research and theory has always defined as good teaching were learning designed based on STEM education method in classroom learning inventory.

A concept inventory is a criterion-referenced test designed to help determine whether a student has an accurate working knowledge of a specific set of concepts. The concepts tested may not be fundamental or important in a particular discipline, the concepts involved may not be explicitly taught in a class or curriculum, or answering a question correctly may require only a superficial understanding of a topic (Treagust, 2013). Learning inventory helps students become better learners; one teaching and learning of this instructional design have helped students learn how to become better lifelong learners in and out of the classroom (Gosales, 2016). In short, instructional design is the systematic process by which instructional materials are designed, developed, and delivered (Gutierrez, 2017). Instructional design models help instructional designers to make sense of Abstract learning theory and enable the real-world application. Usually, an *instructional design model* tells how to organize appropriate pedagogical scenarios to achieve instructional goals. In this research study was designed the instructional model with the STEM education for teaching in science classroom learning environment.

Educational reformation has proceeded slowly despite the many calls to improve science and mathematics for our students. The acronym STEM (science, technology, engineering, and mathematics) has been adopted by numerous programs as an important focus for renewed global competitiveness for the United States, but conceptions of what STEM entails often vary among stakeholders (Breiner, *et al.*, 2012). STEM is the acronym for Science, Technology, Engineering, and Mathematics, and encompasses a vast array of subjects that fall into each of those terms. While it is almost impossible to list every discipline, some common STEM areas include: aerospace engineering, astrophysics, astronomy, biochemistry, biomechanics, chemical engineering, chemistry, civil engineering, computer science, mathematical biology, nanotechnology, neurobiology, nuclear physics, physics, and robotics, among many, many others. As evidenced by the multitude of disciplines, it's clear that STEM fields affect virtually every component of our everyday lives (Hom, 2014). To reach students at this critical stage, a design-based afterschool STEM program, titled Studio STEM, was implemented to foster motivation and engagement in STEM topics and activities (Chittum, Jones, Akalin, and Schram, 2017).

STEM activities require varied types of science process skills of students because it values students' real-life experiences and hands-on applications. The students need the process skills both when doing scientific investigations and during their learning process (Harlen, 2000). Science process skills will be the tools for problem solving during the STEM activities. STEM have opportunity to give students room to explore, experiment and solve problems logically (Kroeger, 2016). Teaching STEM in elementary grades will bring opportunities to the students with a strong foundation in science process skills at early year of their education. Ango (2002) confirmed that appropriate selections of science process skills can be taught and studied in the early years of primary school. The basic learning which students achieve from these initial experiences can be used as a basis for building a more extensive understanding of science process skills in the later years of primary school and on into secondary school.

Following as the Basic Core Curriculum B.E. 2551 (A.D. 2008) and the Basic Core Curriculum B.E. 2558 (A.D. 2015) (Draft) based on relevant studies and monitoring as well as evaluation of the curriculum in the application during the past six years. Moreover, problems regarding learners' ability to acquire essential knowledge, skills, capacities and desired characteristics were quite disconcerting (Bureau of Academic Affairs and Educational Standards, 2008). In fact, the Basic Core Curriculum B.E. 2558 (A.D. 2015) has prescribed a structure of minimum time to be allotted to each subject area for each grade level. Schools are given opportunities to increase learning time allotment, depending on their readiness and priorities. Improvement has been made to the process of measuring and evaluating learners' performance as well as criteria for graduation at each educational level (Ministry of Education, 2015). The Institute the Promotion of Teaching Science and Technology has been trying to solve the problems of learning management model with the integration of science education based on the STEM Education Method (The Institute the Promotion of Teaching Science and Technology, 2015). The researchers adopted the STEM education instructional design model to encourage of the basic science process skills for primary students at the 1st grade level using classroom learning inventory based on the STEM education method in science classroom learning environment of the enable learners to be productive and skilled in their scientific skill processes. Thus, the model of STEM education instructional design model was integrated into the model of the primary students at the 1st grade level at Rajabhat Mahasarakham University Demonstration School is the context of research limitation in this study.

Objectives

1. To compare between the basic science process skills of primary students at the 1st grade level who have encouraged learning inventory based on the STEM education method and the criteria learning outcomes at 70%.

2. To examine of the basic science process skills of primary students at the 1st grade level who have encouraged learning inventory based on the STEM education method.

Methodology

An encouragement of the basic science process skills for 1st grade students using classroom learning inventory based on the STEM education method was designed with the STEM innovative lesson plans. The essentials were built how to begin the STEM integration journey with five guiding principles for effective STEM education instructional model.

Target group

A sample size consisted of 16 primary students at the 1st grade level who have encouraged learning inventory based on the STEM education method in the second semester in academic year 2016 in Rajabhat Mahasarakham University Demonstration School.

Content of research administration

The content of research administration was followed as the Basic Core Curriculum B.E. 2551 (A.D. 2008) and the Basic Core Curriculum B.E. 2558 (A.D. 2015) (Draft) based on learning area of science on Strand 3: Substances and Properties of Substances, focused on Standard Sc3.1: Understanding of properties of substances; the relationships between properties of substances and structures and binding forces between particles; investigative process for seeking knowledge and scientific mind; and communicating acquired knowledge for useful purposes. The grade level indicates that observing and specifying the apparent characteristics or properties of materials utilized for making toys or articles of everyday use. Classify the materials utilized for making toys or articles of everyday use as well as specify the criteria for such classification. The learning unit composes of 2-learning science contents; 1) characteristic and property of matter of Toys & Devices were designed in 6 hours, and 2) classify of matter invention of Toys & Devices were designed in 6 hours. These were total of 12 hours in a classroom learning inventory.

Research period

Duration of research was in the second semester of 2016, between December 2016 and January 2016, 3 hours per week for 4 weeks totaling 12 weeks.

Research variables

Independent Variable

Independent variable composes of science classroom learning inventory based on the STEM education method on the Toys & Devices issue.

Dependent Variable

Dependent variable composes of the basic science process skills, including, observing, inferring, measuring, communicating, classifying, predicting, using space/time relationships, and using number skills.

Research instruments

There were two research instruments use in this study; the Science Instructional Lesson Plan and the Basic Science Process Skills Assessment (BSPSA). The descriptions are as following.

The Science Instructional Lesson Plan

The *Science Instructional Lesson Plan* based on the STEM education method to invent classroom learning environment in Science Area Learning on Toys & Devices issue in 12 hours was administered. To investigate of the thinking and theory of STEM education method in 5 steps, such as; identify a challenge, exploring ideas, plan and development, testing and evaluation, and presenting the solution steps were invented and improved. The effectiveness of the innovative instructional lesson plans based on the model of learning management in a STEM education method was reviewed and assessed the validity of content, purpose learning with the IOC value (*Index of Item Objective Congruence*), the acceptable accuracy must be 0.61-0.77. It appears that the research plan developed by the researcher has an average of 3.65 to 4.77, which is moderate to the highest.

The Basic Science Process Skills Assessment (BSPSA)

The 10-item *Basic Science Process Skills Assessment* (BSPSA) was estimated scale in 3-level scale. This step was the kindergarten-primary transition with the 8-basic science skill process inventories was designed. Using internal consistency reliability the BSPSA had a value of 0.87 which was considered satisfactory for further use in this study. The research team conducted 20-item Basic Science Process Skills Assessment to assess basic science skills of primary students with discrimination value. Then, selected only of 10 items that appropriated questions was used. Table 1 reported on the basic science process skills, discrimination values, and selecting results.

Table 1: Discrimination values and Selecting Results for the BSPSA

Item No.	Basic Science Process Skill	Discrimination value	Selecting Results
1	Observing skill	0.61	Cut off
2		0.73	Selected
3	Measuring skill	0.67	Cut off
4		0.73	Selected
5		0.77	Selected
6		0.67	Cut off
7	Using number skill	0.71	Cut off
8		0.77	Selected

Item No.	Basic Science Process Skill	Discrimination value	Selecting Results
9	Classifying skill	0.73	Cut off
10		0.75	Selected
11	Using space/time relations	0.67	Selected
12		0.65	Selected
13		0.61	Cut off
14		0.63	Cut off
15	Communicating skill	0.73	Cut off
16		0.75	Selected
17		0.67	Cut off
18		0.73	Selected
19	Predicting skill	0.75	Selected
20		0.67	Cut off
Confidence values			0.87

Data collection

Science and teaching students about science mean more than scientific knowledge. There are three dimensions of science that are all important. The first of these is the content of science, the basic concepts, and our scientific knowledge. This is the dimension of science that most people first think about, and it is certainly very important. These basic skills are integrated together when scientists design and carry out experiments or in everyday life when we all carry out fair test experiments. All the eight basic skills are important individually as well as when they are integrated together.

To develop the basic science process skills for primary students whose they would be achieved from the learning activities. Primary schooled practices the basic science process skills as they explore the world. These processes are the same as adult scientists use. These skills are not a step-by-step procedure but integrated skills that occur in different combinations. The learning activities for encouraging the basic science process skills that following as:

STEM Activities Processes

Researchers expected students to learn how to think, and science process skills are essentially the basis of analytical thinking. The 1st graders target group can learn and practice the most basic science process skills through fun and engaging activities with their learning activities for encouraging the basic science process skills, the integrations of their learning activities for encouraging the basic science process skills, and assessing learning activities for encouraging the basic science process skills that these components were designed for the STEM instructional method of these three components followed as five steps of engineering design process:

1. Identify a Challenge: Teacher give students the floor for discussion, asking them to share what are their "favorite toys", Do their toys have problems that need to fix, Do they want to modify or make a new toys better with more functions, etc. Students have to also clarify what they don't know or would like to know more about how to modify or build the toys.

2. Explore Ideas: Sorting various objects gives students the chance to practice the 8 science process skills. Students might enjoy sorting a bag of leaves, a box of random toys, or various types of candies. Researchers encouraged them to make a list of the different ways that they could sort the objects. For example, what do you see the candy? (Observing skill); what should you do to measure the width of a book? (Measuring skill), how many candies in bag A? is it more or less than bag B? (Using number skill); how could you separate the candies into 3 piles (classifying skill)?; what is the shape of rotating square? (Using space/time relations), if you wake up in the morning and found out that the street in front of your house is wet, do you think where did water come from? (Inferring skill); what should be the next picture? (Predicting skill), etc. The period of administering activities in 50 minutes were conducted. Students' responses with the recording report papers, the identifying and controlling variable test, and the identifying and controlling training activity were tested.

Plan and Develop: Students in each group discuss and make conclusion, what toy they are going to modify or make. They sketch to design for model development and choose materials for the construction with concerns of functioning, usability, and worthy.

Test and Evaluate: After students done the toy construction, they have to test their design and reflecting to ascertain whether the toy's functions have been met the criteria, if it not, they have to adjust/modify the initial until everything works as expected.

Present the Solution: When the toy completed, each group of students present their toy to the class, explain how it functions, what do they expected, what is work/not work, what have they done to modify/make the toy, etc.

Basic Science Process Skills Examine

After the lesson plans implementation, researchers collected students' Basic Science Process Skills data through the BSPSA and taken it to statistical systematic, continually.

Data analysis

Quantitative data were obtained using the research instrument (BSPSA), students' basic science process skills with the average mean scores and the standardized criteria evidence of 70% were compared. Determining the mean of the mean values as three levels:

Average mean scores of 2.51 – 3.00, referring to have science process skill of high level

Average mean scores of 2.01 – 2.50, referring to have science process skill of moderate level

Average mean scores of 1.00 – 2.00, referring to have science process skill of low level

The personal score were also interpreted as:

Average mean scores of 21 – 30, referring to have science process skill of high level

Average mean scores of 11 – 20, referring to have science process skill of moderate level

Average mean scores below 10, referring to have science process skill of low level

Appropriate statistical procedures were selected to test traditionally used with means, standard deviation, and dependent *t*-test analysis.

Results

An encouragement of the basic science process skills for primary students at the 1st grade level using classroom learning inventory based on the STEM education method of this research study. The *Science Instructional Lesson Plan* based on the STEM education method on Toys & Devices issue in 12 hours was administered. The effectiveness of the innovative instructional lesson plans was reviewed and assessed the validity of content, purpose learning with the IOC value, the acceptable accuracy must be a high-quality instrument. Students' performances of their learning were assessed with the 10-item *Basic Science Process Skills Assessment* (BSPSA) was estimated scale in 3-level scale, which was considered satisfactory for further use in this study.

Comparisons between Students' Learning Outcomes of their Basic Science Process Skills Based on the STEM Education Method and the Standardized Criteria Learning at 70%

Using the average mean scores of students' learning achievements of their post assessing test and the criteria learning outcomes at 70% with the STEM Education method were analyzed. Table 2 shows the result of this research study.

To assess an encouragement of the basic science process skills for primary students at the 1st grade level using classroom learning inventory based on the STEM education method of 16 students of their basic science process skills assessment in eight skills. The results given in Table 2 show the average mean scores, standard deviation, and science process skill level for the BSPSM.

Table 2: The Mean, Standard Deviation, Total Score, the Criteria Score of 70%, Mean Different, and Independent Variable t-test for the STEM Education Method

Students' Number	Total Score	Criteria Score 70%	Mean	S.D.	df	t-test	Sig. (ρ)
16	30	21	24.19	2.90	15	4.39	.000***

$^*\rho<.05$, $^{**}\rho<.01$, $^{***}\rho<.001$

In Table 2, comparisons of mean scores between students' learning outcomes of their basic science process skills based on the STEM education method and the standardized criteria learning at 70% for encouraging the basic science process skills of 16 primary students at the 1st grade level using classroom learning inventory**,** using the 10-item *Basic Science Process Skills Assessment* (BSPSA) as three multiple choices. Students' performances of their basic science process skills evidence of 24.19, the standard deviation was 2.90 when analyzing the difference using *t*-test statistics (One-Way ANOVA), it was found that the t-test indicated that was 4.39 and statistically significant at the level of .001, differently.

The Basic Science Process Skills for Primary Students at the 1st Grade Level Using Classroom Learning Inventory Based on the STEM Education Method

Using the 10-item *Basic Science Process Skills Assessment* (BSPSA) was assessed an encouragement of the basic science process skills for primary students at the 1st grade level using classroom learning inventory based on the STEM education method. This research study on the numerous researches has focused on the teaching and acquisition of basic process skills.

Table 3: Average Mean Scores, Standard Deviation, and Science Process Skill Level for the BSPSM

Skills' No.	Basic Science Process Skill Types	Mean	Standard Deviation	Science Process Skill Level
1.	Observing skill	2.69	0.48	High
2.	Measuring skill	2.41	0.13	Moderate
3.	Using Number skill	2.25	0.58	Moderate
4.	Classifying skill	2.44	0.73	Moderate
5.	Using Space/Time Relation skill	2.35	0.49	Moderate
6.	Inferring skill	2.63	0.63	High
7.	Communicating skill	2.63	0.50	High
8.	Predicting skill	2.06	0.77	Moderate
	Average Total	**2.42**	**2.90**	**Moderate**

N = 16

Integrating the basic science process skills together and primary students' developing abilities to design fair tests is increasingly emphasized in successive grade levels, and is an expectation of students at the 1st grade level. Table 3 reported the assessment of the basic science process skills for primary students at the 1st grade level using classroom learning inventory based on the STEM education method.

The minimum and maximum scores for each skill would be 1.00 and 3.00, respectively. The skill means ranged from 2.06 (Predicting skill) to 2.69 (Observing skill). Standard deviations ranged from 0.13 (Measuring skill) to 0.77 (Predicting skill). Overall on the average mean score and standard deviation as 2.42 and 2.90 also were found at the moderate level for the basic science process skills of primary students at the 1st grade level using classroom learning inventory based on the STEM education method were encouraged, respectively.

Students' Individualized Performances of their Basic Science Process Skills

Teaching strategies which proved effective were: applying a set of specific clues for predicting, using activities and pencil and paper simulations to teach graphing, and using a combination of explaining, practice with objects, discussions and feedback with the basic science process skills were assessed.

Table 4: Scoring Outcomes and Science Process Skill Level for each Student

Students' Number	Scoring Outcomes	Science Process Skill Level
1	16	Moderate
2	27	High
4	25	High
5	23	High
6	22	High
7	27	High
8	26	High
9	25	High
10	24	High
11	25	High
12	20	Moderate
13	26	High
14	27	High
15	26	High
16	24	High
Total	**24.19 (SD = 3.00)**	**High**

N=16, Maximum Total Score is 30

In other words-just what research and theory have always defined as good teaching? Table 4 revealed the results of students' performances on each student in the basic science process skills with their scoring outcomes. Table 4 aims to determine the abilities of use of basic process skills of the students and the levels of conceptual learning of the students as oriented to science topics based on the STEM education method. The items were selected in the manner that it covers basic skills such as observation, classification, measurement, the sensing of space-time relationship and communicating, etc. and also classified of cognitive development which consist of knowledge, comprehension, application, analysis, synthesis, and evaluation. The results of the analysis show those students' performances of their basic science process skills ranged from 16 to 27 which effect on the potential of the use of basic science process skills.

To encourage learning of the basic science process skills for primary students at the 1st grade level using classroom learning inventory based on the STEM education method in the 4-step coordinated ways because of learning is the process of acquiring new or modifying existing knowledge, behaviors, skills, or pReferences for being the play also facilitates the development of thinking and language skills in children. Creating opportunities for them to pursue their own interests and practice the basic science process skills in a variety of ways to manage cater to different learning styles. Primary student blogs are great tools for reflecting on learning and responding to their peers using the learning inventory based on the STEM education method was provided. The scientific method, scientific thinking and critical thinking have been terms used at various times to describe these science skills. The basic (simpler) process skills provide a foundation for learning the integrated (more complex) skills. These basic science process skills are listed of observing, measuring, inferring, using number, classifying, predicting, using space/time relations, and communicating skills were designed of the innovative instructional lesson plan based on STEM education method. All the eight basic skills are important individually as well as when they are integrated together.

The STEM is the acronym for Science, Technology, Engineering, and Mathematics, and encompasses a vast array of subjects that fall into each of those terms. While it is almost impossible to list every discipline, some common STEM areas include aerospace engineering, astrophysics, astronomy, biochemistry, biomechanics, chemical engineering, chemistry, civil engineering, computer science, mathematical biology, nanotechnology, neurobiology, nuclear physics, physics, and robotics, among many, many others. As evidenced by the multitude of disciplines, it's clear that STEM fields affect virtually every component of our everyday lives in this resent. Following as to compare between the basic science process skills of primary students at the 1st grade level who have encouraged learning inventory based on the STEM education method and the criteria learning outcomes at 70%, and to study of the basic science process skills of primary students at the 1st-grade level who have encouraged learning inventory based on the STEM education method were to the research purposes with a sample size consisted of 16 primary students at the 1st-grade level who have encouraged learning inventory based on the STEM education method in the second semester in academic year 2016 in Rajabhat Mahasarakham University Demonstration School. To develop the basic science process skills for primary students whose they would be achieved from the learning activities in four steps, such as *Purposes of Learning*, for example, indicates the meanings of identifying and controlling variables, indicates the meaning of identifying different types of variables, and identify the benefits of different types of identification skills. *Thinking based on the identifying* and controlling variables. *Period of administering activities* was spent time in 70 minutes, and Instructional Medias were composed of the 2-Aluminum rings, Cripps, Tape, Harder papers, Recording report papers, the *Identifying and Controlling Variable Test* (ICVT), the *Identifying and Controlling Training Activity* (ICTA).

Focused on activity processes, assessing learning activities for encouraging the basic science process skills that these components of the STEM instructional method of the three components, followed as in five steps, namely; Introduction, activities, discussions, conclusions, and assessment and evaluation of the STEM education instructional inventory were designed. Using a *Science Instructional Lesson Plan* based on the STEM education method to invent classroom learning environment in Science Area Learning on Toys & Devices issue in 12 hours was administered. To investigate of the thinking and theory of STEM education method in 5 steps, such as; identify a challenge, exploring ideas, plan and development, testing and evaluation, and presenting the solution steps were invented and improved. The effectiveness of the innovative instructional lesson plans based on the model of learning management in a STEM Education Method was reviewed and assessed the validity of content, purpose learning with the IOC value (*Index of Item Objective Congruence*), the acceptable accuracy must be 0.61-0.77. It appears that the research plan developed by the researcher has an average of 3.65 to 4.77, which is moderate to the highest. The 10-item *Basic Science Process Skills Assessment* (BSPSM) was estimated scale in 3-level scale. This step was the kindergarten-primary transition with the 8-basic science skill process inventories was designed. Using internal consistency reliability the BSPSM had a value of 0.87 which was considered satisfactory for further use in this study.

Comparisons of mean scores on comparisons between students' learning outcomes of their basic science process skills based on the STEM education method and the standardized criteria learning at 70% for encouraging the basic science process skills of 16 primary students at the 1st grade level using classroom learning inventory**,** using the 10-item *Basic Science Process Skills Assessment* (BSPSM) as three multiple choices, it was found that the mean scores of students' performances of their basic science process skills evidence of 24.19, the standard deviation was 2.90 when analyzing the difference using *t*-test statistics (One-Way ANOVA), it was found that the t-test indicated that was 4.39 and statistically significant at the level of .001, differently. The average mean scores, standard deviation, and science process skill level for the BSPSM. The minimum and maximum scores for each skill would be 1.00 and 3.00, respectively. The skill means ranged from 2.06 (Predicting skill) to 2.69 (Observing skill). Standard deviations ranged from 0.13 (Measuring skill) to 0.77 (Predicting skill). Overall on the average mean score and standard deviation as 2.42 and 2.90 also were found at the moderate level for the basic science process skills of primary students at the 1st grade level using classroom learning inventory based on the STEM education method were encouraged, respectively. The results of the analysis show those students' performances of their basic science process skills ranged from 16 to 27 which effect on the potential of the use of basic science process skills.

To encourage learning of the basic science process skills for primary students at the 1st grade level using classroom learning inventory based on the STEM education method in the 4-step coordinated ways because of learning is the process of acquiring new or modifying existing knowledge, behaviors, skills, or pReferences for being the play also facilitates the development of thinking and language skills in children. As a nation, our education industry has recognized a shortcoming in our students. We've fallen behind other industrialized countries in terms of STEM-related fields, which include Science, Technology, Engineering, and Mathematics. Not only does a STEM-focused education open students to new subjects, it also allows for different learning methodologies to be utilized. Creativity in class structure promotes innovative thinking in students. When researcher put a spotlight on project-based learning – which is common in STEM – researcher provides opportunities for authentic growth and development. Teaching STEM in elementary grades opens the door for teachers and students to become tomorrow's movers and shakers. Young children with a strong foundation in science, technology, engineering, and mathematics will go on to play an integral role in our nation's global competitiveness and economic stability. Teachers can foster critical thinking through problem-solving in elementary STEM education and provide students with an academic edge over the competition. The advantages of teaching STEM early also become obvious when researcher look at statistics (Kroeger, 2016).

The study supports research indicating young learners' potential for early engineering. Students can engage in design and redesign processes, applying their STEM disciplinary knowledge in doing so. An appropriate balance is needed between teacher input of new concepts and students' application of this learning in ways they choose. For example, scaffolding by the teacher about how to improve designs for increased detail could be included in subsequent experiences. Such input could enhance students' application of STEM disciplinary knowledge in the redesign process (English and King, 2015). Research team offers the framework of design processes for younger learners as one way to approach early engineering education with respect to both the creation of rich problem experiences and the analysis of their learning.

This quantitative study seeks to explore how design thinking as a new model of learning is used in classroom learning. The participants for this study are the school leader and teachers from primary students at the 1st grade level who have encouraged learning inventory based on the STEM education method in the second semester in the academic year 2016 in Rajabhat Mahasarakham University Demonstration School. This study aims to develop a fuller understanding of the motivations that drive teachers to adopt this innovative approach and the considerations they have when using it in the teaching and learning of core curriculum content. This study thus emphasizes the need to promote 21st century skills and academic content knowledge as similarly important student outcomes.

Normally, all teachers want their students to learn how to think, and science process skills are essentially the basis of analytical thinking. First graders can learn and practice the most basic of these skills, such as; observing, classifying, inferring, measuring, predicting and communicating skills through fun and engaging activities. Sorting various objects gives students the chance to practice the process skills of observing and classifying. Students might enjoy sorting a bag of leaves, a box of random toys, or various types of pretzels. Estimating how large an object or a distance is can be a difficult skill for second graders. You can let them practice the process skill of measuring by challenging them to estimate the length of various objects or distances and then showing them how to confirm their estimate. The findings of this research study are confirmed by a study of Carrie Perles (2016) reported in the science process skill of predicting is more than just taking a wild guess. It requires students to use prior knowledge to figure out what they think will happen in the future. Allowing students to experiment with plants, which they know need water, soil, and sunlight to survive, can give them the chance to practice the skill of predicting. For example, students might put one plant in direct sunlight, one in indirect sunlight, and one in a dark closet. They should predict which plant will grow the most over the course of a week, and they may also want to guess how much it will grow in a week after they've measured one day of its growth.

The results of this research study of the comparisons of mean scores on comparisons between students' learning outcomes of their basic science process skills based on the STEM education method and the standardized criteria learning at 70% for encouraging the basic science process skills of 16 primary students at the 1st grade level using classroom learning inventory**,** using the 10-item *Basic Science Process Skills Assessment* (BSPSA) as three multiple choices, it was found that the mean scores of students' performances of their basic science process skills evidence of 24.19, the standard deviation was 2.90 when analyzing the difference using *t*-test statistics (One-Way ANOVA), it was found that the t-test indicated that was 4.39 and statistically significant at the level of .001, differently. Followed by Robinson, Dailey, Hughes, and Cotabish (2013; 2014) who reported of their studied "The effects of a science-focused stem intervention on normal and gifted elementary students' science knowledge and skills" were confirmed. Statistically significant gains in science process skills, science concepts, and science content knowledge were found among both normal and gifted students in the treatment group when compared with the comparison group that it's finding indicates that of this research study, similarly.

Confirmation, science process skills are related to cognitive development, developing *Science Process Skill* supports students' thinking, reasoning, inquiry, evaluation, and problem-solving skills, as well as their creativity. Therefore, future research needs to investigate these relationships more deeply via experimental studies (Özgelen, 2012). The pre-service teachers had limited conceptual understanding of science process skills. On the other hand, they had higher performance on the science process skills. The findings have implications for science teaching, learning, and teacher education. The implications of these findings are that although the experience of STEM students may be bolstered by access to resources, their experience of teaching and learning (and particularly that experienced by males on STEM courses) is less satisfactory than that of non-STEM students. This finding is of particular interest in light of the increasing use of student satisfaction data to inform league tables and students' degree choice. Furthermore, these data challenge stereotypes of the experiences of males and females in STEM disciplines and have implications for how STEM teaching practitioners approach the learning experience of their students (Pawson, 2012).

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