Service Learning by STEM Activity in Secondary School at Prachin Buri Province, Thailand

Jaruwan Chutrtong, Narumon Boonman, and Waradoon Chutrtong

***Abstract*—The two purposes of this study were: 1) to explore the effects of one-time service learning on the cognitive and affective development of science undergraduates student of Suan Sunandha Rajabhat University and 2) to evaluate the effectiveness of STEM using on students' engagement in academic services. These questions were explored by means of qualitative study of 130 (grade 10-12) students of KrokSombunwittayakom School and 21 industrial microbiology students of Suan Sunandha Rajabhat University who participated in one-time service learning at Prachin Buri Province in 2016 and 2017. The study discussed in this article examined the benefits of service-learning using both questionnaire and interview data. From data analyses, it indicated that activity participants engaged in activities actively and mindfully. STEM, significantly, influenced students behavior. Service participation showed positive effects to students' performance. The positive effects of service can be explained by the fact that participation in service increases their experiences.**

***Index Terms*—Service learning, Secondary school, STEM, Thailand.**

I. Introduction

Service learning (SL) or community engagement pedagogies is an educational approach that combines learning objectives with community service in order to provide a pragmatic, progressive learning experience while meeting societal needs [1]. This concept derives from "learning by doing" which was popular in USA in the era of 60-70 [2]. It is also promotes in Latin America and many European countries. In countries with strong educational systems, higher education institutions integrate learning with the form of service learning [3]. The service-learning in USA is now actively as part of the core curriculum [4]-[6].

Service learning is widely accepted and applied to alternative learning in higher education institutions because it is the method that claimed to enhance student growth and the common good. It also claimed to enrich the learning experience [7]. The benefits that students will receive from the service learning are better learning outcomes, better personal outcomes and better social outcomes. Students will able to apply what they have learned in the real situation. They will able to analyze and solve problem. They will have greater sense of personal efficacy, personal identity, spiritual growth, and moral development. To live with others, students will have greater interpersonal development. They will able to work well with others, and build leadership and communication skills. In social part, students who joy in service learning activity will improve social responsibility and citizenship skills. On the other hand, community also benefited from this activity. It will enhance community-university relations. Student participation is the channel to apply new knowledge or innovation to community.

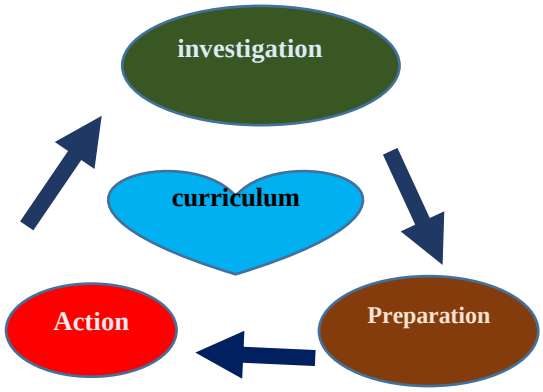

Fig. 1. Service learning pattern.

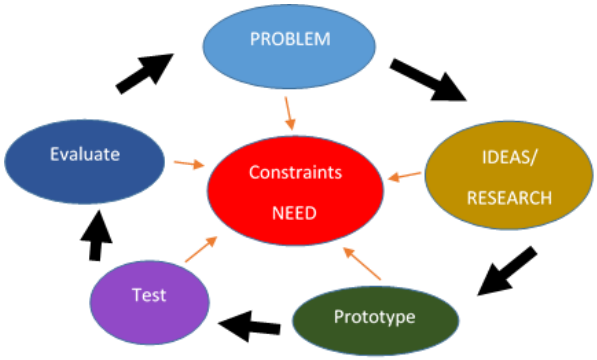

Fig. 2. STEM education model.

In Thailand, social services are defined as one of educational institutions duty by government policy. Some university integrate service learning into the curriculum of different subjects but most are organized as extra activities [8]. Social services by science students are activities that need to be done too. Nowadays, STEM (science, technology, engineering and mathematics) education is the model for scientific teaching. STEM integrates four specific disciplines into a cohesive learning paradigm based on real-world [9].

This model makes it possible for all learners to develop all aspects for being a quality person of the 21st century. If the STEM model is used to organize service learning activities of science subjects, the results should be better. This research aims to find out the effects of STEM in a Service-Learning

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activity which operate by industrial microbiology students of Suan Sunandha Rajabhat University, Thailand. This paper reports an assessment of using STEM in a Service-Learning. We were interested to see whether advantages could be shown.

II. Procedure

A. Apply Service-Learning Theory to the Activity

Service-learning applications vary depending on the detail of activity content and the area. Service-learning combine community need into the curriculum, giving students real-world learning experiences while providing benefit for the community. Four major objectives are realize to achieve quality service-learning: duration and intensity, links to curriculum, partnerships, and meaningful service.

B. Designate the Activity

Industrial microbiology department of Suan Sunandha Rajabhat University (SSRU) is a government education institution which teaches in variety of fields including arts, social science, business, education, sciences and technology major. The service-learning activity took place at KrokSombunwittayakom School, a small secondary school in Prachin Buri Province Thailand. Most KrokSombunwittayakom students are from rural areas. The study design for examining students' transformation after participation. I2 industrial microbiology students and 45 student in grade 11-12 of KrokSombunwittayakom School participated in 2016, the first year. In 2017, the participant of activity are 9 industrial microbiology students and 85 student in grade 10-12 of KrokSombunwittayakom School.

C. Microbiology Concerns Products Service-Learning Activity

Most students from rural area in Thailand do not go to higher education. So, current Thai government has policy for education organization to provide knowledge that is beneficial to life and can be career. One-time group service activity was held to achieve the objectives of the government and to serve service learning.

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D. Data Analysis

Methods for gathering data included on-site participant observation, document analysis, questionnaire and interview.

Data collected included reflective comments, course evaluations, and feedback from the director of *KrokSombunwittayakom School, teachers, and students.*

III. Findings

A. Participants' Information

Two-year participant data is shown in the Table I.

B. Evaluation of Activities in Terms of Satisfaction, Understanding and Appliance

Evaluation of activities was done by giving the participants from KrokSombunwittayakom School a questionnaire about satisfaction, knowledge, and utilization.

TABLE I: SSRU Participants' information

Cohort Year	Number of student	Sex		Age
		Female	Male	
2016	12	8	4	20-22
2017	9	8	1	20-22

TABLE II: School Participants' information

Cohort Year	Number of student	Sex		Age
		Female	Male	
2016	45	27	18	16-18
2017	85	4	42	15-18

TABLE III: Evaluation of Activities in 2016

Survey categories	Mean, Standard Deviation
Satisfaction with knowledge transfer	4.93 +/- 0.64
Understand the knowledge	4.85 +/- 0.55
Fully integrate with project activities	4.79 +/- 0.46
Expected to apply the knowledge	4.85 +/- 0.69
engender mutual support	4.78 +/- 0.54

TABLE IV: Evaluation of Activities in 2017

Survey categories	Mean, Standard Deviation
Satisfaction with knowledge transfer	4.25 +/- 0.69
Understand the knowledge	4.27 +/- 0.55
Fully integrate with project activities	4.14 +/- 0.52
Expected to apply the knowledge	4.06 +/- 0.83
engender mutual support	4.13 +/- 0.61

C. Qualitative Assessment from KrokSombunwittayakom School's Members

The director and teachers who observe the activity were invited for individual interviews. All agreed to participate. Each interview lasted for around 15 minutes. The interviews were audio-recorded on recorder and the recorded conversations were transcribed verbatim. The designed interview protocol was semi-structured and so some emerging questions were asked during the conversations. The following comments exemplify the ways in which student enhanced by this activity.

TABLE V: School Members' Reflection

Topic	Comment
Learning process	This implementation has greatly affected on students' interest and skills developing.
Knowledgeable	The content is not related to the high school curriculum, but it can be used in everyday life.
Emerging Consciousness	Students are more attentive to learning by doing. They are more interested in science and have better skills in using basic equipment.
application	Although the content is rarely related to the level of the course, it is useful to convey to intimate person.
Networking	The school is located in country and needs a lot of development. It is good for school that has other organizations host such activities to develop students' potential.

D. Qualitative Assessment from Suan Sunandha Rajabhat University Participants

The industrial microbiology students of Suan Sunandha

Rajabhat University who participate in this activity in the role of academic service provider were individual interviews. Participants each year are different, not the same person. Information will be asked in 2 aspects. The first topic is asking about the operation. The second one is about participant perspective transformation. Each interview lasted for around 30 minutes. The interviews were audio-recorded on recorder and the recorded conversations were transcribed verbatim.

Fig. 3. Cooperation from KrokSombunwittayakom school's director.

TABLE VI: SSRU STUDENTS' TRANSFORMING

Transforming Forms	Characteristics and Examples
Moral	Unaltered
Intellectual	Can processed, delivered and answer questions to the trainees. More ability to search information.
Cultural	Socially conscious lifestyle, relationships, career, and educational choices.
Personal	Emotional suspension. More discreet.
Working	Act on privilege, power, and position.

Fig. 4. Students from SSRU and KrokSombunwittayakom School: 2016's participants.

Fig. 5. Students from SSRU and KrokSombunwittayakom School: 2017's participants.

TABLE VII: SSRU STUDENTS' REFLECTION ON THE OPERATION

Topic	Comment
Planning	Short period activities need to be tightened up. Interesting activities make participants willing to attend. Activities must be age appropriate.
Equipment	Equipment must be small amount and convenient to carry. But it must be enough to use because school can't support.
Participants	Participants enjoy activities but concentrate on limited sessions. They didn't listen carefully. Some group hard to control.
Supporting	University focus on activities by providing funding. The teacher advise and recommend. The school also helps during the activities. Activities are assisted throughout.
Problem	Personal problem, weather problems and surrounding problems

Fig. 6. Activity figure in 2016.

Fig. 7. Activity figure in 2017.

IV. CONCLUSION

This activities were held using STEM as tool because it was more directly measured. It also uses interviews and the responses from the questionnaire to assess the achievement of the activity. The evaluation showed that the provided activities were satisfied by the participants and the relatives. Activity knowledge is beneficial to the participants. Satisfaction in various aspects of the activity is more than 80 percent. This shows that STEM allows the learner to be interested and able to receive the information that teacher has set. This makes successful teaching. STEM is a way to stimulate interest for teenage participants. Teenagers in the digital age like learning by doing more than learning by the traditional way. Although the used method is interesting, there are other factors that affect the activity. The number of attending school's students in the first year was less than in second year while the number of university's in second year was less than in the first year. This inverse proportion is another factor in activity quality. Activities should have a balanced proportion of participants so that the activities will be thoroughly supervised.

Service learning for students in higher education is another way of learning, especially not content part. Service learning helps students learn in real-life situations. They face problems and solve problems by themselves. When students evaluated themselves, they found that participation in the activity caused some good changes. This research activity is one-time service, which is short period proceeding. Learning events was quite a little. The permanent transformation changes will

not happen. Although service learning is encouraged to be part of a university course in America, to emerge undergrads as better community members, but it is not as prevalent in Asia. With a cultural difference, this kind of learning method still be difficult. At this time, In Thailand, management of service learning in course is still one-time project or option within a course. There are also financial factors involved.

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