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DEVELOPMENT OF ACTIVITY-BASED LEARNING CONCEPTUAL APPROACH WITH THE STEM EDUCATION INSTRUCTIONAL METHOD ON THE PHOTOSYNTHESIS ISSUE AT THE 11TH GRADE LEVEL TO PROMOTE STUDENTS' LEARNING ACHIEVEMENTS AND THEIR SYSTEMATIC THINKING ABILITIES

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Abstract:

The purposes of this research study were to develop solving-problems in science learning approach with the *Problem-Based Learning* (PBL) instructional lesson plans to enhance students' learning achievements and their solving-problem abilities in science with the efficiency of the processing performances and the performance results (E_1/E_2) at the determining criteria as 80/80, students' learning achievements of their post assessing test and the criteria learning outcomes at 80% with the PBL, and students' solving-problem abilities and the criteria learning outcomes at 80% with the PBL toward science were compared, and to associate between students' learning achievements and their solving-problem abilities with the PBL was analyzed. Administrations with a sample size which consisted of 48 lower secondary educational students at the 9th grade The aims of this research study were 1) to develop activity-based learning conceptual approach with the STEM Education instructional method on the photosynthesis issue to promote students' learning achievements and their systematic thinking abilities at the 11th grade level with the efficiency of the processing

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performances and the performance results (E_1/E_2) at the determining criteria as 75/75, 2) to compare between students' learning achievements of their pre-test and post-test assessments with the STEM Education instructional method on the photosynthesis issue, 3) to compare between students' systematic thinking abilities of their pre- and post-learning activities that based on learning conceptual approach with the STEM Education instructional method on the photosynthesis issue, 4) to analyze of students' associations between their learning achievements and their systematic thinking abilities with the post learning activities that based on learning conceptual approach with the STEM Education instructional method on the photosynthesis issue. Data administrations with a sample size consisted of 21 upper secondary educational students at the 11th grade level from Mahawichanukul School under the Maha Sarakham Secondary Educational Service Area Office 26 with the purposive sampling random technique was selected. The research instruments were determined with a main-STEM Education instructional method's lesson plan to management of the activity-based learning conceptual approach in 15 hours, the *Learning Achievement Assessing Test*, and the *Systematic Thinking Ability Measuring Test* were used. Statistically significant with the average mean score, standard deviation, percentage, independent variable *t*-test were analyzed, simple and multiple correlations, standardized regression weight validity, and coefficient predictive value (R^2) were associated.

The results of these research findings have revealed as:

1. Students were evaluated to determine performance criteria with the efficiency of the processing performance and the performance results (E_1/E_2) of the STEM Education instructional method's lesson plan to management to the activity-based learning conceptual approach indicated that of 77.16/75.24, which was higher than standardized criteria of 75/75.
2. Students' learning achievements of their pre-test and post-test assessing differences were also found evidence of statistically significant at the 0.01 level.
3. Students' responses of their systematic thinking abilities to their previous and lately learning with the STEM Education instructional method's lesson plan to management of the activity-based learning conceptual approach were differentiated evidence of 0.01, significantly.
4. Associations between students' performances of their learning achievements and their systematic thinking abilities toward their activity-based learning conceptual approach with the STEM Education instructional method on the photosynthesis class were considered together, there was a significant evidence of the 0.01 with the systematic thinking abilities, relatively.

Keywords: development, activity-based learning conceptual approach, STEM education instructional method, photosynthesis issue, learning achievements, systematic thinking abilities

1. Introduction

The current Thai educational management is based on the National Education Act 1999, which states that "*All learners have the ability to learn and develop themselves, assuming the learner is the most important, the educational process needs to encourage students to develop themselves naturally and to the full quality.*" The learners are emphasized to practice thinking skills, coping management and the application of knowledge to be used in the prevention and resolution of such problems (Ministry of Education. 2002: 13). Teachers are the only guides to learning and explain the basic knowledge to understand, to use as a basis for further study and research, especially in learning science. Because of science is concerned with everyone's life, both in daily living and the occupations that are used as tools to facilitate life and work. (Bureau of Academic and Educational Standards, 2008:1). The processes that make people knowledgeable and the ability to live in the world, which is beneficial to oneself; family and society, so the quality of education reflects the quality of people who are the product of education (National Institute for Educational Testing 2012) are enhanced. In addition, science has helped human understanding of natural phenomena to be developed rational thinking, creative thinking, analytical thinking that have the skills to research. The learners' abilities are able to solving-problems their various information as being introduced, systematically. There are testimonials that can be verified to adapt to new situations to come into life helping people to live happily in society. Therefore, to promote and develop science and technology to advance, it is necessary to lay the foundations for quality education. Thailand has always focused on education by setting the purpose of educational management to develop Thai people into a complete human body both physically and mentally of their intellect knowledge Ethics and the culture of living can live happily with others (Bureau of Academic and Educational Standards. 2008: 1) with the factors contributing to the effectiveness of teaching science. Science teachers must have knowledge of the content and transforming teaching methods from knowledge transfer to learning-oriented learning is the center of true learning (Institute for the Promotion of Teaching Science and Technology, 2003: 6).

STEM Education is one of the most popular concepts in the present. This is an integrated approach to education with the introduction of Science, Technology,

Engineering (Engineering) and Mathematics, which promote on 1) Identify a challenge, 2) Explore ideas, 3) Planning and development (Plan and develop), 4) Test and evaluate, and 5) Present the solution (Institute for the Promotion of Teaching Science and Technology, 2557: 4). Focused on bringing knowledge to solve the problems associated with real daily life are connected. Including the new process development or productivity is useful to the lifestyle. To emphasize the students' connection to knowledge in problem solving with a systematic thinking process (Thongchai 2013) to be used in current learning management by using the context of activities that students are familiar and content related to knowledge, to connect with real life and as close as it is, there are open-ended questions to help them solve problems with their systematic thinking practice and analytical thinking (Siripatrachai, 2013:49; Pellegrino and Hilton, 2012: 98). Focusing on teamwork acting and to train learners to use technology devices that are found in real life as a learning tool, to include practice presentations that students have prepared, to help students realize their aims to their reason and the process of learning (Channang, 2013: 29) has resulted in the student learning from the practice of the investigation and self-research students are enthusiastic, have fun, and want to be involved in more activities for making the grade level of the students studying in science and mathematics soared, and further narrowing the gap of achievement (Han and et al. 2014: 1089) who reported the advantage of technology and engineering can be used to solve problems and have a good attitude towards occupational activities related to the Tsunami Tseng and et al. (2013: 87).

Systematic thinking is the integration of ideas into holistic management, because of the society is facing more and more complex problems. Systemic thinking is a turning point in the way we look at our social problems and our worldviews and our way of life within the world (Saharitdamrong and Thepchit, 2007: 63). Problem occurs to understand the situation; the cause of the situation is the cause of the problem. Then consider the causal factor, how do relationships relate in a rational way? Behavior patterns can cause widespread situations, or it could be a balanced situation where there are no more extensive extensions for changing the structure of the relationship between the underlying causes that this will result in patterns of behavior change and eventually, and change in the level of the situation. This process is described as a systematic thinking process and deep understanding of the relationship Moonkham, 2006: 137). The link between the factors that will lead to a change in system behavior leads to the desired direction. Today's teaching management found that one of the key problems was the educational system does not allow the learner to love to think and organize the knowledge system before practicing, thus, the child has no habit of

planning to memorize parts, can't integrate the knowledge connected with other parts (Charoenwongsak 2002: 50). The job was of no quality to lack of time and resources, which are caused by students not practicing systematic thinking. So it is interesting how to encourage students to have systematic thinking.

Based on the results of the national basic education test (O-NET) of upper education students at the 12th grade level in the academic year 2011 - 2015 in the science field were assessed. The national average score was 30.77, it found that the average score increased by only 1.14 points per year (National Institute for Educational Testing, 2016). This may be due to students not paying attention to science. Because of the learning process is not as interesting as it should be had caused by teaching focused lectures. Describe the contents, principles and theories to lack of connection with real life and to make the students lack the process skills of their student's thinking skills are relatively low (Pornkul, 2011: 4).

From the above, researchers are interested in developing teaching activities to meet the needs of learners. Using the concept of full education; optical synthesis of the upper secondary students at the 11th grade level were to investigated of students' learning achievements and their systematic thinking skills to develop the learner to the fullest potential and to be a qualified person.

2. Methodology

Jumps to science, technology, engineering and mathematics (STEM, previously SMET) are a term that refers to the academic disciplines of science, technology, engineering and mathematics. The term is typically used when addressing education policy and curriculum choices in schools to improve competitiveness in science and technology development. It has implications for workforce development, national security concerns and immigration policy. In this research study was to develop of activity-based learning conceptual approach with the STEM Education instructional method on the Photosynthesis issue at the 11th grade level to promote students' learning achievements and their systematic thinking abilities. Suggestions that the change to promote the numerous programs and attempts to establish a national approach to STEM education in Thailand, responsibility. This research methodology was established as an enrichment program for upper secondary education in Thailand. The research procedures are focused on providing activities for interested students in STEM education instructional method.

3. Research Aims

1. To develop activity-based learning conceptual approach with the STEM Education instructional method on the photosynthesis issue to promote students' learning achievements and their systematic thinking abilities at the 11th grade level with the efficiency of the processing performances and the performance results (E_1/E_2) at the determining criteria as 75/75.
2. To compare between students' learning achievements of their pre-test and post-test assessments with the STEM Education instructional method on the photosynthesis issue.
3. To compare between students' systematic thinking abilities of their pre- and post-learning activities that based on learning conceptual approach with the STEM Education instructional method on the photosynthesis issue.
4. To analyze of students' associations between their learning achievements and their systematic thinking abilities with the post learning activities that based on learning conceptual approach with the STEM Education instructional method on the photosynthesis issue.

4. Research Procedures

The Institute for the Promotion of Teaching Science and Technology (IPST) has initiated a new approach by emphasizing knowledge and skills which are suitable to professional life in a highly competitive. Researcher team was designed of this research study that it based on the important on the new method of teaching science, technology, engineering and mathematics in an applied approach is being promoted by the IPST. Students are expected to be equipped for the 21st century, including necessary work skills, creativity and the ability to bring innovation and competence to the IT sector, but the number of those studying. STEM education is a learning innovation in which science, technology, engineering and mathematics are integrated. This approach engages learners in applying knowledge to problems in daily life, as well to support for developing of activity-based learning conceptual approach with the STEM Education instructional method on the Photosynthesis issue at the 11th grade level to promote students' learning achievements and their systematic thinking abilities.

Step I: Built up of the STEM Education Innovative Lesson Plans

The research procedure was built up of the *STEM Education Innovative Lesson Plans* on the Photosynthesis issue with a main innovation of the 5-sub lesion plans in 15 periods were instructed. Using the *STEM Education Innovative Lesson Plans* was checked of the innovative instructional plans by the 3-Professional Expert Educators with based on the criteria of the 75/75 standard level, were analyzed with the Index of Item-Objective Congruence (IOC index). Carry out learning activities based on the concept of STEM education instructional method.

Step II: Students' learning achievements

Students' learning achievement motives were assessed with the Pre and Post Test Design from the *Learning Achievement Assessing Test* (LAAT) with the pretest and posttest designs.

Step III: Students' Learning Performances Systematic Thinking Abilities

Students' learning performances of their systematic thinking abilities were assessed with the *Systematic Thinking Ability Measuring Test* (STAMT) with the pretest and post-test designs.

Step IV: Associations between Students' learning achievements and their Systematic Thinking Abilities

To associate between students' learning achievements of their learning outcomes with the LAAT to their systematic thinking abilities with the STAMT were related.

4.1 Sample Target

To administer of the sample size with the 21 upper secondary students at the 11th grade level in Biology class from Mahawichanukul School under the Maha Sarakham Secondary Educational Service Area Office 26, Maha Sarakham Province in Thailand with the purposive sampling random technique was selected in the second semester of academic year 2016.

4.2 Research Instruments

4.2.1The STEM Education Innovative Lesson Plans

The innovations of the instructional lesson plans of learning activities according to the concept of the STEM Education Instructional Method on Photosynthesis issue with a main innovation of the 5-sub lesion plans in 15 periods were instructed.

4.2.2 The Learning Achievement Assessing Test (LAAT)

Using the *Learning Achievement Assessing Test* (LAAT) was evaluated for testing of students' learning achievements on the on Photosynthesis issue that it obtained of 20 items with the multiple choice options, ranging from 0.25 to 0.80, and the total confidence value was 0.78.

4.2.3 The Systematic Thinking Ability Measuring Test (STAMT)

Using the *Systematic Thinking Ability Measuring Test* (STAMT) was evaluated students' learning outcomes of their systematic thinking abilities was uses of the given situation. The STAMT test was a 4 points multiple-choice test with 9 explanations.

4.3 Data Analysis

Statistically significant with the average mean score, standard deviation, percentage, independent variable *t*-test were analyzed, simple and multiple correlations, standardized regression weight validity, and coefficient predictive value (R^2) were associated.

5. Results

5.1 The Efficiency of the Processing Performance and the Performance Results (E_1/E_2)

Students were evaluated to determine performance criteria with the efficiency of the processing performance and the performance results (E_1/E_2) of the STEM Education instructional method's lesson plan to management to the activity-based learning conceptual approach.

Table 1: The Total Score, Numbering Students, Score Mean, Standard Deviation, and Percentage Results for the E_1/E_2

Efficiency	Total Scores	Numbering Student	$\bar{X}$	S.D.	Percentage
The efficiency of the processing performance (E1)	128	21	98.16	4.57	77.16
The efficiency of the performance results (E2)	20	21	15.05	1.94	75.24
The efficiency of the Innovative Lesson Plans (E_1/E_2) = 77.16/75.24					

Table 1 shows the efficiency of the *Innovative Lesson Plans* (E_1/E_2), this result indicated that of 77.16/75.24, which was higher than standardized criteria of 75/75.

5.2 Students' Learning Achievements of their Pre-Test and Post-Test Assessments

Using the average mean scores of students' learning achievements of their pre and post assessing test of their learning outcomes with the STEM Education Instructional Model to management to the activity-based learning conceptual approach were analyzed. Table 2 shows the result of this research study.

Table 2: Numbering Students, Score Mean, Standard Deviation, and Independent Variable t-test of the STEM Education Instructional Model for the LAAT

Testing Types	Total Scores	Numbering Student	$\bar{x}$	S.D.	t-test	*p*
Pre-Test	20	21	8.19	2.20	17.77	.000
Post-Test	20	21	15.05	1.94		

In Table 2 reports of the comparisons of mean scores on students' learning achievements of their pre-test and post-test assessments using the *Learning Achievement Assessing Test* (LAAT) was evaluated for testing of students' learning achievements on the on Photosynthesis issue that it obtained of 20 items with the multiple choice options, it was found that the mean scores of pre-test assessment result of mean scoring was 8.19, and of the post-test assessment result of 15.05 when analyzing the difference using t-test statistics (Independent t-test), the t-test indicated that was 17.77 and statistically significant at the level of .001, differently.

5.3 Students' Responses of their Systematic Thinking Abilities

Using the *Systematic Thinking Ability Measuring Test* (STAMT) was evaluated students' learning outcomes of their systematic thinking abilities was uses of the given situation. The STAMT test was a 4 points multiple-choice test with 9 explanations with their pre and post-test designs of the STAMT were analyzed.

Table 3: Numbering Students, Score Mean, Standard Deviation, and Independent Variable t-test of the STEM Education Instructional Model for the STAMT

Testing Types	Numbering Student	Total Score	$\bar{x}$	S.D.	t-test	*p*
Pre-Test	21	27	15.10	3.91	5.70	.000
Post-Test	21	27	20.52	3.38		

In Table 3 shows the result of the comparisons of mean scores on students' responses of their systematic thinking abilities to their pre and post systematic thinking ability tests and post-test assessments Using the *Systematic Thinking Ability Measuring Test* (STAMT) was evaluated for testing on the on Photosynthesis issue that it obtained of 27 items

with the multiple choice options, it was found that the mean scores of pre-test assessment result of mean scoring was 15.10, and of the post-test assessment result of 20.52 when analyzing the difference using t-test statistics (Independent t-test), the t-test indicated that was 5.70 and statistically significant at the level of .001, differently.

5.4 Associations between Students' Performances of their Learning Achievements and their Systematic Thinking Abilities

Simple correlation and multiple correlation analyses were conducted to examine whether associations exist students' learning performances of their post learning achievements and their systematic thinking abilities toward their activity-based learning conceptual approach with the STEM Education instructional method on the Photosynthesis Issue class were considered together. Table 4 shows the students' learning achievements on posttest and their systematic thinking abilities.

An investigation of associations between upper secondary students' perceptions of their learning performances of their post learning achievements and their systematic thinking abilities toward their activity-based learning conceptual approach with the STEM Education instructional method. In these results, Table 4 shows the statistically significance of students' learning performances of their post learning achievements and their systematic thinking abilities, using simple correlation analysis (r) shows of 0.89, the standardized Regression Coefficient (β) indicates of 0.69 that the relationships between the students' leaning achievements of their post learning achievements and their systematic thinking abilities were related at the evidence of 0.01, significantly. In terms of the multiple correlations R and the predictive efficiency (R2) values indicate that 69% and 48% of the variances in students' learning achievements and their systematic thinking abilities towards biology for the STEM Education instructional method.

Table 4: Associations between Students' Learning Performances of their Post Learning Achievements and their Systematic Thinking Abilities on Posttest to Biology Classes in Terms of Simple and Multiple Correlations (R) and Standardized Regression Coefficient (β) for the LAAT and the STAMT

Variable	$\bar{x}$ (100)	S.D.	r	β	R	R^2
The Post Learning Achievements	75.24	9.68	0.89**	0.69**	0.6902**	0.4764**
The Post Systematic Thinking Abilities	76.01	12.54				

N = 21, *p<0.05, **p<0.01, ***p<0.001

In Table 4 reports of the associations between students' performances of their learning achievements and their systematic thinking abilities toward their activity-based learning conceptual approach with the STEM Education instructional method on the photosynthesis class were considered together, there was a significant evidence of the 0.01 with the systematic thinking abilities, relatively.

6. Conclusions

This research study was designed to essential stem teaching practices. Research team would sake and the sake of target students, set high expectations for students, challenges them to succeed, and believe that they will. Most students will perform at the level expect, so trust them to make informed choices about their engineering challenges, come up with creative solutions, complete complex tasks, and work together smoothly to do so. To develop activity-based learning conceptual approach with the STEM Education instructional method on the photosynthesis issue to promote students' learning achievements and their systematic thinking abilities at the 11th grade level with the efficiency of the processing performances and the performance results (E_1/E_2) at the determining criteria as 75/75. To compare between students' learning achievements of their pre-test and post-test assessments with the STEM education instructional method on the photosynthesis issue. To compare between students' systematic thinking abilities of their pre- and post-learning activities that based on learning conceptual approach with the STEM Education instructional method on the photosynthesis issue. To analyze of students' associations between their learning achievements and their systematic thinking abilities with the post learning activities that based on learning conceptual approach with the STEM Education instructional method on the photosynthesis issue for transferring control of the learning process to the students.

To increase collaboration among students**,** research team get comfortable with teamwork. Actively teach teamwork skills and work with students to heighten awareness of their team behaviors and ways of interacting in the class. Here is a link to a student teamwork guide that teacher may find useful. Feel free to download and use it. Data administrations with a sample size consisted of 21 upper secondary educational students at the 11th grade level from Mahawichanukul School under the Maha Sarakham Secondary Educational Service Area Office 26, Maha Sarakham Province in Thailand with the purposive sampling random technique was selected. The research instruments were determined with a main-STEM Education instructional method's

lesson plan to management of the activity-based learning conceptual approach in 15 hours, the *Learning Achievement Assessing Test* (LAAT), and the *Systematic Thinking Ability Measuring Test* (STAMT) were used. Statistically significant with the average mean score, standard deviation, percentage, independent variable *t*-test were analyzed, simple and multiple correlations, standardized regression weight validity, and coefficient predictive value (R^2) were associated.

The results of these research findings have revealed as: students were evaluated to determine performance criteria with the efficiency of the processing performance and the performance results (E_1/E_2) of the STEM Education instructional method's lesson plan to management to the activity-based learning conceptual approach indicated that of 77.16/75.24, which was higher than standardized criteria of 75/75. Students' learning achievements of their pre-test and post-test assessing differences were also found evidence of statistically significant at the 0.01 level. Students' responses of their systematic thinking abilities to their previous and lately learning with the STEM Education instructional method's lesson plan to management of the activity-based learning conceptual approach were differentiated evidence of 0.01, significantly. Associations between students' performances of their learning achievements and their systematic thinking abilities toward their activity-based learning conceptual approach with the STEM Education instructional method on the photosynthesis class were considered together, there was a significant evidence of the 0.01 with the systematic thinking abilities, relatively. Finally, one of the most important things research team can do, as a STEM teacher, is to pay attention to the art of teaching. Develop students' skills in facilitating (as opposed to dictating) so that students focus on learning how to think like engineers, embrace digital tools and technology in the classroom with help from students' performances of their learning achievements to their systematic thinking abilities with the STEM Education instructional model.

7. Discussions

The innovative instructional lesson plans of learning activities according to the concept of education with the STEM education instructional method on photosynthesis issue indicated that of 77.16/75.24, it's mean that the students have average scores from activities during the course of study, which are collected from the activity/work score, behavioral observation and quizzes collected during the learning, this is 77.16%. The average score after the completion of the achievement test revealed that of 75.24% showed that the results of the learning management based on the research concept

developed by the researcher were E1 and E2 were 75 percent higher than the criteria of the concept of full education is a teaching that focuses on integration. In order for the learners to create links between the four disciplines related to the full study. Focusing on learners' thinking processes, problem solving, querying, jointly solve the problem group work actual practice in scientific methods of systematic work (O'Neil. 2012: 36). Corresponding to Wongchachom (2016: 120), his research was conducted to find out the effectiveness of the learning management plan based on the concept. His study with learning based projects as a base for learning physics. The result was that the effectiveness of the learning management plan. It has a performance of 98.14/80.00, which was well above the established threshold of 75/75.

The posttest learning achievement of the students who received the learning activities under the concept of STEM Education instructional method on photosynthesis issue was higher than that of the pretest with statistically significance at .01 levels. According to the assumptions set, the learning activity based on the concept of the study is to teach students how to think, ask questions, find information, and analyze new information discovered. There is an integration of scientific knowledge, mathematics and disciplines (Chulawattanatoon, 2556: 16) emphasize that learners connect their knowledge to problem solving approaches with systematic thinking (Thongchai 2013) with the research of Saengpromsri (2010: 75), research was conducted to compare learning achievement of upper secondary student at the 11^{th} grade level after learning management with the STEM Education and conventional instructional method were compared. The results showed that the students who had been taught in the school had higher academic achievement than the students at the ***.01*** level and also in accordance with Wongchachom (2016: 129). The learning achievements in upper secondary student at the 11^{th} grade level after being taught in the science-based learning and learning based on the project as a base for learning physics showed that the students had the average learning achievement, it was higher than the criterion of ***75%*** of the full score at .05 levels. This result was the same effect as Han and et al. (2014: 1089) of integrated learning activities in science, technology, engineering and mathematics through the use of project-based learning activities in mathematics. The result was that such learning activities increase the achievement of learning and the highest increase in the lowest achieving students.

The systematic thinking abilities of the students after learning activities under the concept of learning about photosynthesis issue were higher than previous learning at the .01 level. An integrated approach that brings knowledge to the solution that was currently linked to real life, including new process development or productivity for

useful to the lifestyle. To emphasize the students' linking knowledge to the problem solving method with a systematic thinking process (Thongchai, 2013) was found.

It also uses the context of the activities that students practice and knowledge content for the learner to practice the problem. Systematic thinking practice and analytical thinking (Siripatrachai, 2013: 49; Pellegrino and Hilton, 2012: 98) to make a holistic look and can link cause and effect to each other (Anderson and Johnson, 1997: 17) has a clear goal recognizing the continually associated elements (Wongyai. 2007; Jutarasok, 2008: 21) who reported of their study on systematic thinking in upper secondary student at the 10th grade level. The results show that the average score of systematic thinking in learning's management that promotes the systematic thinking process after school in each school was higher than that before the study at the .05 level of significance and was consistent with Sihapanya (2013: 88) conducted a study to compare students who studied with the developed lesson program. There was a significantly higher level of thinking ability after learning than before learning at .05 levels, significantly.

Students who had been given learning activities based on the STEM Education instructional method had a correlation between learning achievements, the ability to think systematically at the .01 level. To organize learning activities along the lines of education is to train the students to know how to solve problems, create skills, search information, analyze new findings, and bring science knowledge and mathematics to integration for problem solving (Chulawattanatoon, 2013: 16) who had a survey logical reasoning, skills of learning (Chanprasert, 2014: 4) can link knowledge to problem solving approaches with a systematic thinking process (Thongchai, 2013) and learning activities were to have an overview of the content, content link, the sub-elements include the main elements for making students look at the whole system and describing the relationships has resulted in students developing their systems thinking abilities.

8. Suggestions

8.1 Suggestions for Applying Research Results

1. Learning activities according to the concept of education. It is an activity that encourages learners to study independently and design work to solve the problem. Teachers should allow students access to various media sources, including the Internet to provide students with quality learning and continuous learning. So that teachers should encourage students to take advantage of the use

of Smartphone to search for information for supporting the effectively organize learning activities.

2. Planning and development step, this is a step in learning management based on the concept of education. To integrate knowledge in engineering design and technology to create a piece of work. It's never happened in the classroom. The learner is not confident in the activity, material selection equipment to create work piece. So that the teacher should take care and provide practical advice.
3. Learning activities based on the concept of education. It is a practical activity. It takes a lot of time to practice. This resulted in delays in organizing activities. Sometimes teachers have to schedule extra activities outside of class time. Teachers can be flexible and adjust the time to fit in the activity.

8.2 Suggestions for Future Research

1. Research and development activities should be developed in accordance with the concept of education by integrating teachers in related subjects. It may be defined as an integrated learning unit and allows students to create work pieces of their interest to get a clear and effective activity.
2. Researcher should be conducted to study the effect of learning management on the concept of education in order to match the skills needed in the 21st century.

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