Current Situation of Problem Solving Ability Development for Chemistry Teaching at High Schools of Lao PDR

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Abstract. Education in the Lao People's Democratic Republic (Lao PDR) plays an important role in the development of national construction and defense. Among subjects at High schools, Chemistry is one in the field of natural science with many applications. However, nowadays, despite many achievements, the reality of teaching chemistry at High school has showed a lot of inadequacies. This article addresses some of the problems in the development of problem solving ability in chemistry-teaching at high schools in the Lao People's Democratic Republic.

1. Introduction

Ability development-oriented education is a modern pedagogy trend [1-5, 8,9]. The Lao People's Democratic Republic (Lao PDR) is also in the same general trend. In the national education system of Lao PDR, high school education is the middle level of education, followed by secondary education. Article 18 of the Education Law of the Lao PDR has stated “General education is a regular educational activity. High school education lasts for 3 years and is responsible for upgrading and expanding the content learned from secondary school. In addition, high school education has to go into some subjects to develop the students' awareness, skills, abilities and talents.” [5]. High school education plays a very important role in the national education system. The high school’s education goal is defined in Article 18, Chapter III of the Education Law of Lao PDR as follows: “High school education must consolidate and develop the content of primary and secondary education, ensure that students have a common understanding of culture, mathematics, history, natural science, social science, law and vocational guidance, etc.”[7].

Therefore, the Lao government has set a vision of socio cultural development by 2030 as follows: “Developing human resources is to ensure a competitive economy like other countries in the region and in the world, is a strong production capacity to meet the demand of socio economic development. The people of Lao PDR can therefore receive education, health care, quality, efficiency and increase their average life expectancy up to 75 years old.”

Basing on these vision and strategy, the Lao Ministry of Education and Sports has set a vision by 2030 which is “By 2030, all Lao people can receive a quality education that is fair to provide them with the opportunity to develop themselves to become good citizens of the country, having good
morals, good health, high level of knowledge for the nation’s sustainable development and can be associated with other countries in the region and the world”[7], [9].

2. Content of research

2.1 Research methods

2.1.1. Theoretical research methods. Study documents on policies and educational development of Lao PDR. Study theoretical chemistry teaching on problem solving ability development through chemistry teaching integrated with environmental education. Study the methods and techniques of active chemistry teaching.

2.1.2. Research methodology. The survey content was developed in the form of questionnaires in teacher poll and sent to upper secondary schools in some provinces and cities in the country with 226 teachers including 79 teachers who directly lectured Chemistry.

- Send directly to teachers and students, collect questionnaires and comments.
- Use information technology to get feedback: To facilitate the investigation, processing, and analysis of data, Google Drive's "Forms" tool was created. After designing the contents of the questionnaire, we sent the link to teachers and students to get feedback on the design contents, the results obtained will be processed by the functions available in google combining the part Microsoft Excel to handle the slip and send directly.

Findings and discussions

2.1.3. Current status of the use of active teaching techniques

- Onthelevel of use of teaching methods and techniques

Table 1. Level of use of some methods and techniques of teaching in high school.

| No. | Methods and techniques of teaching | Frequent | Sometimes | Rarely | Not used |
|-----|-----------------------------------|----------|-----------|--------|----------|
| 1   | Use visual aids                   | 28,0%    | 35,1%     | 27,6%  | 9,3%     |
| 2   | Use chemical exercises            | 14,8%    | 61,4%     | 21,1%  | 2,7%     |
| 3   | Presentation of the problem       | 26,8%    | 48,2%     | 21,4%  | 3,6%     |
| 4   | Inquiry Based learning            | 23,1%    | 51,2%     | 20,3%  | 5,4%     |
| 5   | Problem Based learning            | 37,8%    | 48,9%     | 11,6%  | 1,8%     |
| 6   | Project Based Learning            | 33,5%    | 48,2%     | 16,1%  | 2,2%     |
| 7   | Cooperative learning              | 28,7%    | 52,0%     | 15,7%  | 3,6%     |
| 8   | Work in corner                    | 16,5%    | 56,7%     | 20,5%  | 6,3%     |
| 9   | Mind Mapping Technique            | 21,8%    | 51,1%     | 21,8%  | 5,3%     |
| 10  | KWL technique                     | 15,6%    | 51,3%     | 21,9%  | 11,2%    |
| 11  | Brainstorming Technique           | 18,4%    | 48,2%     | 21,2%  | 12,2%    |
| 12  | Technique JIGSAW                  | 15,3%    | 50,9%     | 21,6%  | 12,2%    |
Based on Figure 1, teachers have applied the methods and techniques of active teaching in the teaching process. However, the use of active teaching methods and techniques Frequency is low. Some active teaching techniques, such as KWL, brainstorming, JIGSAW have over 10% of total teachers never used in teaching.

- On the level of difficulty using problem based learning method

**Table 2.** Difficulties in using problem based learning method

| Difficulties                                                   | Teachers’comments |
|---------------------------------------------------------------|-------------------|
| 1. Design a problematic situation in teaching chemistry       | 83,2% 23,7%       |
| 2. Chemistry curriculum is not flexible                      | 76,3% 23,7%       |
| 3. Lack of equipment for learning and teaching                | 77,7% 22,7%       |
| 4. It takes a long time for design lesson plan                | 79,1% 20,9%       |
| 5. Student’s capacity is limited                              | 80,2% 19,8%       |
| 6. Teachers do not understand the problem based learning method | 73,3% 26,7%       |

Through the analysis of Table 1.2, teachers face many difficulties in using teaching methods to solve problems. Most teachers said that the development of problem solving capacity for students is difficult; most teachers said that 83.2% of the teachers found it difficult to design the situation problem. As many as 73% of teachers said that they did not know the content of using Problem Based learning methods. Thus, although the survey data in Table 1.1 has 37.8% of teachers regularly use Problem Based learning method; however, they also realize that they have not mastered the Problem Based learning method.

- On the difficulty level of using Project based learning

**Table 3.** The difficulty level of using Project based learning

| Difficulties                                                   | Agree  | Disagree |
|---------------------------------------------------------------|--------|----------|
| 1. It takes a long time                                       | 79,4% 20,6% |
| 2. Student’s capacity is limited                              | 70,8% 29,2% |
| 3. Chemistry curriculum is not flexible                       | 67,2% 32,8% |
| 4. Lack of equipment for learning and teaching                 | 74,0% 26,0% |
| 5. Teachers do not understand the project based learning method | 69,5% 30,5% |
Based on the analysis of Table 1.3, teachers face many difficulties when using Project based learning. When being asked about the difficulties of using project based learning, 79.4% of teachers said that it took a lot of time to prepare and finish the project. As many as 70.8% of teachers said that difficulty due to student’s capacity is limited. Most of the total teachers, 74% of the teachers said that the school did not meet the necessary facilities such as internet computer system and other machines when using Project based learning. There are 69.5% of teachers said they are not mastering the Project based learning.

2.1.4. The status of environmental education in Lao PDR

- The use of integrated teaching of environmental protection through the teaching of chemistry.

Table 4. Level of use of integrated teaching of environmental protection through the teaching of chemistry

| No. | Content                                | Level                                      |
|-----|----------------------------------------|--------------------------------------------|
|     |                                        | Totally Agree | Agree | Disagree | Totally Disagree |
| 1   | Integrated in mainstreaming form       | 30.6%         | 47.7% | 18.0%     | 3.6%              |
| 2   | Internal subjects integration          | 21.6%         | 57.7% | 18.9%     | 1.8%              |
| 3   | Related subjects integration           | 22.9%         | 50.2% | 20.2%     | 6.7%              |
| 4   | Cross subjects integration             | 24.1%         | 48.2% | 16.4%     | 11.4%             |

Figure 2. Level of use of some methods and techniques of teaching in high school

As a result, the majority (> 70%) of the teachers in the surveyed schools agree with the levels of environmental education integration. In particular, most teachers agree to use the Internal subjects integration (79.3%) and Integrated in mainstreaming form (78.3%), the teachers assume that Internal subject’s integration and Integrated in mainstreaming form are the integrated way which is easy to access and the content is also more diverse compared to other levels such as Related subjects integration or Cross subjects integration.

- On the importance of environmental education to the sustainable development of Laos.
Table 5. On the importance of environmental education to the sustainable development of Laos

| No. | Content                                                                                     | Level               |
|-----|---------------------------------------------------------------------------------------------|---------------------|
| 1   | Sustainable development is the harmonious development of both socio-economic and environmental | 45,5% 46,0% 7,7% 0,9% |
| 2   | Environmental education includes relevant atmospheric, hydrological, and local knowledge     | 22,5% 62,2% 14,9% 0,5% |
| 3   | Chemistry is a science that has a strength in environmental education for students           | 29,9% 53,4% 14,0% 2,7% |

When talking about the sustainable development of Laos, the majority of teachers are very enthusiastic and want to come up with solutions such as 81.5% of teachers agree and fully agree on the concept of sustainable development. Up to 83.2% of teachers identified that chemistry is a subject that can promote the development of environmental education for students.

- On the importance of environmental education to the sustainable development of Laos.

Table 6. Using the level of environmental education integrated exercises in chemistry teaching in high school

| Purpose                                              | Agree | Do not agree |
|------------------------------------------------------|-------|--------------|
| 1. To consolidate and systematize the chemical knowledge for the students | 87,0% | 13,0%        |
| 2. To practice learning skills (such as using Chemistry language, writing, solving problems in chemistry ...) | 74,0% | 26,0%        |
| 3. To form and improve ability (problem solving, awareness, thinking) | 73,6% | 26,4%        |
| 4. To test and evaluate study result of the students  | 82,3% | 17,7%        |
| 5. To enable the students to enjoy learning, have the positive attitude, be active in learning | 80,0% | 20,0%        |
| 6. To use exercises as a source of knowledge for students to study new knowledge. | 82,9% | 17,1%        |

On the basis of consultations with teachers who are teaching directly in high schools, the majority of teachers totally agree with testing, consolidating and systematizing chemical knowledge for students; 73.6% of teachers vote for the examination and evaluation organized in parallel with ability development.

2.1.5. The current situation of chemistry teaching with the development of problem solving ability in Lao People's Democratic Republic

- Teaching objective
Table 7. The difficulty level of using Project based learning

| Survey content                                                                 | Chosen solution                                                                 |          |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------|----------|
| 1. How often do you care about ability development for the students?         | A. Usually                                                                    | 15,5%    |
|                                                                                | B. Sometimes                                                                  | 42,5%    |
|                                                                                | C. Rarely                                                                     | 33,0%    |
|                                                                                | D. Never                                                                      | 9,0%     |
| 2. During the process of chemistry teaching, how often do you care about the development of problem solving ability for the students? | A. Usually                                                                    | 53,2%    |
|                                                                                | B. Sometimes                                                                  | 24,0%    |
|                                                                                | C. Rarely                                                                     | 12,5%    |
|                                                                                | D. Never                                                                      | 10,3%    |
| 3. In chemistry teaching, which teaching objective do you particularly concentrate on? | A. To convey theoretical content to the students                             | 6,5%     |
|                                                                                | B. To instruct the students to do types of exercises in the high school chemistry program | 57,5%    |
|                                                                                | C. To develop specific ability of the subject for the students               | 37,0%    |

Regarding teaching objective, 57.5% of teachers supposed to mainly instruct the students to do types of exercises in the high school chemistry program according to the textbook of the Ministry. In the teaching process, 53.2% of teachers considered development of problem solving ability for the students as the main ability in comparison to other abilities.

- On assessing the importance of developing the capacity of solving problems through teaching the topic of integrated environmental education.

![Image](image_url)

Figure 3. The important level of developing problems solving capacity through teaching the topic of integrated environmental education.

89,3% of teachers said that the development of problems solving capacity of students is important and very important in teaching Chemistry through integrated environmental education topics.

2.1.6. Current status of facilities for chemistry teaching in Lao People's Democratic Republic.
- On facilities for Chemistry teaching. Statistical tables of facilities conditions for Chemistry teaching of high schools in Lao People's Democratic Republic.

Table 8 Facilities conditions of surveyed schools

| No. | Contents                                                                 | Own  | Doesn’t own |
|------|--------------------------------------------------------------------------|------|-------------|
| 1    | Projector or TV connected to computer                                   | 48,0%| 52,0%       |
| 2    | Chemistry classrooms                                                    | 36,0%| 64,0%       |
| 3    | Sufficient chemicals and equipment according to the minimum equipment list | 37,8%| 62,2%       |
According to the survey data, there are many high schools do not have sufficient chemistry classrooms, chemicals and laboratory instruments that in the list of school equipment. Some schools still lack of projector or TV connected to computer which is the necessary conditions for favorable chemistry teaching and learning, meet the demand for innovation in teaching methods.

### 2.2. Results of student surveys

#### About Chemistry learning enjoyment

- **Really enjoyed**: 2%
- **Enjoyed**: 5%
- **Normal**: 37%
- **Dislike**: 56%

#### Level of teacher's environmental education integration

- **Very Often**: 1%
- **Often**: 13%
- **Sometimes**: 22%
- **Never**: 64%

#### Pleasantness of Chemistry lessons with the relation of environmental education

- **Very interesting**: 2%
- **Interesting**: 3%
- **Normal**: 37%
- **Not interesting**: 56%

#### Necessity of Chemical lesson with the relation of environmental education

- **Very necessary**: 1%
- **Necessary**: 4%
- **Normal**: 38%
- **Not necessary**: 57%

#### Giving practical problems and situations requires students to use the chemical knowledge and knowledge of other subjects to explain and solve problems.

- **Very often**: 2%
- **Often**: 8%
- **Sometimes**: 20%
- **Never**: 70%

56% of students are interested in chemistry and 37.59% of students find it normal and are not interested.

Level of lecturer’s environmental education integration: 64, 40% of students said that the integrated environment education had sometimes been used, 22% of students said that it had never been used.
About giving practical problems and situations requires students to use the chemical knowledge and knowledge of other subjects to explain and solve problems: 70% of students sometimes used it and 2, 14% of students never used it.

Pleasantness, necessity of Chemistry lessons with relation of environmental education: 56,03% of students found it interested, 56,62% of students found it necessary; 1,93% of students found it not interested and 1,23% of students found it not necessary.

Through the surveys of teachers and students of some high schools in Laos, some comments can be made as follows:

- Integrated teaching, capacity development, especially problem solving capacity is a very new concept for teachers and students of some high schools in Laos.
- There are still many high school students don’t know how to integrate Chemistry with other subjects.

3. Conclusion
From the results of survey teachers and students in the provinces, we can see the positive situation of using positive teaching methodologies and techniques, difficulties in applying the Teaching methodologies of Solving Problems and Teaching project. The survey results show that the development of the topic of Integrated Teaching and organizing Integrated Teaching contributing to development of capability of solving problems for high school pupils through teaching Chemical is very necessary in order to reach the target of high school education of the Lao People's Democratic Republic in present.

In order to successfully implement the basic and comprehensive reform of education and sports of the Lao People's Democratic Republic, it is necessary to carry out synchronously the renewal of teaching and learning contents and methods with a view to the stressed importance of training for students’ comprehensive capability, especially problem solving ability at all levels. Fostering and development of capacity for students, especially, a key issue is extremely important in the educational and sports development strategy to provide indigenous and high quality human resources for the country. I investigated and studied the situation of teaching chemistry and investigated through teachers and students to assess the current status of solving problem ability of high school students in the Lao People's Democratic Republic. Measures for solving problem capacity development for the students are being researched and will be published in next papers. The current situation of problem solving ability development for students through chemistry teaching at high schools of lao people's democratic republic.

4. Summary
Education in the People's Republic of Laos (Lao PDR) plays an important role in the cause of national construction and defense. In general school subjects, chemistry is a subject in the field of natural science with many applications. However, despite the achievements, the reality of teaching chemistry at the upper secondary level is still inadequate. This article addresses some of the problems in the development of problem solving capacity in high school chemistry teaching in Lao PDR.

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