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SEFL-STUDY TEACHING FOR BIOLOGY SPECIALIZED STUDENTS STUDY CELLS IN GIFTED SCHOOLS

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PART 1. INTRODUCTION

1. RESEARCH RATIONALE

The issue of education reform was included in the resolutions of the Party Congress IX, X, XI and was institutionalized by the Education Law. In that trend, the system of specialized schools should be the model for other high schools to follow with specific objectives: *"Specialized schools not only focus on equipping students with specialized knowledge but also on competence development for students, including self-study. Self-study is considered one of the core competencies required by students."* However, at high school teachers are still too focused on the transmission of knowledge of the lesson without equipping students with studying skills, especially the skill of self-study that should be trained and developed from the beginning of high school. For these reasons, we chose the topic "***Organize self-studying skill teaching activities in Cell Biology for specialized high school students"***

2. RESEARCH OBJECTIVES

Based on the research and analysis of the content of Cell Biology curriculum, practical evidences of self-study competence and impacts of teaching to students' learning process, the research proposes fundamentals and procedures of organizing self study teaching activities in order to help Biology-majored high school students gain knowledge of the topic, as well as developing their competence, thus enhancing the effectiveness of the teaching quality in specialized high schools.

3. SUBJECTS AND OBJECTS OF STUDY

3.1. Subjects of the study

+ Structure, content and program of Cell Biology for specialized high school students.
+ Self-study competence of specialized high school students.
+ Procedure and measures of self-study teaching in Cell Biology
+ Procedure and measures of competence evaluation for high school students

3.2. Objects of study

The process of self-study teaching for high school students towards training and developing self-study competence.

4. SCIENTIFIC HYPOTHESIS

If the materials on cell biology are made according to the topic and the procedures of self-study teaching is proposed, students' self-study competence and knowledge should be enhanced positively.

5. SCOPE OF THE STUDY

5.1. Cells biology curriculum at gifted high schools for the purpose of building material for guiding how to organize teaching self-studying cells biology for gifted students.

5.2. Process and methods to organize teaching self-studying skill based on self-studying skill of Biology-majored students.

6. TASKS OF THE STUDY

6.1. Study theoretical and practical foundation of teaching self-studying and self-studying cell biology for students at gifted high-schools.

6.2. Analyze the content and structure of biology curriculum at gifted high-schools; identify standard of knowledge to construct materials about cell biology according to topics and materials about cell biology and materials for guiding how to organize teaching self-studying cells biology

6.3. Study psychological and physiological features of students at gifted high-schools to form the foundation for proposal of measures to organize self-studying teaching.

6.4. Found the process, propose some measurement to organize self-studying teaching for students at gifted high-schools.

6.5. Found the criteria and instruments to assess knowledge as well as self-study competence of students at gifted high-schools.

6.6. Experiment to assess the scientific hypothesis, value of processes and measured proposed in the Thesis.

7. RESEARCH METHODOLOGY

7.1. Theoretical research

7.2. Expert methodology

7.3. Basic investigation

7.4. Pedagogical experiments

7.5. Statistics methodology

8. CONTRIBUTION OF STUDY

8.1. Contributed to the theory of teaching self-studying and self-studying, simultaneously give supplementary practical research of teaching self-studying and self-studying with students at gifted-high-schools in Viet Nam.

8.2. Identified the fundamentals, process to construct materials about cell biology and materials for guiding how to organize teaching self-studying cells biology according to curriculum at gifted high-school.

8.3. Identified structure of self-studying competence, proposals and measures to enhance both academic knowledge and self-studying competence among students at gifted high-school.

8.4. Found the criteria to assess self-studying competence among students at gifted high-school.

9. STRUCTURE OF THE STUDY

Beside introduction, conclusion, proposal, references, published researches and appendix, thesis includes 3 chapters: Chapter 1. Literature Review; Chapter 2: Organize activities of teaching self-studying skill; Chapter 3: Pedagogical experiments.

PART 2. RESEARCH FINDINGS
CHAPTER 1. THEORETICAL AND PRACTICAL FRAMEWORK

1.1. LITERATURE REVIEW ON SELF-STUDY AND SELF-STUDY TEACHING

Self-studying and teaching self-studying are discussed by lot of researchers all over the world through history of education such as Comenxki, John Dewey, Makarenko, Disteswerg, Babanski,; Goroxepxki, Lubixona Sharma, Ahmed,… ; as well as Nguyen Canh Toan, Le Khanh Bang, Dinh Quang Bao, Tran Ba Hoanh, Thai Duy Tuyen, Le Duc Ngoc, Nguyen Duy Cau,... in Viet Nam. By studying the previous researches about self-studying, we found that in the early days, most studies related to self-studying were conducted with the philosophy approach, and later illustrated by physiology; psychology, pedagogics and has ever since become a separate branch of study. In most studies, the role of self-studying skill is always emphasized and it is affirmed that motivation is the most important factor for students to make progress. It is also confirmed that the self-studying competence of students is highly enhanced when participating in self-studying teaching sessions. There are some methods which are considered as active and effective ones to help students improve self-studying skills such as case study, cognitive method, co-operative method, project-based method or research method … However, in general, literature only focuses on the objects of university students instead of a more systematic procedure of self-study teaching for high school students.

1.2. THEORETICAL FRAMEWORK

1.2.1. Self-studying

1.2.1.1. Definition

As defined by the research team: ***Self-study is the process in which leaners individually complete learning tasks, with or without assistance from other people. Learners actively participates in studying cases or solving different problems to gain knowledge and form skills to achieve the initial learning targets.***

The nature of self-study is to let learners have an active impact on the objects positively and creatively to reach the learning target. The process of gaining knowledge, skill and attitude formation is done by the learners themselves, with support from the learning environment. Self-study can be seen as the identification of the goals, the construction of plans, the establishment, the control, the adjustment, the discovery, the attainment of knowledge, the assessment, the reflection of learners themselves in a creative way. To achieve the expected result, learners should have proper attitudes, high determination, clear targets and plans and be equipped with self-study experience.

1.2.1.2. Scientific framework of self-studying

- ***Philosophy framework:*** Theoretically, studying is a process of awareness, a special cognitive activity of human whose result is to form scientific concepts, from which turns into scientific hypothesis.

- ***Psychological framework:*** Every behavior of humans is the sign of adaptation or re-adaptation to the environment. A person only acts when he/ she possesses a demand for something, including two factors: awareness and emotion. Emotion can create motivation of behaviors, while awareness narrates those behaviors, helping an individual to gain balance with the surroundings. The result of an actions is always influenced by two factors: subjective and objective (factors). In process of studying, objective factors come from the impact of teachers, facilities and external effects. Subjective factors are defined as knowledge, experience and motivation within the students, which are also considered as the core factors.
- ***Physiological framework***: The physiological framework of teaching self-study is *"Theory about reflection with active conditions"* by B.F. Skinner. Therefore, to teach self-study successfully, teachers must pay attention to organize activities which focus on stimulating the activeness and creativity of students.
- ***Pedagogical framework:*** Process of teaching self-study includes factors such as target, content, method, organization… The association of teaching and learning processes creates quality and productivity in education, reaching the target of training students to possess capabilities such as activeness, flexibility, creativity, critical thinking and problem solving skills, self-studying skills… A good teacher must organize teaching self-study activities and help students form the self-study competence for their whole life.

1.2.1.3. The role of self-studying with students in general and specialized high school students in particular

Self-study is a scientific solution which helps solve the contradiction between the huge amount of knowledge and the limited time of lectures. It is an important factor in forming and developing the ability to conduct researches for students.

For gifted students, self-study enables them to search for and update information quickly, widen and deepen their knowledge, systematize and generalize the lessons to meet the increasing demands of student competitions.

1.2.1.4. Types of self-study

Approaching self-studying in relation with the teaching of self-study, there are three types of self-study: ① Students' self-study process under the direct control of teachers; ② Students' self-study process through materials and instructions of teachers; ③ Students' self-study process without the instruction of teachers

In this study, we mainly focus on the students' self-study process under control of teachers; in other words, through the organization of teaching self-study by teachers. In the first stage, teachers give direct instruction for students in each contributing factor; in the next stages, teachers indirectly control the further training if needed.

1.2.2. Competence

1.2.2.1. Definition

Competence is the ability to master a system of knowledge, skills or attitude and apply them appropriately to succeed in doing something in a certain situation.

1.2.2.2. Structure of competence

According to Rychen, Dominique Simone, Salganik and Laura Hersh, *"Competence consists of a system of internal structures, including the ability to apply knowledge, awareness, practical performance, attitudes, emotions, values, morality and motivation of a person to perform successfully an activity in a particular situation".* Sharing the similar opinion with the literature, the research team further emphasizes that skill is the fundamental element that forms the structure of competence. Competence is the combination from 7 elements : (1) Knowledge, (2) Awareness; (3) Ability to apply knowledge into practice and life experience of learners; (4) Attitudes; (5) Studying motivation; (6) Emotion; (7) Values and Morality; these elements are put in specific settings or realistic situations.

1.2.2.3. Process of forming competence

The competence of each individual is formed through a process of studying and practicing continuously with several periods, in which the former is the precedent for the later one.

1.2.2.4. Competence of high school students

Competence of high-school students is the ability to take full command of knowledge or skills appropriately and make use of them in reality to solve the problems arisen in their daily life. It comprises of General Competence and Professional Competence. Vietnamese students, after finishing high school education are targeted to achieve the following competences: (1) the competence in self-study; (2) the competence in communication and cooperation; (3) the competence in solving problems and creativity; (4) the competence in language; (5) the competence in calculation; (6) the competence in researching science and society issues; (7) the competence in technology; (8) the competence in computer sciences, (9) the competence in arts; (10) the competence in physical training.

1.2.3. Self-studying competence

1.2.3.1. Definition

Self-study competence is the learners' ability to apply knowledge and experience actively and positively that results in the successful completion the assignment by selecting and performing activities related to the content of the lesson in order to attain knowledge, develop skills to achieve the initial studying targets.

1.2.3.2. Structure of self-studying competence

There are different opinions about the structure of students' self-study competence. In this study, the following structure of self-study includes: (1) the ability to determine the aims of self-study; (2) the ability to set self-study plans; (3) the ability to implement self-study plans including the ability to search for materials; ability to work with books

(ability to identify goals, ability to read and exploit information from written materials, and images, ability to take notes lessons); the ability to ask and answer questions; (4) the ability to self-assess and make adjustments.

1.2.4. Teaching self-study and organizing self-study teaching

The teaching of self-study is to teach students how to create an impact on the subjects to discover and attain knowledge and form skills for themselves. The final goal of teaching self-study is to teach students the pathway to discover knowledge and conduct scientific research on their own.

Organization of teaching self-study is the process in which the teacher organizes and directs students' activities in order to make the best of the self-study process and form skills through which students attain scientific knowledge, form and develop the competence in self-study.

1.2.5. Themes of study and theme-based teaching

1.2.5.1. Themes/Topics of study

A theme/topic is a unit of knowledge content that, after a period of researching done by students, will solve a theoretical or practical issue. Upon completing a topic, students can gain the scientific knowledge, as well as practicing and forming basic skills such as problem solving, language, computation, creativity, critical thinking, and self-study.

1.2.5.2. Theme-based teaching

Theme-based teaching is technically a combination of teaching and learning, including a harmonious combination of elements and objects involved in the teaching process to maximize the cognitive ability and Multi-dimensional thinking in a reasonable way, in accordance with the capacity of students during the implementation of the activities according to each topic.

1.2.6. The relation between teaching of self-study and self-studying

The relation between teaching self-studying and self-studying is the one between external and internal forces. Accordingly, the external factors play a supporting role, promoting the development of internal factors. Internal factors are key factors in the success of self-learning.

1.2.7. Materials for teaching of self-studying

Materials for teaching of self-studying are materials that contain information about the content, methodology, teaching techniques, and the organization of pedagogical activities for teachers to help teachers organize self-study activities, through which students not only acquire knowledge, but also form and develop elemental skills of self-study ability.

1.3. CURRENT SITUATION OF TEACHING SELF-STUDY AND SELF-STUDY IN GIFTED HIGHS CHOOLS

1.3.1. Characteristics of the research subjects

1.3.1.1. Teachers

The analysis results of 92 questionnaire surveys for teachers, the information collected includes: the average years of experiences is 18,36 years, in which the number of teachers with experience from 10 to 30 years makes up to 71,74%. With these years of profession, they have already acquired plenty of experiences in teaching, training exceptional students and contributing to innovation in teaching methods with the orientation in providing activeness to learners.

1.3.1.2. Gifted high school students

Based on the analysis of the IQ, EQ, AQ of 4778 students from 5 specialized high schools of the Northern region, Mai Van Hung et al found that: (1) Most of them are good students, talented in their majors, having good intellectual ability, good ability to understand and solve problems, good ability to learn, to think logically, good critical thinking, and flexibility in thinking ... (2) they have the ability to understand themselves and empathy for others; to control emotions to adapt to circumstances, they also have potential social communication skills. (3) They are the ones who have the spirit to overcome difficulties, try to change the situation and more importantly, they can overcome themselves to find a solution to any difficulties faced. (4) Students majored in Biology have the quotients: IQ, EQ, AQ ranging between the gifted students and normal students.

1.3.2. Current situation of cell biology materials, teaching self-study and self-study in specialized schools

1.3.2.1. The use of biology materials of teachers and students in biology classes at specialized high schools

+ 75,19% of students say that the lack of textbooks and too diverse and rich sources of materials on cell biology nowadays also cause difficulties for students.

+ Most students and teachers want to have a standard book on "Cell Biology" for teaching and learning,

+ 45,65% of teachers suggest that the time needed to teach cell biology to biology students is 45 periods.

1.3.2.2. Teachers' levels of understanding of student's self-study competence

The majority of biology teachers are knowledgeable about the componential skills of self-study competence; However, the levels of understanding of these skills are not the same.

1.3.2.3. Awareness of teachers and students about teaching self-study and self-study

100% of teachers and students have a proper understanding of the role and importance of organizing teaching self-study for students. However, there are only 8.70% of them teach self-study to their students regularly and up to 14.13% have never taught self-study to students.

1.3.1.3. The skill of reading books and textbooks (generally called books) of biology students at specialized high schools

Most students have not fully mastered the skill of reading books, which results from the fact that teachers has not paid attention to train students.

1.3.1.4. Current situation of evaluating students' learning outcomes

The majority of current teachers only assess their knowledge without paying attention to students' achieved competence in the learning process.

Summary of chapter 1

From the domestic and international research works related to the content of research topics, we find that:

1) There are currently many studies on teaching self-study and self-study. However, the works mainly focus on university students, some focus on high school students and no research works on students who specialize in biology at gifted high schools.

2) Most of the authors affirm that: in teaching, if teachers create a proper learning motivation for their students; as well as creatively and appropriately applying methods and teaching techniques to promote the positive and active roles of students, students can complete the tasks and assignments on their own. As a result, students will attain self-study competence for long term use.

3) The research on self-study and teaching self-studying also provided various definitions, concepts of teaching self-study, self-study, competence, self-study competence for students, but no definition is suitable for biology majored students. Inheriting the results of research on teaching self-study and self-study, as well as other research results such as competence, self-study competence, we have proposed some definitions and concepts of self-study competence, materials on teaching self-study and self-study; select and propose a number of methods, techniques in active teaching to apply in the process of organizing teaching cell biology - an important content that clarifies the basis for easy access to general knowledge in Biology 11, Biology 12 so that biology students will be able to acquire knowledge, form and develop self-study competence right from the first level of education.

4) Through the analysis of Taylor, Candy and some other authors' structure of self-study, applying to the practice of teaching biology for biology-majored students in specialized schools in Vietnam, we have identified 4 components of self-study competence including: (1) Determining the purpose of self-study; (2) Self-study planning; (3) Implementing self-study plan , (4) Evaluating and adjusting.

• The results of the survey on the current situation of teaching self-study and self-study as for biology majored teachers and students at gifted high schools that we found out:

+ Firstly, it is necessary to complete and elaborate the standard of knowledge of cell biology for biology students at specialized high schools to achieve the actual requirements, on that basis, develop the materials on cell biology and teaching self-study

of cell biology to improve the effectiveness of the process of teaching biology, meeting the goals of teaching - learning in specialized high schools.

+ Secondly, most biology majored teachers and students have been aware of the role of self-study and developing students' self-study competence. However, the process of teaching biology in specialized high schools shows that teachers still focus on providing students with academic knowledge without focusing on the organization of teaching self-study to develop students' self-study competence.

+ Thirdly, with regard to evaluating the learning outcomes of the students, the majority of teachers are only used to testing the knowledge level of students and are very confused in the formation and development of students' competence in general and their self-study competence in particular. The main reason is that teachers do not know how to use tools to measure self-study ability. Therefore, it is very necessary to develop a set of criteria and tools and instruct teachers to use them in evaluating students' self-study competence.

Chapter 2. ORGANIZING SELF-STUDY TEACHING ACTIVITIES FOR BIOLOGY MAJORED STUDENTS AT SPECIALIZED HIGH SCHOOLS

2.1. THE CONTENT OF AND THE DURATION FOR CELL BIOLOGY SECTION IN THE BIOLOGY SYLLABUS FOR GIFTED HIGH SCHOOL

The biology syllabus for biology students at gifted high schools is enacted in the Official Letter No.10803/BGDDT-GDTrH dated 16/12/2009 of MOET. Accordingly, the content of teaching for these students, in addition to the advanced biology textbooks, the teacher also, based on the framework of biology syllabus, creates additional specialized topics to teach students; duration for each subject increased by 50% compared to the advanced biology program. Cell biology occupies 53,2% of the total biology time of the 10th grade and accounts for 15,7% of the total duration of the full-time program.

2.2. DEVELOPING THE MATERIALS ON CELL BIOLOGY WITH REGARD TO TOPIC-BASED TEACHING AND TEACHING SELF-STUDY

2.2.1. Demands for materials of cell biology

For biology-majored students at gifted high schools, there is only the framework program and a number of reference materials on cell biology. Some other Cell biology materials are translated from foreign publications, of which content exceeds the knowledge requirement standard for high school students and may cause difficulties to them during the learning process.

Most documents are written in chapters, so that teachers face many difficulties in the use of methods, techniques of teaching self-study to promote activeness and developing self-study skills for students.

The materials are based on the current biology knowledge standard, the innovation trend of national and international exams for gifted students, the requirements for content renewal, teaching methods and the research in cell study in recent years ...

2.2.2. Requirements for Cell Biology materials

- Ensure the content of the curriculum framework of cell biology at specialized high schools.

- Ensure basic knowledge, depth, access to modern knowledge of cell biology; suitable for physiological characteristics of high school students.

- Basically meet the requirements of knowledge and skills of the national and international competitions for gifted students that are currently undergoing a lot of changes according to the learners' competence.

- It should be convenient to organize the activities of teaching self-study to develop students' self-study competence in the direction of integration.

- The content of cell biology materials must reflect the relationship between structure and function; the basic characteristics of life.

2.2.3. Principles of developing materials for cell biology

- Cell biology materials are developed into theme/topic-based lessons. In which, each topic is a unit of knowledge that comprises of theories and practical application, ensuring the systematic, logical distribution of knowledge on cell biology.

- The capacity of knowledge and the level of intensiveness in each topic must be suitable with psychological and physiological characteristics of students; consistent with the amount of time spent studying in the classroom, the amount of time spent studying at home, and the level of students’ perception.

- The content of knowledge contained in each theme/topic must include core knowledge, basic knowledge and extensive knowledge of the lesson, and must ensure that the direction of teaching is to promote self-study teaching and self-study learning.

- Ensure the accuracy, scientific and logical approriation.

- The language should be easy to understand and scientifically accurate; consistent in biological terms.

- Ensure visual aesthetics.

- Ensure the target-orientation feature, the pedagogical interaction between the material and the cognitive ability of the students; as well as the convenience for teachers and students in the process of organizing self-taught and self-learning courses in order to develop and develop the self-learning competence of students.

2.2.4. The process of developing materials for cell biology

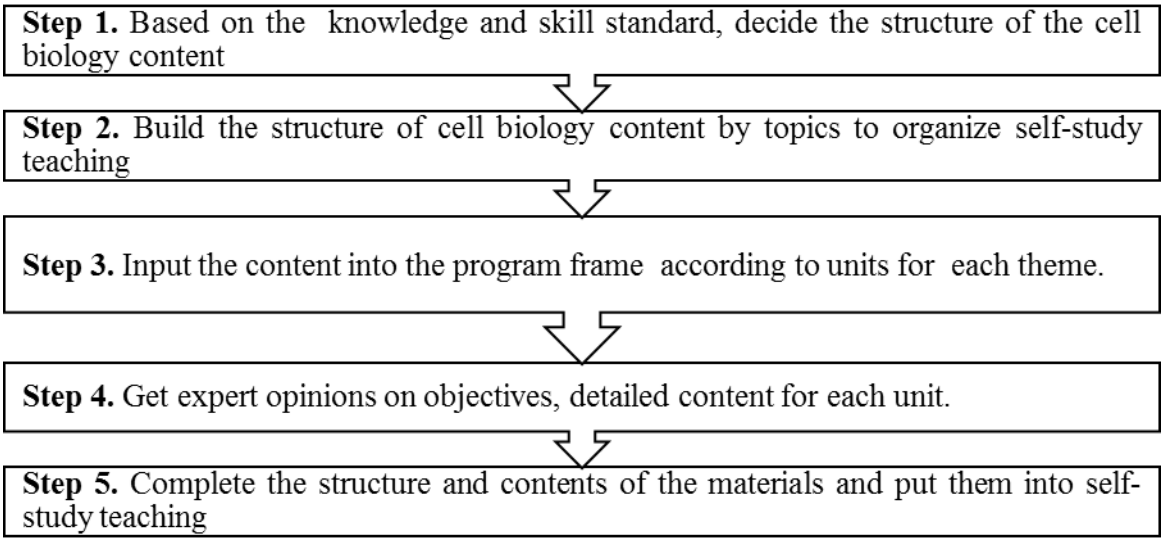


Diagram 2.1. The process of developing topic-based cell biology materials

2.2.5. Results of the development of cell biology materials

Base on the requirements, principles, and procedures, we have developed the Cell Biology guidebook, covering 11 major topics as shown in Table 2.3.

Table 2.3. The topics/sub topics of the self-study teaching and their time distribution

Topic	Sub-topic	Time
1.Common issues in Cell biology		2 periods
2.Chemical composition of the cell	2.1. Inorganic subtances of the cell	2 periods
	2.2 Organic subtances of the cell	5 periods
3.Structure and function of cells	3.1. Structure and function of prcaryotic cells	2 periods
	3.2. Structure and function of eukaryotic cells	6 periods
4. Energy and material Metabolism of cells	4.1. Overview of material and energy metabolism. The role of enzymes in the metabolism of matter and energy	2 periods
	4.2. Synthesis of substances in the cell	6 periods
	4.3. Degradation of substances in the cell	6 periods
5. Receive and transmit information of the cell	5.1. Receive and transmit extracellular information	3 periods
	5.2. Transmission of intracellular information	7 periods
6. Reproduction of cells		4 periods

2.3. ORGANIZING SELF-STUDY TEACHING ACTIVITIES BY TOPIC WITH THE ORIENTATION IN DEVELOPING SELF-STUDY COMPETENCE FOR BIOLOGY MAJORED SPECIALIZED HIGH SCHOOL STUDENTS

2.3.1. Basic principles in self-study teaching Cell Biology with the orientation in developing self-study competence for students

2.3.1.1. Ensure the targets of learning

2.3.1.2. Suitability to the age-specific psychological and physiological features

2.3.1.3. Ensure the succession and development of content

2.3.1.4. Ensure positivity, activeness, creativity in knowledge attainment for students

2.3.1.5. Ensure the gradual improvement of students' self-studying

2.3.2. The process of teaching self-study with the orientation in developing self-study competence for students

2.1.1.1. General process

From the theoretical framework in section 1.2.4 and 1.3.1, as well as the reference to the training procedure with the orientation in competence development of Le Dinh Trung, Phan Thi Thanh Hoi (2016) and related materials; under the context of self-study process for students along with teaching self-study of teachers, we propose the general process of 5 basic steps as in figure 2.2.

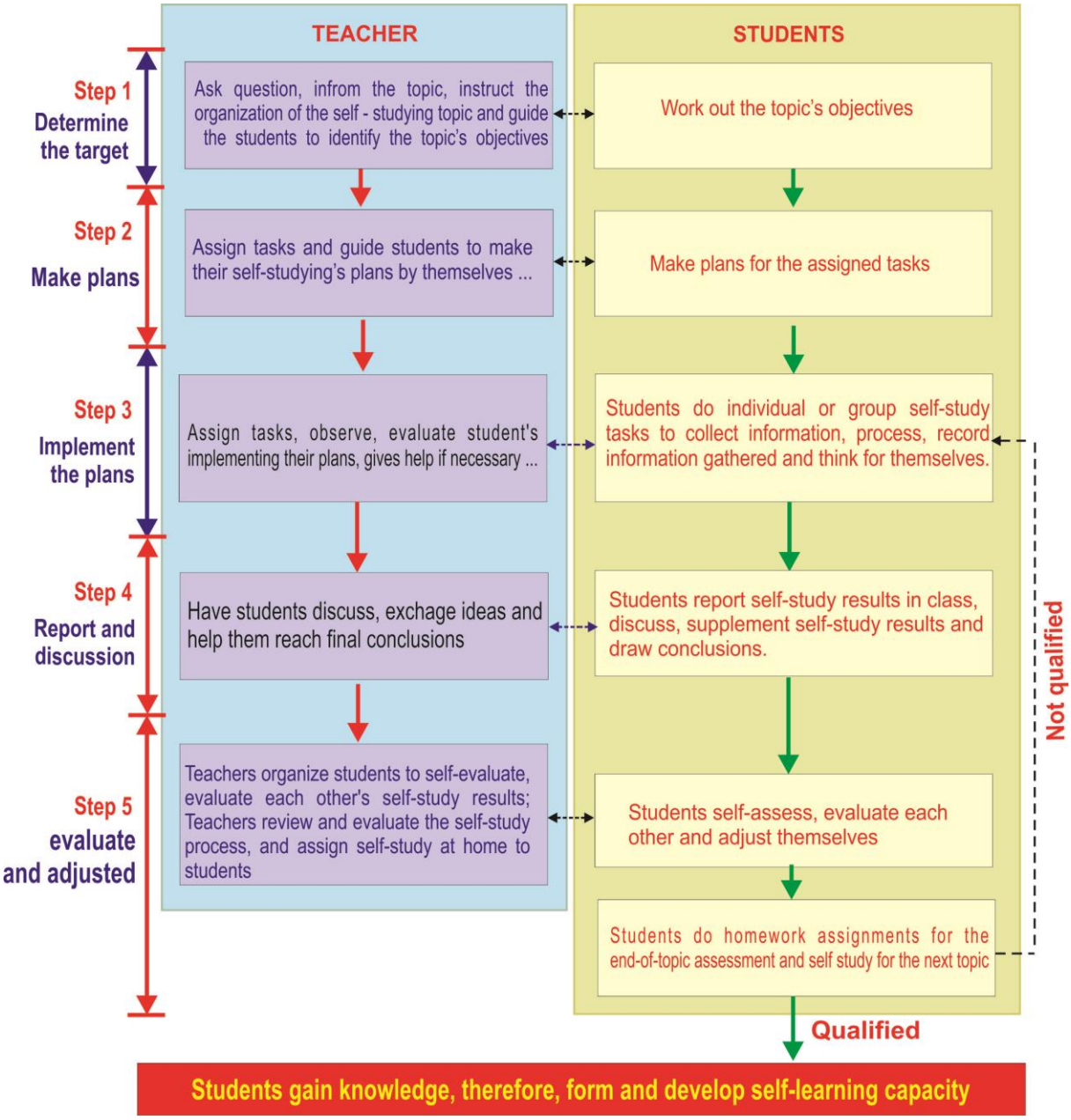


Figure 2.2. The process of teaching self-studying for Biology-majored high school students

2.3.3. Explanation of the steps in the process

In the thesis, the steps of the process will be explained thoroughly, including the activities of the teacher, the activities of the students and the requirements of knowledge and skills that students need to achieve. At each step, an example will be given to illustrate the corresponding self-study progress for the students. (from page 62 to page 107 of the thesis).

2.4. DEVELOPING MATERIALS FOR TEACHING SELF-STUDYING IN CELL BIOLOGY

2.4.1. Principles for developing self-study materials for cell biology

- *Ensure orientation in teaching targets*
- *Ensure pedagogical interaction*
- *Ensure the leading and guiding role of teachers in organizing and controlling self-studying activities.*

2.4.2. The process of developing self-studying materials for cell biology

2.4.3. Steps in developing self-studying materials for cell biology

Step 1. Basing on the goals to achieve in cell biology, determine the taxonomy of knowledge, the skills students will learn after each topic..

Step 2. Decide some methods, techniques and self-studying tools for students to self-study.

Step 3. Guide students to self-study the topic-based cell biology.

Step 4. Do experiment to verify, adjust and complete the materials

Diagram 2.3. The process of developing self-studying materials for cell biology

2.4.2.2. Explanation of the process: We have clearly explained the detailed steps of this process in page 109 and page 110 of the thesis.

2.4.3. Contents of the materials for self-studying of cell biology

The materials include 3 parts:

▪ Part 1: Providing necessary issues for teachers and students before implementing the process of self-studying of cell biology.

▪ Part 2: Instruction on the self-studying process for cell biology according to the 5-step process stated in Figure 2.2, in which each step is to help form a contributing skill of self-study competence.

▪ Part 3: Instruction on the assessment tools to evaluate students' learning outcomes, including performance in contributing skills and level knowledge attained by students after each topic/sub-topic.

2.5. ASSESSMENT OF THE SELF-STUDYING COMPETENCE

2.5.1. Definition

Assessment of self-studying competence is a process of gathering and processing information in all stages of self-studying and teaching self-studying in order to make judgments and provide comments, adjustments, supplement, completion in content, methods of self-learning to achieve the objectives.

2.5.2. Characteristics of self-study competence assessment

Self-study assessment includes the assessment of students' achievement both in terms of knowledge attainment and performance in each contributing skill. These include both external and internal factors of each student

In assessing the self-study competence of students, multiple forms of assessment tools are needed to assess the self-learning competence, especially the progressive evaluation.

The scale in self-assessment is measured according to the levels of self-study competence development of each student. Thus, the self-learning assessment focuses on assessing the progress of students themselves rather than comparing and ranking among students.

2.5.3. Process of self-study competence assessment

With the theoretical study on assessment and application of competence assessment process of Le Dinh Trung and Phan Thi Thanh Hoi (2016), Nguyen Thi Lan Phuong et al (2016) we propose the assessment process including 6 steps:

- Step 1: Determining the competence development pathway
- Step 2: Developing the assessment criteria and evidences for each criterion
- Step 3: Choosing and designing the assessment tool for each component skill
- Step 4: Using the assessment tool to collect information and evidences
- Step 5: Analyzing the data by professional software in order to detect remarkable variables
- Step 6: Explaining the results and conclusion

2.5.4. Set of criteria for assessing students' self-study competence

Based on the self-learning competence structure and the requirements for each component skill of the self-learning competence, we have developed the specific criteria for evaluating each component of the comptence. The set of criteria describes the specific behavior of the students in terms of their level of proficiency and their performance at different levels of each contributing skill. We divide the proficiency level of each element skill into four levels:

+ Level 1: lack of concentration, ignorance with the task and assignments, unable to follow the principles, processes or operations to perform that skill;

+ Level 2: Focus on the task, basically understand the principles and procedures to implement that skill, however still encounter many difficulties in the implementation of the work, so the results achieved face certain limitations.

+ Level 3: Willingness to undertake and perform tasks, fairly understand the principles, processes to implement that skill, with occasional difficulties that requires for support from others to complete the task.

+ Level 4: Always willing to undertake the learning tasks, fully master the principles and procedures to implement that skill, take the initiative to perform tasks and quickly complete the tasks offered by teachers or themselves (The assessment criteria of each component skill of the self-study competence is thoroughly described from page 116 to page 123 of the thesis).

2.4.1. Self-Study Competence Assessment Tool

We have used a variety of tools such as: questions, exercises; checklists, questionnaires, observations, notes... to qualitatively and quantitatively evaluate the students' learning outcomes.

Summary of Chapter 2

Following the published literature, in order to supplement or overcome the shortcomings arising from the theoretical basis and the practical research of the topic, we have proposed and developed:

1) The process of developing topic-based cell biology materials and developed 6 topics for implementing teaching of self-learning.

2) The process of teaching self-study in cell biology consists of 5 steps: 1.Defining learning targets; 2. Planning; 3. Implementation of plans; 4. Asking and answering questions; 5. Evaluation and adjustment. Each step strongly relates with the other, in which the previous step is the basis for the next one. Following these steps require a smooth collaboration and close cooperation between activities of teachers with the activities of students. Each step is in accordance with a component skill of the self-study competence.

3) Based on the processes and principles developed, we propose measures to improve the self-studying competence of studentsm including skill of working with books, skill of making and answering questions,skill of evaluation and adjustment. Throughout the process of training each skill for students, teachers take the active role, leading at all steps in the early stage. Later on, the teacher can gradually step aside and take up the role of orienting the assessment process and settling disputes between students.

4) Based on the self-learning competence structure and skills requirements for biology major specialized high school students, we have developed a set of criteria and set of tools for assessing each component skill of self-studying competence, which becomes the basis for evaluating self-study competence of students. The tool set includes questions, exercises, checklists, questionnaires in line with objectives, and standardized knowledge in advanced biology curriculum in general and cell biology in particular.

5) We have also built a self-study competence development path to serve as a basis for assessing the level of achievement reached in each student's self-study competence during the course of the experiment as well as the future self-study progress.

CHAPTER 3. PEDAGOGICAL EXPERIMENT

3.1. OBJECTIVES OF THE EXPERIMENT

To test the scientific hypothesis, the possibility of the organization process and measures of teaching self-study on the proposed topic in the thesis.

3.2. SCOPE OF THE EXPERIMENT

The experiment is conducted on 271 students grade 10 majored in Biology in 8 specialized high schools represented for each region on the whole country.

3.3. RESULTS AND REASONING

3.3.1. Quantitative analysis

3.3.1.1. Level of self study skill competence of students throughout the experimental topic/sub-topic

To conduct descriptive statistic to evaluate the level of student's development and performance through 7 topics / sub-topics, we used SPSS 22.0 software. Experimental results were evaluated based on descriptive statistics such as mean, error, median, dominant, standard deviation, variance, minimum value, maximum value. Descriptive statistics are presented in Table 3.1.

Table 3.1. Descriptive statistics on the performance of students through 7 topics

	Topic 1	Sub-topic 2.1	Sub-topic 2.2	Sub-topic 3.2	Sub-topic 4.2	Sub-topic 5.2	Topic 6
Valid value	271	271	271	271	271	271	271
Average value	3.75	5.51	6.67	6.63	7.38	7.27	7.67
Standard deviation	0.40	0.26	0.22	0.25	0.22	0.26	0.25
The variance	0.16	0.07	0.05	0.06	0.05	0.07	0.06
Minimum	2.75	4.20	6.00	6.06	6.67	6.61	6.92
Maximum	5.13	5.86	7.25	7.25	7.86	8.00	8.29

Note: Self-study performance scores are the mean of the item skills tested during the experiment (Section 7.4).

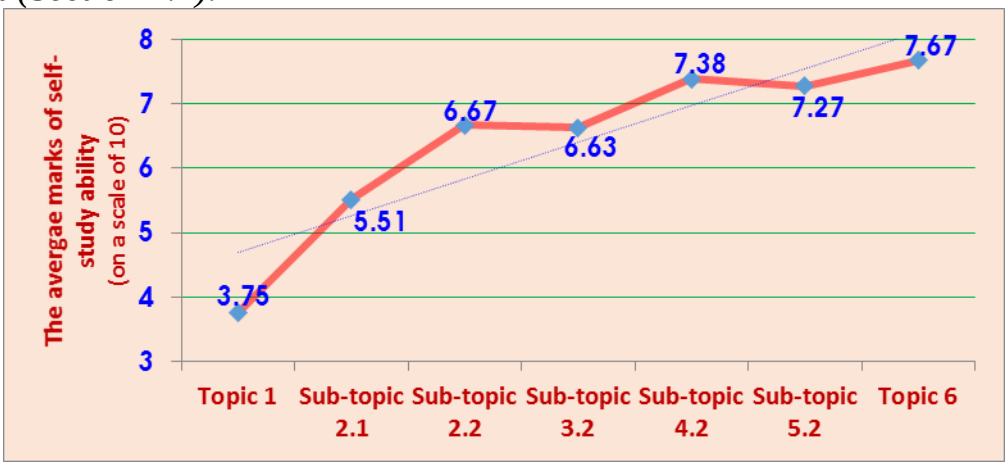


Figure 3.1. Demonstration of the level of self-study competence development progress of students after 7 sessions

From the general average of elementary skills of self-learning, we convert the proficiency levels of self-directed competencies (Table 3.2)

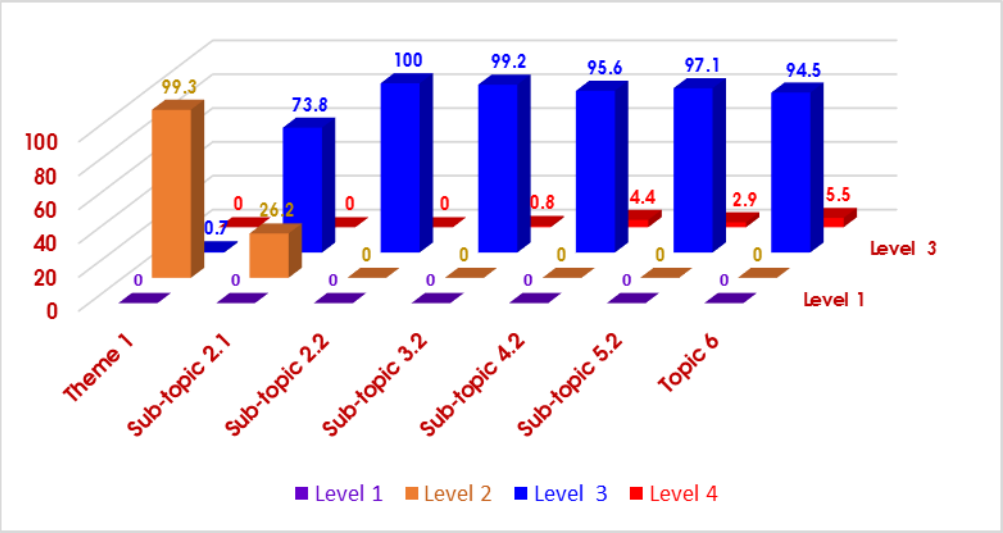


Figure 3.2. The degree of dissipation of capacities in each experimental subject

Thus, after 6 training sessions, almost all students attained self-learning capacity at level 3 (94,5%), the rate of students achieving self-learning capacity at level 4 is still relatively low. Therefore, thematic topics for students in the next topics to continue training, consolidation and improvement of the school for students.

3.3.1.2. The degree of differentiation of each student's self-study skills through experimental topics

We have conducted in-depth data analysis to find out the degree of discrimination and the development of the students in each subject. Analysis results are presented in Table 3.5 and the charts from Chart 3.3 to Figure 3.7.

Table 3.5. Average of all samples of each component of self-learning capacity under experimental topics

TT	Skills/Group skills			Topic/sub-topic of experiment						
				1	2.1	2.2	3.2	4.2	5.2	6
1	Self-study planning				3,59	5,49	6,44		7,35	
2	Perform self plan learning	Finding Materials			4,51	6,14	6,3		7,38	7,72
		work with book	Define lesson's objectives	3,12	6,93	7,41		8,09		
			Read and find out the main idea	4,14	6,79		6,72		7,31	7,83
			Capture content from video channels, tables	3,37	6,35		6,77		7,23	7,51
			Taking note	4,37		7,32		7,15	7,64	8,25
		Asking and answering			6,59	7,04		7,1		7,53
3	Evaluation and adjustment				6,16	7,29	7,03	7,42		7,56

a) Self-study planning skills

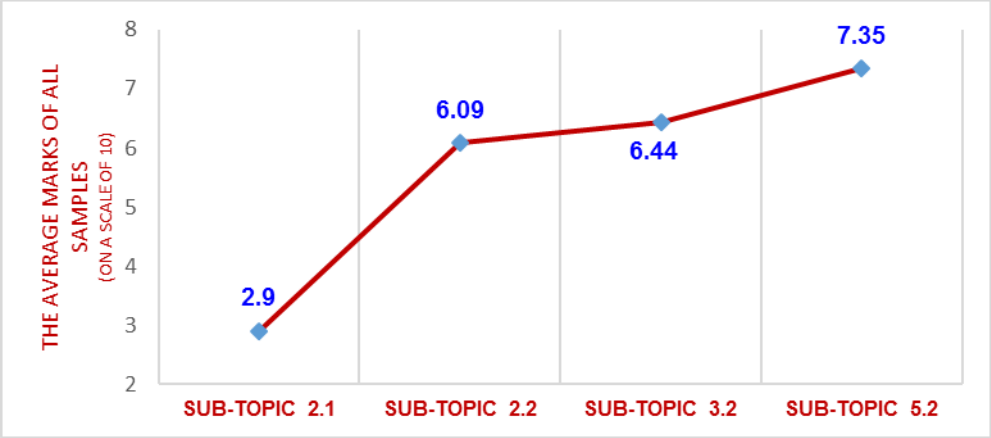


Figure 3.3. Average point average for each topic in self-study planning skills

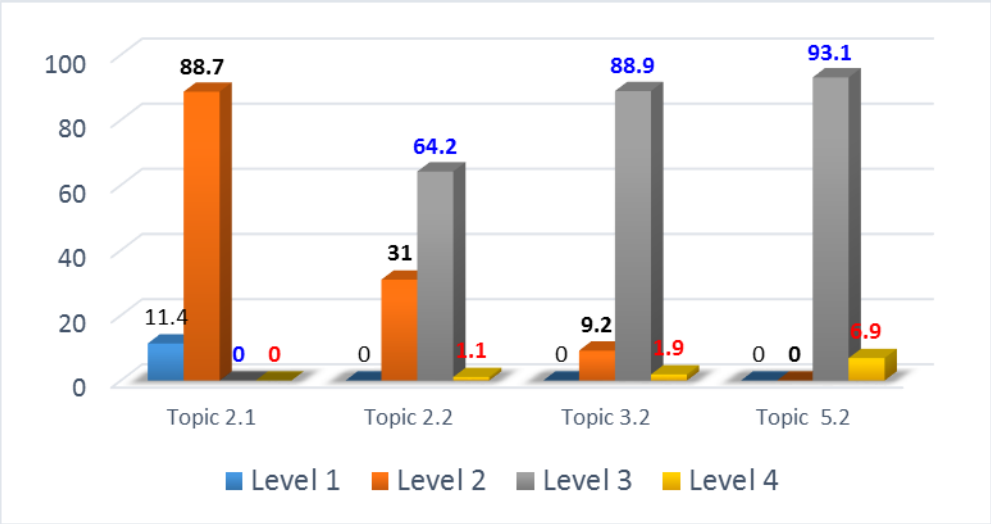


Figure 3.4. Performance differentiation in planning skills

b) Skills of materials searching

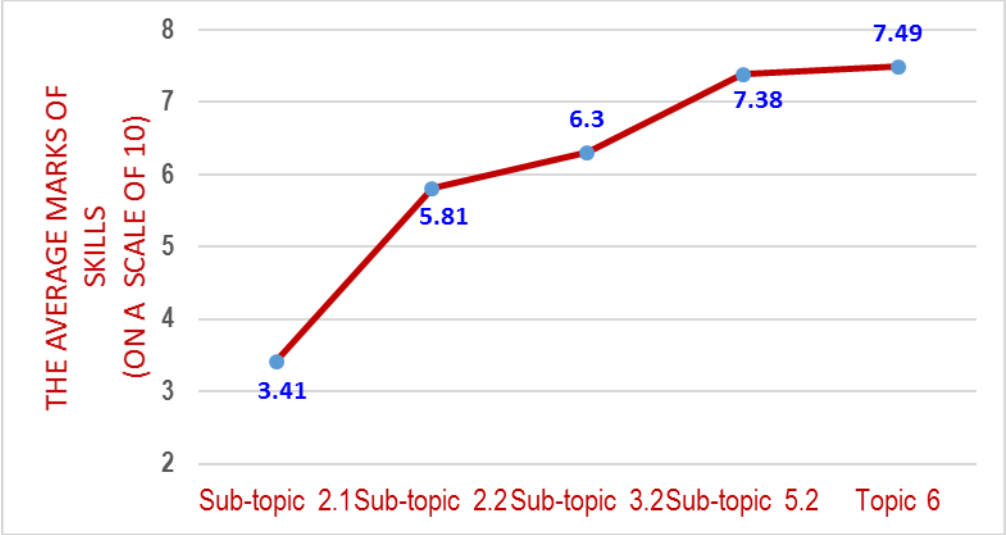


Figure 3.5. Average point average for all samples in the topic of materials searching skills

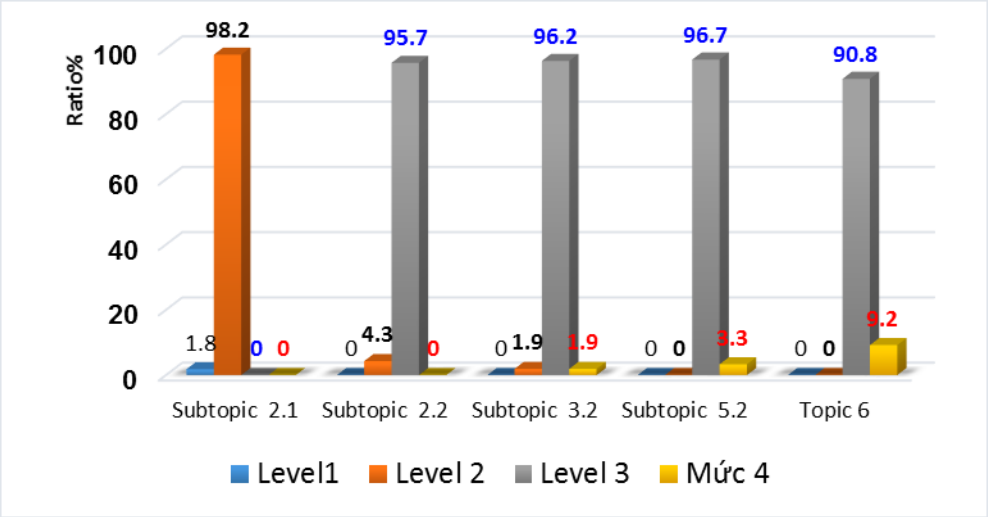


Figure 3.6. Performance differentiation in materials searching skills

c) Skill of working with book

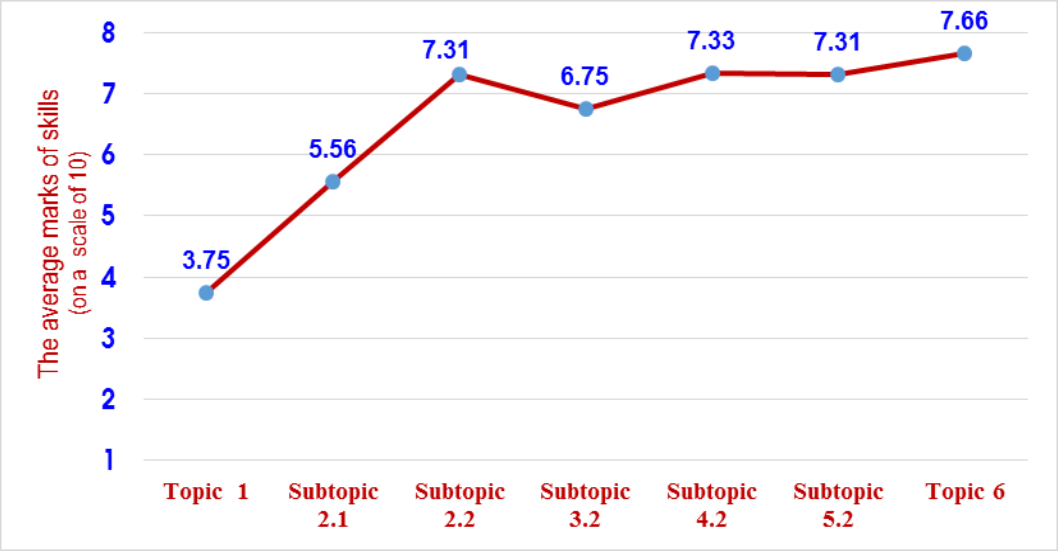


Figure 3.7. Average grade point average for each subject / sub-topic of skills in working with books

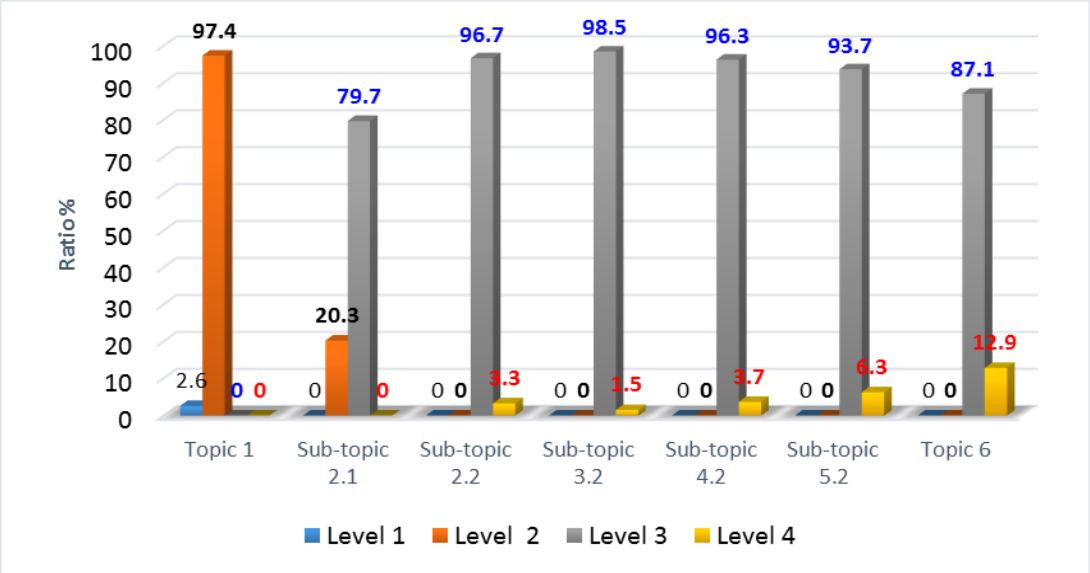


Figure 3.8. Performance differentiation in in working with books

d) Asking and answering skills

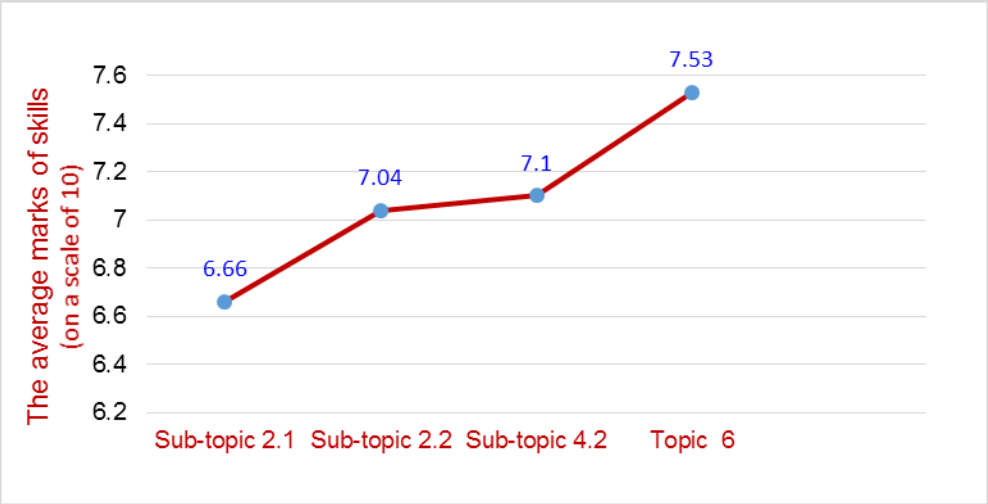


Figure 3.9. The formation and development of Asking and answering skills

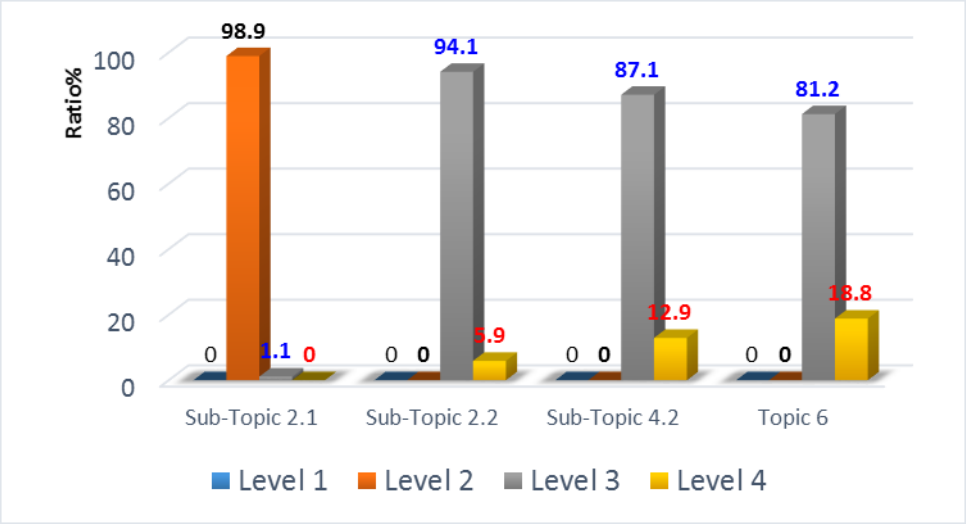


Figure 3.10. The division of performance in asking and answering skills

e) Assessment and adjustment skills

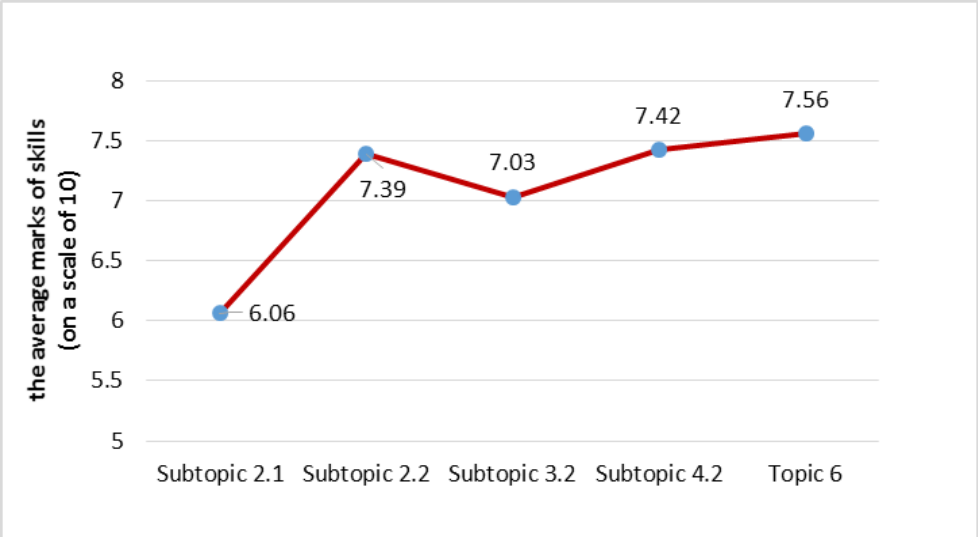


Figure 3.11. Average scores for assessment and adjustment skills

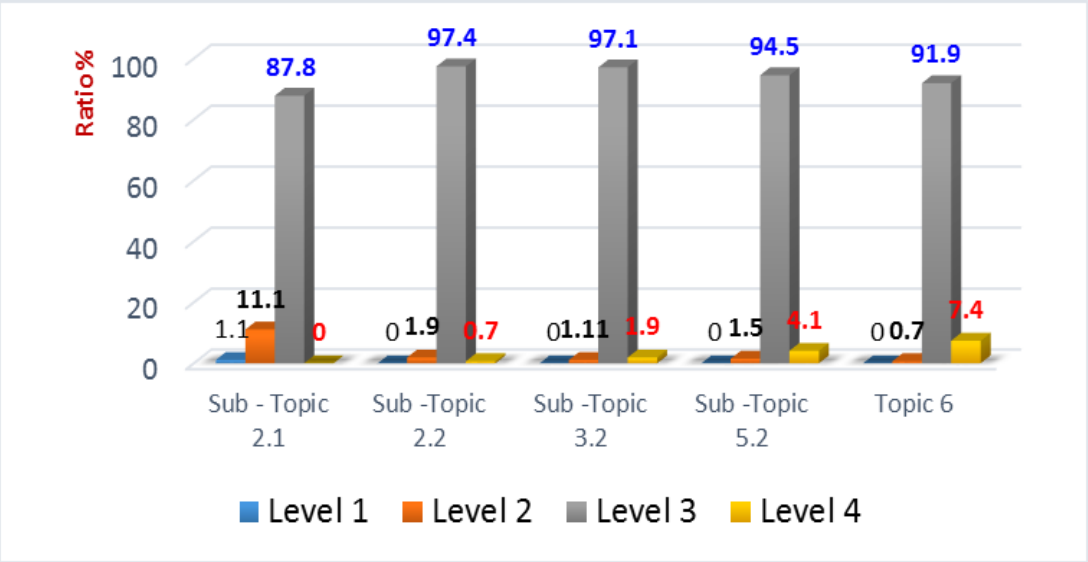


Figure 3.12. Performance differentiation in assessment and adjustment skills

3.3.1.3. Verify the relationship between item skills of self- learning capacity

The results of the verification based on the Pearson correlation among the skills have shown that there is a positive correlation among the development of item skills of self-learning capacity. In other words, Students who are proficient in target-oriented skills will quickly develop a good self-study plan; A detailed, appropriate, practical plan will help students to develop self-learning activities to get high achievement and so on. We also found a positive correlation between the mean score between the self-study skills and the adjusted assessment skills of the students in all experimental subjects.

3.3.1.4. Evaluating the development of students' self-study ability among experimental schools

To compare the process of developement in students' self-study ability among eight experimental schools, we used the analytical method to compare the differences in the average marks of students' self- study ability in each school over each experimental topic (analyze the variance of an ANOVA factor) with the initial hypothesis set out as follows:

+ H_0: There is no difference in the self-study ability of biology students between schools in 6 experimental subjects;

+ H_1: There is a difference in self-learning capacity of students specialize in Byology between schools in 6 experimental subjects;

The analysis results show that the variance of the analysis groups in Equations 2.1 and 3.2 is the same (homogeneous), the remaining variance is not equal (sig <0.05).

3.3.1.5. The results of knowledge acquisition of cell biology in subjects

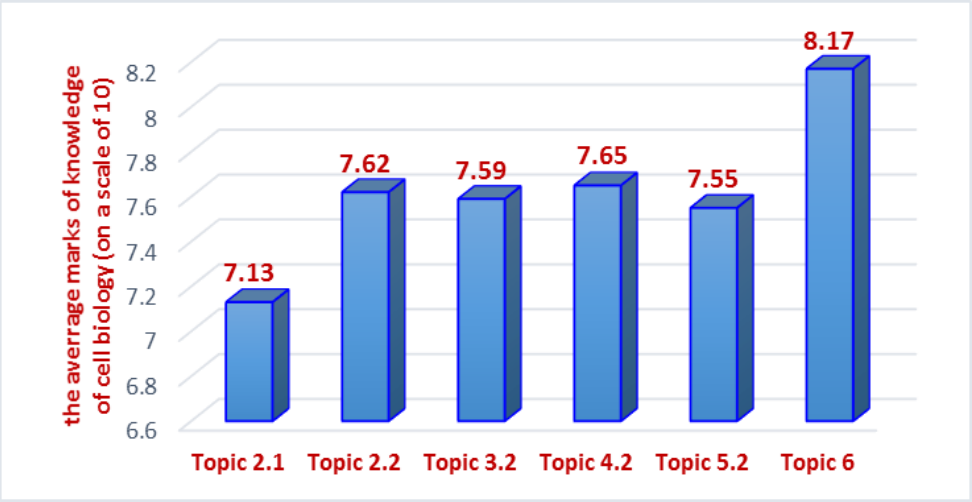
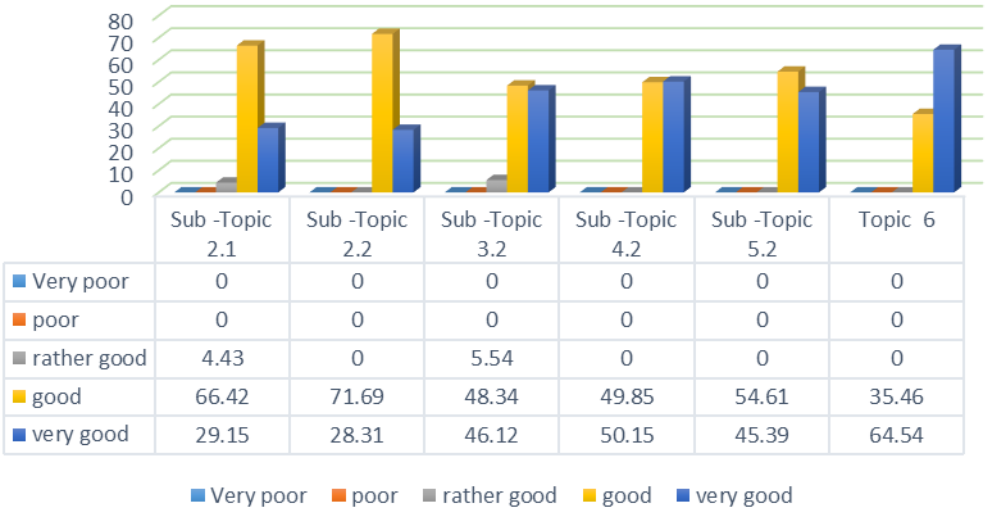


Figure 3.17. Average score on the level of knowledge acquisition of cell biology over experimental topics



	Sub -Topic 2.1	Sub -Topic 2.2	Sub -Topic 3.2	Sub -Topic 4.2	Sub -Topic 5.2	Topic 6
Very poor	0	0	0	0	0	0
poor	0	0	0	0	0	0
rather good	4.43	0	5.54	0	0	0
good	66.42	71.69	48.34	49.85	54.61	35.46
very good	29.15	28.31	46.12	50.15	45.39	64.54

Figure 3.18. Diversify students in terms of the level of occupational knowledge of cell biology in each of the subjects taught by self-taught cell biology

3.3.1.6. The correlation between the development of self-learning capacity and the level of knowledge acquisition of student's cell biology over experimental topics

Table 3.10. The correlation between self-learning capacity and the resutls of knowledge acquisition of student's cell biology

Topic/subtopic	2.1	2.2	3.2	4.2	5.2	6
The average marks of students' self- study ability	5,51	6,67	6,63	7,38	7,27	7,67
The average marks of knowledge of cell biology	7,13	7,62	7,59	7,65	7,55	8,17

As can bee seen in table 3.10, we can see that there is a relative increase and decreace in the level of development of self- learning capacity and the level of knowledge acquisition of student's cell biology over experimental topics.

3.3.2. Quantitative analysis

Based on the direct experimentation and discussion with teachers, it can be seen that there has been a drastic change in the awareness and activities of students during the self-study process throughout each topic/sub-topic. However the skill performance level varies and in Topic 6, students have fully mastered the steps needed for a self-studying process.

Conclusion of chapter 3

To verify the correctness of the scientific hypothesis of the subject, we conducted experiments on 271 students in grade 10 majoring in biology from 8 specialized high schools representing each region. (table 1, page 5 of the thesis). During the experiment, we have made full use of the experiment results, fully complied with the fundamentals, process, measures and methods initially proposed to the organization process.

The quantitative and qualitative results collected throughout the experiment has shown that: “The principles, procedures, and techniques for the organization process and measures of teaching self-study proposed our group have met the scientific hypothesis set out in the thesis and the requirements of division to recognise and foster the students talented in biology in order for them to take the national and international examinations for gifted students and create high- quality human resources for the country”. To test the scientific hypothesis, the possibility of the organization process and measures of teaching self-study on the proposed topic in the thesis.

PART III. CONCLUSION AND RECOMMENDATION

1. CONCLUSION

After the period of executing the targets of the thesis, we have come up with the conclusions as below:

1.1. On the basis of determining the value of self-learning in the modern educational philosophy, from the results of the survey on the current situation of teaching and studying for Biology students at specialized schools, the thesis has contributed to the completion of theoretical and practical literature on developing self-study competence for high school students majored in Biology.

1.2. The results of the situational survey of 92 biology teachers in specialized schools across the country; 411 high school students has shown that: The majority of teachers were aware of the role of self-studying for high school students. Most students have the desire to have the capability to self-study for the rest of their lives. However, the practice of training self-study ability for students specializing in biology in gifted high schools today is still limited. Most teachers are confused with the use of tools and methods to develop self-study skills for students due to lack of determination in structure and organizing process of self-studying activities. This is the foundation to develop the guidebook on cell biology and teaching material.

1.3. Based on the analysis of structure, content of the Biology program, the standard of knowledge and skills of cell biology for high school biology students and the trend of innovation in education and training, including innovation in terms of content, structure of the national and international student competition, we have developed two documents: guidebook on Cell Biology and guidebook on self-studying activities on Cell biology for teachers and students specialized in Biology. Positive results on the content and quality of the materials have been given in the initial testing.

1.4. From identifying the structure of the self- learning ability, we have developed a 5 - step process of self - learning: ① Identify the targets, ② Make a plan for self-learning, ③ Organize the self-study plan, ④ Report and discuss self- learning results, ⑤ Assess and adjust self-study skills; propose measures and techniques for organizing self- learning teaching on topics and applying them to the organization of self- learning teaching Cell biology to improve students' self- learning abilities and help students to acquire knowledge of Cell biology.

1.5. Based on the structure of self-study skill, we have developed the self-study skill development pathway, set of criteria in accordance with the level of performance of each factor; the set of evaluation tool for assessing the performance of each criterion.

1.6. The pedagogy experiment has shown that the measures and process of organizing self-studying activities on cell Biology topic designed for students have achieved the double effect: they enhanced the self-studying skill and helped students gain full knowledge of the cell Biology section; and at the same time distributed the students according to different levels of performance, in order to support the students with superior abilities and develop create the high quality human resources for the society. This result also complies with the initial hypothesis.

1. RECOMMENDATION

1.1. Continuing the development of other teaching topics in Biology 10, Biology 11, Biology 12 and applying the organizing self-studying process on a larger scale for further verification of the suitability for students to develop their own self-studying skills that eventually benefits their life long academic pathway.

1.2. Education administrators should be more active in implementing professional training for teachers, especially for teachers to develop self-studying activities; Active teaching methods and techniques and self-studying activities process so that they can apply flexibly to the practice of competence development for students.

LIST OF SCIENTIFIC WORKS RELATED PUBLIC RELATIONS TO PROJECT

1. Cao Xuan Phan (2012), A number of self-study guides for high school students, The Magazine of Education, No 290, the second term, july 2012, pp 25- 27.
2. Cao Xuan Phan (2013), the structure of content and the orientation of teaching linked genetics (Advanced Biology 12) to develop self- study and scientific thinking skills for students at high schools, The Magazine of Education ,Special edition, September 2013, pp 150-152.
3. Cao Xuan Phan (2016), Developing learning materials of “cell biology" by topics for teaching how to self study for students specilizing in biology at high school, The Magazine of Education, No 393, the first term, November 2016, page 52-54.
4. Cao Xuân Phan (2016), Developing and using teaching materials of how to selfstudy biology of cell in biology specialised classes at gifted high school, The Magazine of Education, Special edition, November 2016, pp 185-188.
5. Cao Xuan Phan (2017), The status and solution of organizing self - taught Biology classes for Biology students in special gifted high school, The Magazine of Education, No 411, the first term, August 2017, pp 33-36.
6. Cao Xuan Phan (2017), Training self–study competency for students specialising in biology in gifted high school, *Proceedings of international conference on the development of sciences teacher’s pedagogical competence to meet the requirements of general education innovation*, Hanoi, december 2017**,** publishing house for science and technology, pp 539-550.
7. Cao Xuan Phan, Le Dinh Trung (2018), Assessing the Biology students’ capability of self-studying at high school, *Proceeding of the 3rd National scienific conference on Biological research and teaching in Vietnam*, Quy Nhon, May 20,2018, pp1250-1263.