Situation of organizing STEM activities in Vietnamese Schools

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Abstract. This study aimed to clarify situation of organizing STEM activities in Vietnamese schools. Methodology regarded the survey research and document analysis. The study aimed to clarify 1) situation of organizing STEM activities in Vietnamese schools, 2) Existing ideas of problem-solving capacity as STEM education evaluation framework, and 3) developing framework of STEM education orientation. Samples included total of 58 teachers and 628 students of these schools: Hai Ba Trung high school, Nguyen Tat Thanh high school, and Van Lang high school in Hanoi; Thai Nguyen high school, Dong Hy high school, Gang Thep high school, Luong Ngoc Quyen high school, Luu Nhan Chu high school, Dai Tu high school in Thai Nguyen and other nearby high schools. The findings revealed that some teachers’ awareness on STEM activities including STEM, STEM education, STEM festival, and STEM club. And, Low teachers’ awareness on STEM activities included STEM occupation, STEM resources, and robotics competition. The reality of developing problem-solving capacity in schools was provided in small frequency. It found that the Ministry of Education and Training (Vietnam, 2018) provided some ideas of problem-solving capacity as STEM education evaluation framework. And, the MOET framework and literatures suggested an STEM Process of teaching Science according to STEM education orientation.

Keywords: STEM education, activities, Vietnamese schools

1. Introduction
Increasingly, educators, policy developers, non-government organization, and business and industry organization are stressing the urgency for improving STEM skills to meet current and future social and economic challenges. There are many concerning with the STEM education in shaping innovation and development. This push the policy of many countries continues under the orientation of STEM education [10].

Internationally, there is a boarded view of perceptions, beliefs and actions on STEM. However, the leaders and educators in each country held the varied beliefs, focuses, and actions of STEM education. They organized various kinds of STEM activities STEM educational reform, preparing for STEM workforce and STEM literacy, structuring STEM as a track of school curriculum, providing a broad range of content and practices, exploration of different teaching strategies for STEM, teacher preparation for STEM education teaching approach, and so on [1]; [2]; [3]; [4]; [6]; [8]; [12]; [13]; [14]; [15].
STEM education appeared in Vietnam a few years ago. It has just been the stage of media announcement and experimental. It has not been an official education activity in high school. However, STEM education with the tasks of providing crucial knowledge and skills for students in 21st Century will become a widespread education model in the future [3]. Therefore, STEM education is highly needed the concern and awareness of the whole society. To move further on STEM education in Vietnam, the studying of what they organize the STEM activities may provide baseline of developing STEM education in Vietnamese schools.

2. Methodology
   Methodology regarded the survey research and document analysis. The study aimed to clarify 1) situation of organizing STEM activities in Vietnamese schools, 2) Existing ideas of problem-solving capacity as STEM education evaluation framework, and 3) developing framework of STEM education orientation.

2.1 Samples
   Samples inclued total of 58 teachers and 628 students of these schools: Hai Ba Trung high school, Nguyen Tat Thanh high school and Van Lang high school in Hanoi; Thai Nguyen high school, Dong Hy high school, Gang Thep high school, Luong Ngoc Quyen high school, Luu Nhan Chu high school, Dai Tu high school in Thai Nguyen and other nearby high schools.

2.2 Data collection and analysis
   The research team conducted the survey from July 2016 to August 2017. The survey form of organizing STEM activities was developed to examine the reality of organizing STEM activities in Vietnamese schools, 2) the reality of developing problem-solving capacity in schools. Then, statistics descriptives were provided to describe the reality of organizing STEM activities at high schools and developing problem-solving capacity for students.
   Document analysis was also carried out. The literatures were categorized and find pattern to develop existing ideas of problem-solving capacity as STEM education evaluation framework and STEM Process of teaching Science according to STEM education orientation.

3. Findings
   3.1. Reality of organizing STEM activities at high schools
       For teachers: The result of the awareness of teachers in Science subject about STEM shows that a few teachers know about STEM and STEM education activities, issues related to STEM education is presented in figure 1. High teachers’ awareness on STEM activities incluced STEM, STEM education, STEM festival, and STEM club. Low teachers’ awareness on STEM activities included STEM occupation, STEM resources, and robotics competition.
Exchanging with teachers gives these comments: integration and problem-solving capacity related to reality are difficult problems with teachers. Although it has been focused for years, the reality of conducting is not as expected. Applying the advantages of STEM education is very beneficial and necessary with general education in Vietnam but STEM education is just conducted in high school in order to attract a number of students attending the competition, for example, the annual Intel ISEP.

With students: The result shows that in the learning process, students are interested in learning STEM education orientation (Figure 2). STEM education highly recommends the improvement and the development of problem-solving capacity for students. In each lesson with STEM topic, students have to deal with a practical situation which needs to be solved and relates to scientific knowledge. To solve the problem, students need to research the knowledge of the subjects related to the problem (through the text book, learning materials, experiments, technology) and use them to solve the problem. These knowledge and skills have to be integrated and connected to each other to help students know about the principles, practise and make products in daily life.
3.2 The reality of developing problem-solving capacity in schools

a) Results of investigating teachers

- About the level of applying knowledge in solving reality problems: In the lessons, teachers do not pay attention to applying knowledge in solving reality problems, 14.29% of teachers never apply, 62.84% of teachers sometimes apply and 22.87% of teachers usually apply.

- About the level of connecting knowledge in teaching Science: Most of teachers hardly connect the knowledge from Mathematics, Physics, Chemistry, Biology, Informatics, Technology, Engineering in the process of teaching Science (57.19%). The proportion of teachers who never connect the knowledge and just teach Physics, Chemistry and Biology separately is very high: 14.26%.

- About the level of difficulty that teachers have while using problem solving teaching method: The majority of teachers say that problem solving method takes too much time (85.71%) and it is difficult to evaluate the participation of students in solving problem (50%). Besides, the quality of teachers in this method is not good enough, 28.58% of teachers do not understand the content clearly. 42.84% of teachers find that the capacities of students are limited.

b. Result of investigating students.

- About the level of applying knowledge in solving reality problems: In the lessons, students do not pay attention to applying knowledge in solving reality problems, 14.29% of students never apply, 42.84% of students sometimes apply.

- About the level of connecting knowledge in learning Science: Most of students hardly connect the knowledge from Mathematics, Physics, Chemistry, Biology, Informatics, Technology, Engineering in the process of teaching Science (77.38%). The proportion of teachers who never connect the knowledge and just teach Physics, Chemistry and Biology separately is very high: 12.62%.

- About the attitude when recognize the conflict between the exercises and the questions: Most of students do not care about strange problems (56.2%), a small number of students pays attention and find out how to solve a conflict (17.3%). This could be caused by teachers who do not focus on the situations in teaching.

3.3 Existing ideas of problem-solving capacity as STEM education evaluation framework

3.3.1. The concept of problem-solving capacity

Problem-solving capacity shows the ability of an individual (working by himself/herself or working in groups) to think about the situation, research and conduct the solution for the problem. Therefore, we can know as: Problem solving capacity is the ability to use effectively the awareness process, actions and attitudes, motive and emotion to solve problems that there is no available process and normal solution [10].

3.3.2. Expression of problem-solving capacity

According to general education of the Ministry of Education and Training [9] general capacities of students were determined. Problem-solving capacity of high school students has these expressions:

- Find out and clarify problems: Analyze the situation in learning and life, determine and propose the situation in study and life.

- Propose and select solutions: Collect and clarify the information related to the problem; propose and analyze some solutions to solve the problem; choose which one is most suitable.

- Conduct and evaluate the solutions: conduct and evaluate the solutions of the problem, think about the method and process of solving problems to adjust and apply in new scenes

- Aware of new ideas: Determine and clarify information, new ideas and different sources of information; analyze the information independently to see the new ideas.
- Form and improve new ideas: Propose new ideas in learning and life; think in a new way; create new factors from different ideas; form and connect the ideas; research to change the methods before the change; evaluate the risk and have back up plan.

- Think independently: Ask valuable questions, do not take one way information easily; do not prejudice after evaluating; care about the evidence, ready to evaluate the problem again.

From the expressions of problem-solving capacity developed in Vietnamese high school students, we find the similarities with the process of STEM education, so that we use this expressions to organize learning activities for students, to build the evaluation tools for problem-solving capacity development through STEM education for students in teaching Science.

3.4 STEM Process of teaching Science according to STEM education orientation

From the international experience in approaching STEM education [7] (Process 5E, process of approaching scientific research method, process of approaching engineering design) and the reality of the program and Science text book in the new general education in Vietnam, we research and propose the general process of teaching Science in STEM education orientation including 5 steps (Figure 3):

![Figure 3. STEM Process of teaching Science in STEM education orientation](image)

5. Conclusion

This study provided some beliefs and actions about STEM Education in Vietnam. The teachers’ awareness on STEM education revealed the reality of organizing STEM education in Vietnam. According to the findings, it seems that STEM resources and robotics competition should be strongly supported. And, based on the MOET, it have showed that MOET provided already STEM education orientation in school setting. Therefore, Vietnamese teachers may develop STEM education learning activities regarding on the 5 steps. These included (1) Building the topic, (2) Building the learning content in STEM orientation, (3) Designing learning tasks, (4) Conducting, and (5) Assessment.

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