STEM education Project -Based Learning Activities impacting on teamwork skills and Satisfaction of grade 11 Students in KhonKaenWittayayon School.

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Abstract This research aims to 1) To study the teamwork skills of the students 2) To study the effects of the project STEM education-based learning activities on the students' satisfaction. The target group was the Grade 11 students of KhonKaenWittayayon School. The study was conducted in the first semester of the academic year 2017. The 92 students were selected by purposive sampling. Research instruments included 9 lesson plans STEM approach, Teamwork assessment and satisfaction questionnaire. The result found that 1. The ability of teamwork skills of students who have been provided with the project STEM education-based learning activities was found that to Level 4 include 1) Listening to the opinions of others (125 points) Collaboration (122 points) and the reflection of their knowledge (122 points) all that means the students are attentive Listen to the proposals and ideas of the group members before presenting their ideas. Students can work with other members of the group well and share responsibilities with all team members. Students present or reflect a positive and creative concept. Level 3 include students Participation (116 points) Working behavior (107 points). Level 2 include Leadership (84 points) 2. Satisfaction with project STEM education-based learning activities was high level (4.70 S.D. = 0.2).

1. Introduction The world of education has changed dramatically in the 21st century. Knowledge acquisition tools are more important than knowledge content. The advancement of communication technology enables learners to find their own knowledge from various sources [12]. The key to facing change and the challenge is the quality of people. In the present age of education, children are encouraged to develop their lifelong learning abilities [16]. According to the aforementioned problem, it leads to a crisis which is not how bad the students score on the exam but that they are not capable of analyzing[8]. Students do not truly understand the lessons since they try to remember. But have no idea how the lessons can be used in real life. Students are not able to connect their knowledge to the big picture[9]. When students encounter problems that are different from the classroom or have to do tests that have never encountered such problems, and can not solve the problem. However if the students have learned from the actual experience, practice, doing, think, have a continuous learning and discover self-knowledge, which can be applied or solved in real life. This will lead to self-development. Project-based learning is a process of seeking knowledge or search for the answer to what the students want to know or doubt in various ways. It is a way of learning that students choose to study according to their own interests or groups. It's a mutual decision, until the production can be used in the real life [11]. STEM education is Integration of integrated teaching across disciplines. Science (S), Technology (T), Engineering (E), and Mathematics (M), with the emphasis on nature and interdisciplinary teaching approach that are supported by a large number of research.

According to the problem and importance, researchers as teachers are interested in STEM learning styles to integrate in the course Knowledge Creation and Independent Education (ISI-2) in order to study Teamwork skills and Satisfaction of Grade 11 students, Khon Kaen Wittayayon School.
2. Purposes
1. To study the ability of teamwork skills of the students who have been provided with the STEM education project-based learning and Robotic activities.
2. To study the students’ satisfaction of the STEM education project-based learning and Robotic activities.

3. Target group
Target group used in this study are Grade 11 students in Khonkaen Wittayayon School. The 92 students in the first semester of the academic year 2017 were selected by purposive sampling.

4. Research Plan
One Group Pretest Posttest Design [10]. was used as a guideline for conducting the research. The pretest was administered by researcher and the treatment was provided during the 1st semester. After the treatment section the post test was administered to evaluate the understanding with the following pattern.

| Group | Pre-test | Technique | Post-test |
|-------|----------|-----------|-----------|
| E     | T1       | X         | T2        |

When E represents the target audience
X represents the learning activities of the researcher created by the researcher.
T1 represents the student's grades before class.
T2 represents student's grades after class.

5. Research tools
The instruments used in the study were the research instruments.
1) A plans of the learning activities of the project of the full school education project of the Grade 11 students and the test of learning achievement evaluating the basic knowledge on research methodology.
2) Teamwork assessment was used form to study the skills of teamwork. The results of the study were as follows.
3) Satisfaction Questionnaire on STEM Educational Activities
The questionnaire consisted of 5 sets of questionnaires.

Research Framework

| independent variable | dependent variable |
|----------------------|--------------------|
| Learning Management for Grade 11 students is as follows. | 1. Teamwork Skill |
| Step 1: Intro STEM education. | 2. Satisfaction |
| Step 2: Improve Critical thinking from model. | Step 3: Review the concept |
| Step 4: Create and develop | Step 5: Presenting than improvements. |

6. Data collection
The researcher collected the data manually as follows:
1) Pre-test Grade 11 students using the basic achievement test, knowledge, research methodology. A total of 10 items were taken and checked for grade point average.
2) Conduct learning activities in full education with Grade 11 students. There are 10 plans for 18 periods using the creative assessment record in every lesson.
3) At the completion of the learning management of 18 class periods, the test of achievement(posttest) was administered and had students answer their attitude and satisfaction questionnaires were used to collect the data.
4) All data were analyzed using statistical methods. As discussed in the statistical section used for data analysis.

5) Summary of data analysis.

7. Data analysis

1) Analyze Teamwork Skill using the Teamwork assessment form to the group, then summarize the results in the table.
2) Analyze students' Satisfaction using answer in the assessment of individual Satisfaction Questionnaire then summarized in the table.

8. The analysis of data

Teamwork Skill

Table 1. Teamwork Skill

| Evaluation Item         | Number of students showing behavior | Score Sum | Rating |
|-------------------------|-------------------------------------|-----------|--------|
| 1. Collaboration        | 4 3 2 1                             | 122       | 4      |
| 2. Participation        | 22 10 2 0                           | 116       | 3      |
| 3. Listening to others  | 25 7 2 0                            | 125       | 4      |
| 4. Reflecting knowledge | 21 12 1 0                           | 122       | 4      |
| 5. Leadership           | 6 6 20 2                            | 84        | 2      |
| 6. Working behavior     | 14 11 9 0                           | 107       | 3      |

From Table 1, shows the total score. Listening to the opinions of others. Overall, students have a maximum score of 125, which is a 4-point scale, which means that students are attentive and listen to the proposals and ideas of the group members before presenting their idea. The second is the student participation. Overall, a total score of 122, which scores 4 points scale shows that the student is able to work with other members of the group well and is responsible for all members of the team. The reflecting knowledge score is 122 points, which is a score of 4 points, indicating that the student is offering or reflecting on the positive and constructive concept the third aspectis student participation displaying a total score of 116, which is a 3-point scale, indicates that the student is involved in most work and is interested in their work. The fourth aspect is working behavior scoring 107 points which is a 3 point scale indicating that students paid attention to what they had been learning. Leadership with a total score of 84 points, compared to a score of 2 point scale, indicates that students are involved in the work, but find that they wasted time with unprofitable work and finding problems with sharing. Show that little students show leadership.

Figure 1. Teamwork Skill
Satisfaction of students toward the project activities.

Table 2. The students' satisfaction towards the project-based learning activities.

| Evaluation Issues                          | Number of students (n) = 92 |
|-------------------------------------------|-----------------------------|
|                                           | (x̅) | (S.D.) | Assessment |
| **Part 1 The nature of the activity.**    |      |        |            |
| 1. Activities Activities                 | 4.93 | 0.25   | The Most   |
| 2. Steps to Organize Activities           | 4.91 | 0.29   | The Most   |
| 3. Time spent on activities.              | 4.96 | 0.21   | The Most   |
| 4. Documents and media for activities.    | 4.91 | 0.29   | The Most   |
| 5. Appropriate activities.                | 4.90 | 0.25   | The Most   |

**Average of Part 1**

| (x̅) | (S.D.) | Assessment |
|------|--------|------------|
| 4.92 | 0.26   | The Most   |

**Part 2 Teacher.**

|                                           | (x̅) | (S.D.) | Assessment |
|-------------------------------------------|------|--------|------------|
| 6. The teacher has good manners.          | 4.16 | 0.21   | The Most   |
| 7. Teachers have the ability to care and solve problems. | 4.78 | 0.15   | The Most   |
| 8. Teachers are ready to facilitate the provision of learning materials. | 4.90 | 0.21   | The Most   |
| 9. Teachers take care of every teaching activity. | 4.91 | 0.21   | The Most   |
| 10. The teacher can explain it comprehensively. | 4.54 | 0.15   | The Most   |

**Average of Part 2**

| (x̅) | (S.D.) | Assessment |
|------|--------|------------|
| 4.65 | 0.19   | The Most   |

**Part 3 Measurement and Evaluation**

|                                           | (x̅) | (S.D.) | Assessment |
|-------------------------------------------|------|--------|------------|
| 11. How to measure the evaluation of teachers. | 4.35 | 0.21   | The Most   |
| 12. Evaluation is difficult.               | 4.00 | 0.15   | The Most   |
| 13. Activity sheets are appropriate for the time spent learning. | 4.96 | 0.21   | The Most   |
| 14. Activities to promote a variety of thinking. | 4.21 | 0.32   | The Most   |
| 15. Encourage students to practice data collection. And self-knowledge. | 4.98 | 0.15   | The Most   |

**Average of Part 3**

| (x̅) | (S.D.) | Assessment |
|------|--------|------------|
| 4.50 | 0.21   | The Most   |

**Part 4 Aspect of success in learning**

|                                           | (x̅) | (S.D.) | Assessment |
|-------------------------------------------|------|--------|------------|
| 16. This activity allows students to apply knowledge to their daily lives. | 4.41 | 0.25   | The Most   |
| 17. Students become more curious and committed to their careers in this profession. | 5.00 | 0.00   | The Most   |
| 18. Students are happy to learn from this activity. | 4.91 | 0.29   | The Most   |
| 19. Student activities have a positive attitude towards science and math. | 4.24 | 0.32   | The Most   |
| 20. A series of activities enables students to succeed in their studies. | 4.98 | 0.15   | The Most   |

**Average of Part 4**

| (x̅) | (S.D.) | Assessment |
|------|--------|------------|
| 4.71 | 0.21   | The Most   |

**Average Total**

| (x̅) | (S.D.) | Assessment |
|------|--------|------------|
| 4.70 | 0.20   | The Most   |

From Table 2, it was found that Satisfaction with Learning Activities Project The average of 4.70 (S.D. = 0.2) was at the highest level followed by the assumptions set. When considering satisfaction, it was found that The highest mean of satisfaction was in the first aspect of the activity ("x̅" = 4.92, SD = 0.26). The fourth aspect of learning achievement ("x̅" = 4.71, SD = 0.21). 2) Teachers ("x̅"=4.65, SD = 0.19) and the third aspect of measurement and evaluation ("x̅"= 4.50, SD = 0.21) respectively.

![Figure 2. student Satisfaction](image)
9. Discussions

According to the study, the STEM education project-based activity and Robotic activities affect creative thinking and attitude of Grade 11 Students, KhonKaen Wittayayon School. The results can be discussed as follows.

1) Grade 11 students who have been provided with project-based learning activities have skillfulness in teamwork shown by the students, attention by listening to the proposals and ideas of the group members before presenting their ideas. Also, they work with other members of the group well and share responsibilities with all team members offering or reflecting a positive and creative concept. Students pay attention to their work by being reminded and engage in work, but find that wasting time with unprofitable work and finding problems with sharing the findings also show that students show leadership. This is consistent with the assumption that The students in the Grade 11 receive a full-scale learning project. And have the ability to work as a team after learning more than before. Since the project learning activities, each step has a group process, Students will need to adjust their behavior. Step 1: Understand the basics of STEM education. Step 2: Develop creative ideas from the third stage. Step 4: Create and develop the ideas. Step 5.

The results of the research project of the Faculty of Science, Chulalongkorn University said that integrated teaching across disciplines. Science, technology, engineering and mathematics. The nature of the teaching as well as the teaching methods of each field to blend perfectly. To teach the students to use the knowledge to solve problems, research and development. As in the actual work or in daily life, a large amount of knowledge is needed in the process of group work throughout the project, students are encouraged to learn through real-life activities or projects that enhance the experience of life skills, creativity leading to innovation.

2) Grade 11 students received the project-based learning activities. The satisfaction of the students on the project-based learning activities was 4.70 (SD = 0.2). At the highest level Followed by the assumptions set. When considering satisfaction, it was found that The highest mean satisfaction were the aspect of activity, the success of learning teachers in the assessment and evaluation respectively, which is consistent with the assumption that students in the Grade 11 are satisfied with the project learning activities in full education. Students are expected to perform at all stages with fewer lectures in the activity. Use of high technology integration is used in this STEM project. Students use a variety of thinking processes. Teachers have the knowledge and ability to organize activities. There are assessment models that make students successful in learning. Students are satisfied with the level of activity.

10. Suggestion

1) The learning activities of the project should focus on how to access and evaluate each activity before class in order to give students a sense of the importance of making a portfolio, group activities, answering questions, and projects.

2) Teachers play an important role in encouraging them in Learning activities of the project. Students should be encouraged by question or problematic situation and receiving continuing suggestions to result in curious and self-learner.

3) Teachers should create a learning environment that allows learners to be free in their learning, thinking and practice to stimulate their thinking processes in many way.

4) The learning activities of the project focus on group work. To achieve the purpose Teachers must focus on the importance of working in a very group. Some activities may cause students to have different opinions. Teachers need to guide the students to think about the value of the good and the bad. Then share the ideas and choose the best idea.

5) In project-Based Learning Activities, there are many activities in the learning plan. Teachers will see the ability of different students, try to let the students express themselves. And instruct the students to see their abilities. However, in some activities, some students did not always collaborate especially brainstorming. Teacher should ask students to brainstorm their ideas in a paper and then organize them into groups. Teachers may motivate to grade each group. In the manner of accumulating points. And award the highest scoring group in each learning activity.

6) The media and research resources are important to organize learning activities. Teachers should provide sufficient media, materials and resources. This will result in effective activities.

To effectively

7) Presentation will give the student to show their potential and be confidents in presentation which will make them proud of themselves and develop a learning habit.
11. REFERENCES

[1] Chulavatnatol, M. (2015). Preparing Thai STEM Workforce with 21st Century. Skills by STEM Education. Paper presented in the 2nd International Conference on Innovation in Education (ICIE 2015).
[2] Csikszentmihalyi, M. (1988). Society, culture and person: A system view of creativity. In R. Sternberg (Ed.), The nature of creativity. Cambridge, NY: Cambridge University Press.
[3] Falk, J. H., & Needham, M. D. (2013). Factors contributing to adult knowledge of science and technology. Journal of Research in Science Teaching, 50, 431–452. doi:10.1002/tea.21080.
[4] Falk, J.H., Dierking, L.D., Staus, N.L., Wyld, J.N., Bailey, D., and Penuel, W. (2016). The Synergies research–practice partnership project: a 2020 Vision case study. Cult Stud of Sci Educ. 11:195–212.
[5] Guilford, J.P. (1967). The Nature of Human Intelligence. McGraw-Hill, Book Company.
[6] Gupta, B. N.; Singh, R. B.; Chatterjee, D., (1981). Chemical composition and nutritive value of rice bean (Phaseolus calcaratus Roxb) hay. Indian Vet. J., 58 (9): 527-530
[7] Hathcock, S.J., and Dickerson, D.L. (2015). Scaffolding for Creative Product Possibilities in a Design-Based STEM Activity. Res Sci Educ 45:727–748.
[8] IPST (2003). Science evaluation guide. Bangkok : Printing of Teachers Council of Ladprao
[9] Kittibhum Lertkittikulyothin,(2007). The Study of Problem Solving Ability and scientific creative Thinking by Practical Science Project and Technology of Mathayom Suksa II Students. Master’s Project, M.E.d.(Secondary Education). Bangkok: Graduate School, Srinakarinwirot University. Advisor Committee: Assoc. Prof. Dr. Chutima Wattanakeeree.
[10] Loun Saiyos and Angkana Saiyos, (1995). Educational research techniques. 4th. Bangkok : Printing of Suweeriyasan.
[11] Office of the Secretary of the Education Council, (2007). Framework for educational development During the 10th National Economic and Social Development (2007-2011). Bangkok: Printing of Chulalongkorn University.
[12] Pornthip Siripatrachai, (2013). STEM Education for development of skills in the 21st century. journal (April-June 2013
[13] Seattha, P., Tupsai, J., Sranamkham, T., and Yuenyong, C. (2016). Students’ view on STEM in learning about circular motion through STS approach. AIP Conference Proceedings 1775, 030063; doi: 10.1063/1.4965183.
[14] Sompanya Sripakananon,(1992). The study of the ability to create inventions and ideasCreation of Mathayom Suksa 2 students using a set of constructions to create artifactsKarma, repairing scientific inventions. Master’s Project, M.E.d.(Secondary Education). Bangkok: Graduate School, Srinakarinwirot University.
[15] Tassanee Pruksatan(1974).The creation of scientific creativity test of lower secondary school students. Master’s Project, M.E.d.(Secondary Education). Bangkok: Graduate School, Chulalongkorn University.
[16] Wachara Loareindee, (2010) . Development of teaching and learning styles to promote critical thinking abilities Science learning strand of grade 5 students. Journal