MINISTRY OF EDUCATION AND TRAINING
HANOI NATIONAL UNIVERSITY OF EDUCATION

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TRAINING ON SKILL OF DESIGNING EXPERIENTIAL ACTIVITIES FOR PRE-SERVICE TEACHERS IN TEACHING BIOLOGY IN HIGH SCHOOL

Major: Theory and Method of Teaching Biology
Code : 9140111

DISERTATION SUMMARY FOR
DOCTOR OF PHILOSOPHY PROGRAM IN EDUCATION

Hanoi - 2018

The thesis has been completed at:

Faculty of Biology – Hanoi National University of Education

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at …. hour…… day….. month……. Year

The dissertation can be referred at:

1. National Library of Vietnam
2. Library of Hanoi National University of Education

PUBLICATIONS

1. Tran Thi Gai (2017), *"Applying the experiential learning model of David Kolb to design the experiential learning cycle in teaching Biology in high school"*, VNU Journal of Science, Vol. 33(3), 1-6 (in Vietnamese).
2. Tran Thi Gai, Phan Thi Thanh Hoi (2017), *Designing experiential activities in teaching Biology in general school*, Vietnam Journal of Education, 144, 59-64 (in Vietnamese).
3. Tran Thi Gai, Cao Cu Giac, Phan Thi Thanh Hoi (2017) *Organizing the experiential learning activities in teaching science for general education in Vietnam*, World Journal of Chemical Education, Vol. 5, No. 5, 2017, 180-184, DOI: 12691/wjce-5-5-7.
4. Tran Thi Gai, Phan Thi Thanh Hoi (2017) *The Process of training on skill of designing experiential learning activities for pre-sevice teacher in teaching Biology*, HNUE journal of Educational Sciences. 2017, Vol. 62, Iss. 12, p.111-118, DOI: 10.18173/2354-1059.2017-0001
5. Tran Thi Gai, Phan Thi Thanh Hoi (2017), *Applying lesson study methodology for training skill of designing experiential learning activities for preservice teacher in teaching biology.* Processding of International conference training and professional development for teachers, principal advisors and education lectures, Ho Chi Minh City University of Education, 102 - 110 (in Vietnamese).

INTRODUCTION

1. THE REASON TO CHOOSE THE TOPIC

1.1. Originated from the demand for educational innovation nowadays

In the spirit of the Resolution No. 29-NQ/TW on teaching method innovation to develop the capacity of students. To diversify forms of learning, especially experiential activities and scientific research of students.

1.2. Originated from the demand for quality improvement within the Colleges of Education system

When it comes to improving the quality of education, the key step is to consolidate the colleges of education. These institutions have been highly contributing to improving the professional skills of the pre-service teachers (PTs). However, the current curriculum and training methods are no longer in line with the trend of general education.

1.3. Originated from the meaning of experiential activity (EA) in the updated general education curriculum

As Biology is the science of experiment and the knowledge of biology is connected with reality, students need to understand the nature of phenomena and the connection between theoretical knowledge and practical situation. Therefore, it is necessary to strengthen EA in the general subjects and Biology in particular to help students develop their creativity and solve practical problems. To achieve that effect, it is mandatory to promote the role of teacher as a person who provide guidance to students in the course of their work. In order to successfully implement the innovation in the upcoming school curriculum, the colleges must intensively train its students to meet the general needs, especially to equip students with designing EA skills in teaching Biology.

From the theoretical, legal and practical basis, we decided to select the topic: ***"Training on skill of designing experiential activities for pre-service teachers in teaching biology in high school"*.**

2. RESEARCH PURPOSES

Based on the study and application of David Kolb's experiential learning model to teaching Biology, identify the structure of experiential activity design skills; Develop and use the training process for PTs to design experiential activity skills in teaching biology at high schools, contributing to improving the quality of training biology teachers in universities of education.

3. STUDY OBJECTTIVES AND STUDY SUBJECTS

3.1. Study objectives

- Experiential activities, experiential activities model, process of design experiential activities in teaching Biology in high school.
- Skill of design for experiential activities; the process of training design EA skills for PTs; criteria and tools for evaluating EA design skills.

3.2. Study subjects

The process of training the teaching competences of PTs in teacher training institutions.

4. SCIENTIFIC ASSUMPTIONS

If the EA designing skill in teaching Biology in high school are identified the structure; developing and using the appropriate skill training process will train PTs skills of designing EA in teaching Biology in high school.

5. RESEARCH TASKS

5.1. Study the theoretical basis for EA, EA model, skills and EA design skills.

5.2. Develop the EA model and process of designing EA in teaching Biology in high school.

5.3. Identify the structure of the EA design skills and the system of skills assessment criteria of PTs.

5.4. Develop the process of training design EA skill for Biology PTs.

5.5. Pedagogical experiments were conducted to verify the hypothesis of the subject.

6. RESEARCH METHODS

6.1. Theoretical research

Collecting, analyzing and processing scientific documents and works related to the field of research as the basis for the thesis, the materials include: research on the basis of experiential learning, solutions to improve the EA designing skill.

6.2. Baseline Survey

Investigating the current situation of the awareness of EA, as well as the designing and utilizing level of teachers in teaching Biology: A survey of 248 Biology teachers in some Provinces through questionnaires and direct interviews.

- Cognitive appraisal of PTs about EA: Investigating 650 third and fourth year Biology PTs in some Universities of education.

- A survey of 30 lecture about the development for PTs of EA design skills.

6.3. Expert method

6.4. Pedagogy experiment

Practical experiments that aim to assess the effectiveness of the process and measures for students to design EA skills in teaching Biology in high school.

(1) Experimental survey at Vinh University with 76 fourth year PTs.

(2) Formal experiment in 3 universities: Vinh University, he University of Da Nang - University of Education, Hanoi Pedagogical University No 2.

6.5. Mathematical Statistics

Quantitative baseline survey data were processed in SPSS 18.0 software. Qualitative information will be collated with different sources to draw scientific conclusions.

7. RESEARCH LIMITATIONS

7.1. Research criteria

The dissertation focuses on theoretical foundations of EA. The thesis does not focus on training and evaluating EA's organizational skills in teaching biology. However, in the process of training, after the PTs have designed the EA, it is necessary to test the EA designed so that will contribute to the formation and development of EA organizational

skills in teaching Biology in high school.

7.2. Scope of the study

The research was conducted at 3 universities of education with Biology major in different regions.

8. NEW CONTRIBUTIONS OF THE STUDY

- Select and study the rationale for EA, EA model, skills and EA design skills.
- Develop the process of design EA in in teaching Biology in high school.
- Develop the process and measures to train EA design skills for Biology PTs.
- Design of various types of exercises for students to practice their EA design skill.
- Identify criteria and tools for evaluating EA design skills in teaching high school biology.

REASEARCH RESULTS

Chapter 1

THEORETICAL BASIS AND PRACTICE OF THE RESEARCH

1.1. OVERVIEW OF RESEARCH RELATED TO THE TOPIC

1.1.1. Research on experiential learning

1.1.1.1. International studies

Experiential learning is the learning process that originates from experiences, which has a long history of development and, is associated with philosophical thought. Philosophies that focus on experience as a form of learning have evolved over time, starting with great philosophers such as Socrates (384-322 BC), Platon (427 - 347 BC), Aristotle (450-325 BC) as well as current researchers like Dewey Lewin, Piaget and Kolb.

In 1984, based on Dewey's, Lewin’s, Piaget’s research; David Kolb developed Kolb's theory of experiential learning that learning is the process of producing knowledge through the transformation of experiences that takes place in a cycle. The four phases include: Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation. Learning bias in each phase will show different learning styles.

1.1.1.2. Studies in Vietnam

The innovation of experiential learning in Vietnam began to be mentioned in the 1960s in the direction of active teaching, namely the work of authors such as Nguyen Ky (1993) with "active learner-centered learning methods"; Tran Ba Hoanh (1996) with "Positive Method"; Nguyen Ngoc Bao (1995) with "Promoting positive, self-reliant students in the teaching process"; Bernd Meier, Nguyen Van Cuong (2015) with "Modern teaching theory - The basis of innovation in teaching targets, content and methods" ... The research focused on teaching according tectonic theory, with the viewpoint stating that students should be encouraged to earn their own knowledge. Modern active teaching methods are studied and applied including: group practice methods, problem solving teaching, exploring teaching, case study, hands-on training, project teaching, teaching through scientific research.

The teaching program of Intel (2005), Vietnam-Belgium Project (2006) aims to

"Improve the quality of teacher training in primary and secondary schools in northern mountainous provinces of Vietnam" to promote active teaching methods.

Recently, there have been some studies that use experiential learning to develop competencies for students, such as self-learning ability, creative ability, etc. These studies show that learning experiences can be suitable for all ages, from preschool to adult. However, these studies only apply the learning process based on Kolb's experience in education without clarifying the learning experiences and operational design processes.

1.1.2. Research on skill off instructional design and skill of designing experiential activities

1.1.2.1. International studies

The term "lesson design", "design of instructional plans" (formerly called lesson planning, teaching design, or in English term “instructional design”). The lesson plan is a detailed description of the teacher about the teaching process to make a concrete lesson. The lesson design covers a range of skills and activities related to planning, selecting or preparing, presenting, evaluating, and revising lesson plans. Tyle (1949) suggests that teachers should plan by (1) identifying goals, (2) choosing learning activities, (3) organizing learning activities, and (4) evaluation tool.

Numerous studies have shown that the skill development of lesson plans for pedagogic students will improve the effectiveness of education. According to Rosales Dordelly and Short (1985), pedagogical schools often use Tyler's curriculum planning model to organize the lesson planning design.

1.1.2.2. Studies in Vietnam

The issue of designing teaching plans has attracted a lot of literature such as the work of Nguyen Nhu An, Nguyen Huu Dung, Phan Thanh Long, which all affirmed that teaching design skill is a basic element of teaching ability. It contributes significantly to the development of the professional capacity of teachers. Specific studies on the design of lessons in subjects or instructional design also attracts a lot of attention. From the overview studies on learning experience, on the design skills of teaching plans, we determine that Learning through experience is a teaching perspective that promotes the activeness of students. In Vietnam, there are no researches on training skills in EA design. Our research topics have practical significance, contributing to improving the quality of teacher training in education majored universities.

1.2. RATIONALES BASIC

1.2.1. Experiential learning and experiential activities

1.2.1.1. Learning through experience (experiential learning)

- Experience education

Experience education is a complex concept in which the instructor encourages learners to carry out practical actions and experiences to enhance understanding, extend

experiences, develop skills, form living values, and developing the potential of oneself. Experiential learning is the backbone of "experiential education".

- The concept of experiential learning

Experiential learning is the learning process in which knowledge is acquired through experience (Kolb, 1984). It is the process of passing on the action, the subject that creates the new knowledge on the basis of actual experience, based on the assessment, analysis of the experience and knowledge available through the influence of knowledge acquired through action with object. Thus, experiential learning is how learners learn from experiences and through experiential activities. Learners' activities are carried out in a closed cycle with successive phases in order to transform experience and capture new experiences.

- *Theoretical foundation of experiential learning*

✓ Mental foundation

Experiential learning is associated with the brain's information perception and analysis process.

✓ Tectonic theory

Learning activities are the process learners develop their own knowledge instead of receiving the solutions from the teacher.

- Experiential learning model

The learning experience model consists of four stages: concrete experience; reflective observation; abtract conceptualization; active experimentation ((Figure 1).

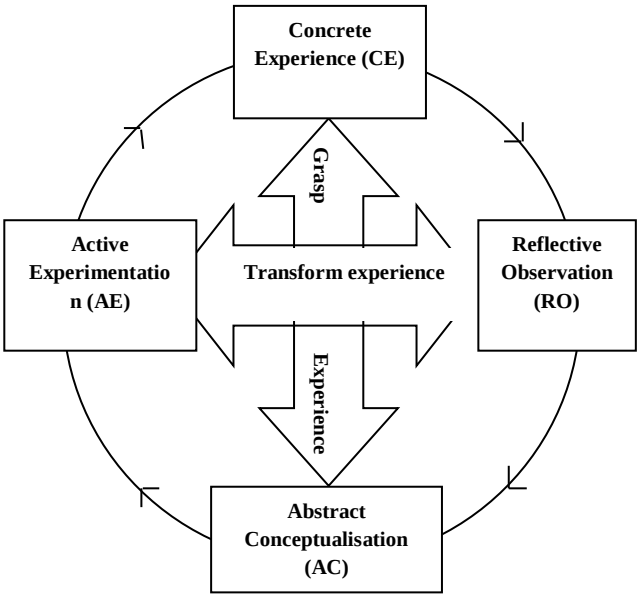


Figure 1: Experiential learning model of David Kolb

1.2.1.1. Experiential activities

- *Concept of Experiential activities*

EA can be defined as an act in which the subject is directly involved in an event or interacts directly with certain objects, thereby forming knowledge, skill, and emotion about the event. EA in teaching is about learners performing learning tasks that directly interact with the object in order to shape knowledge, skills, abilities and emotions.

➢ *The principle of EA*

Students participate actively in learning. As defined above, in general teaching and teaching biology in particular, activities in learning from active listening, reading, visual observation, positive video to hands-on activities, Field trips, tours, projects, seminars are all EA. Depending on the goals of the stages in the experience cycle and the level of learner participation, there are different classifications. Active learning only becomes EA when it is arranged into an experience cycle.

1.2.2. Skill of designing experiential activities

1.2.2.1. The concept

➢ Skill

Based on an overview of skills and skills training in teaching, in the direction of conducting researches on PTs, we conceptualize *the skill as the ability of the subject to master one or more sequences of actions through knowledge or experience to achieve specific results.*

➢ Skill of designing experiential leaning activities

EA design is not just a single activity but a chain of EA, so we define *EA design skill in learning as the ability of the subject to design a sequence of learning activities according to the experience cycle.*

- The design of the experiential learning activities is composed of various parts. The components of the design of the experiential learning activities is described in Table 1.

1.2.2.2. ***The structure for skill of designing experiential learning activities***

Table 1. The structure for skill of designing experiential learning activities

Components	Illustrative Activities
1. Defining the experiential cycles	- Define the objectives of the chapter (topic / lesson). - Determine the major content circuits of the chapter corresponding to the experience cycle.
2. Determine the type of activity	- Analyze the characteristics of each content circuit to determine the corresponding experience cycles. - Determine the objective of each phase in the experience cycle. - Select EA based on the knowledge content and targets of each phase.
3. Development of the process	- Determine the operating conditions: time to organize the activities, identification of necessary facilities. - Design the specific tasks to guide learning activities for students in the phases of the experiential cycle. - Identify the steps to perform the operation: specify the process of operation.

4. Assessment after experiential learning activities	- Design criteria and tools to assess the level of knowledge and competencies to apply knowledge of students; Evaluation of the students' abilities.

1.2.2.3. The purpose of EA design skill in teaching competencies

EA design skill is a component of teaching competencies, contributing to the development of component competencies of teaching competencies. Training EA design skills is to prepare for PTs to perform well in future teaching.

1.2.2.4. The role of lesson study in the training of EA design skill for PTs

Lesson study is a process in which small groups of teachers meet regularly to collaborate on the planning, implementation, evaluation and revision of research. The model has been studied by various authors**.**

1.3. PRACTICAL PRINCIPLES

1.3.1. The current situation on designing and organizing EA of high school Biology teachers

To find out the current situation of EA's design and organization, we have designed a questionnaire and conducted a survey of 248 high school biology teachers in the provinces.

Survey data show that teachers very often or often organize traditional learning activities for students in teaching as listening (86.7%); Q & A (76.7%); 30% to 35% often and very often organize activities such as watching movies, studying textbooks, homework; 15% - 20% of teachers often and very often organize activities such as role play, games, simulation; The remaining activities are very small (2% - 10%). In particular, many teachers rarely or never organized activities such as the project (77.2%), fieldtrip (68.9), seminar (80.6%); survey (83.5%); field research (78.1%) because these activities require investment in time and facility, so teachers have not invested. When organizing learning activities for students, the level of student participation is still low.

- Most teachers do not fully understand the nature of learning through experience. Most Biology teachers think that EA means that the students have to leave the classroom, school. This issue has been clarified on the basis of reasoning and we will analyze the EA model in teaching biology in Chapter 2.
- Teacher has difficulty in designing EA to teach Biology. This is one of the basics that helps us propose the EA design process for teaching Biology in general in Chapter 2.

1.3.2. The current situation of EA design skills training in the program of training PTs in teaching biology

In order to understand the students' perceptions about EA, the real situation of training EA skills of students in biology education, we have designed two questionnaires and investigated 30 subject lecturers teaching methods of biology and 650 students of biology in some pedagogical universities.

Survey data show that only 13.8% of students understand the nature of experiential activity and 64.3% think EA is an extracurricular activity. Some students are still confused

EA with teaching (6.8%) or teaching project (15.1%). This shows that the students do not understand the nature of EA so the selection and arrangement of learning activities are often based on the lesson objectives (42.5%); The sequence of content (38.7%); The learning cycle explored (15%) and only 3.8% was based on experiential cycle. The well-known EA student learning cycle through a variety of channels, but mainly through the Biology teaching module (72.6%) or through instructor-provided materials (38.4%). As such, students already know about EA but still do not understand the true nature of EA in teaching. Thus, It is necessary to supplement the knowledge of EA. When assessing whether or not students have EA design skills, there is a similarity between student self-assessment and teacher judgment that most students believe they have no skills (55%); low level skill (35.9%); adequate skill (9.1%), and no student claims to master the skill. Faculty evaluates students at 51% for level 1; 32.5% for level 2; 16.5 for level 3; and 0% for level 4. This is it is absolutely necessary to train students to design EA skills. Through interviews, we found that students who are not well versed in EA design skills are students who have not yet mastered the principle of EA and need to take appropriate measures to improve their skills.

Students are mainly trained in the design of activities such as presentations, Q & A, discussion. Other activities, such as practical exercises, simulations, surveys, and scientific studies are sometimes practiced. Activities such as projects, field trips, onsite training or seminars are rarely or never excercised.

- Most lecturers and students recognize the importance of EA design skills to biology majored college students.
- Most lecturers believe that integrating the training content of EA design skills for biology students should be involved in the modules of teaching methods.
- In order to design EA, students should be trained in the design of all kinds of positive learning activities and in particular the selection and arrangement of activities into the experience cycle. At present this skill of students is not sufficient, which highly requires further training.

CHAPTER 2: TRAINING ON SKILL OF DESIGNING EXPERIENTIAL ACTIVITIES FOR PRE-SERVICE TEACHER IN TEACHING BIOLOGY IN HIGH SCHOOL

2.1. Analyzing the goals and structure of the teaching methods as a basis for developing design EA skills for pre – service students

By learning about the current curriculum of the colleges of education, we found that there are three disciplines: theoretical teaching of biology, the module of teaching methods of biology 10, 11, 12, elective classes.

2.2.1. Analysis of high school biology curriculum

High-level biology of knowledge is built on the principle of concentric, there are advanced and further research from secondary level biological knowledge. Components of knowledge in biology: group of knowledge about the structure and anatomy morphology; group of knowledge about the biological process and disciplines; group of knowledge about scientific theory, group of knowledge about Biological Methodology.

2.2.2. Analysis of David Kolb model in Biology teaching

Determining the type of EA can be based on the target and experience level of students during the operation (see table 1).

Table 2.1. Activities in the stages of the experiential learning cycle

Stages	Object	Objectives Activities with levels of experience
Concerete experience	Experiencing	Observation => Role play/ game => Simulation => Practice: experiment / measurement / measurement / anatomy/ prototype/ culture => Visiting/ Field work
Reflective Observation	Reflecting and sharing experiences	Question => Brainstorming => Discussion => Debate => Seminar => Journals => Logs.
Abstract Conceptualisation	Adjusting the concept	Listening exercises => Theoretical exercises => Project proposals => Theoretical modeling.
Active Experimentation	Experiencing the concept in the practical situation or planning for the new experience	- Simulation Design => Case Study => Practical Exercise => Field Trip => Project

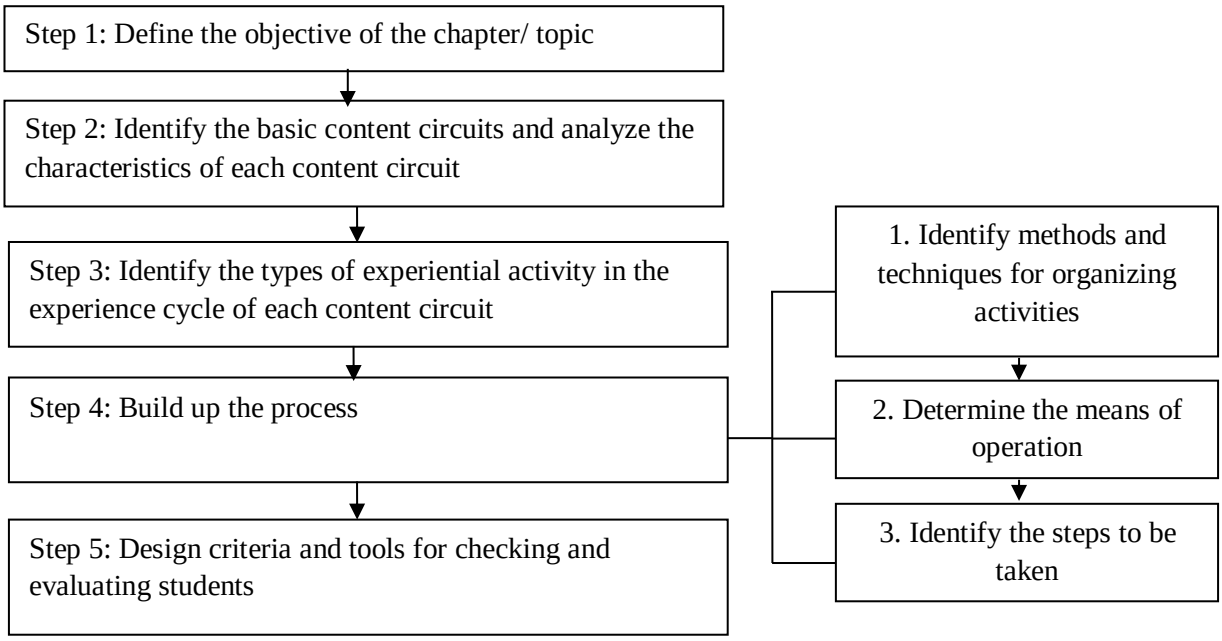
Table 2.2: Corresponding EA to the Biology groups of knowledge

Structure and anatomy morphology	**Biological process and disciplines**	**Scientific theory**	**Biological Methodology**	**Structure and anatomy morphology**
Concerete experience	- Observation; Role play; Game; Simulation/ Model; Field work	Role play/ game; simulation/ model; experiment	Role play/ game; simulation/ modeling	Practice: Testing/ measurement/ measurement/ anatomy/ prototype/ culture Micro oganism
Reflective Observation	Quections; Brainstorming; Discussion; Debate; Seminar; Journals; Logs			
Abstract Conceptualisation	Lecture; Paper; Theoretical exercises; Project proposals; Theoretical modeling.			
Active Experimentation	- Simulation Design; Practical Exercises; Field work; Projects	- Simulation Design; Case Study; Practical Exercise; Laboratory; Field work.	Practical exercise; Survey; Project	Practical exercise; Practice; Fieldwork; Project

Depending on the content, learning objectives, experience and student learning styles, as well as facility conditions to proceed EA selection and scheduling according to the logical

sequence of the learning cycle.

2.2.3. The process of designing experiential activity in teaching biology



Step 1: Define the objectives of the chapter/ topic

Objectives: Identify the goals, knowledge, skills, attitudes and competencies that students need to pursue after the course.

Process:

- Knowledge: Presentation of knowledge content that students learned through the topic.

+ Determine the level of awareness of HS students according to the awareness scale Bloom: Improve knowledge, understanding, application, analysis, evaluation, creativity.

Use verbs to write goals so that goals can be quantified and evaluated.

- Skills: presenting the skills of students formed through the implementation of learning activities. Targeted skills include thinking group, skill group, and science skill group.

- Attitude: presentation of the impact of implementing learning activities on awareness, living values and behavioral orientation of students. It is necessary to define the learner's sense of human, nature, environment, sense of learning and scientific thinking.

Key competencies to be addressed: Students are taught through experience to discover their own knowledge, recognize the value of knowledge, and then apply knowledge to practice. Targeted competencies are usually self-directed, problem-solving ability, creative ability, cooperative capacity.

Step 2: Identify the basic content circuits and analyze the characteristics of each content circuit

Objectives: Identify the major content circuits of the topic. Analyze the knowledge characteristics in each content circuit and the development of the concepts in each content

circuit as a basis for selecting the appropriate types of EAs.

Process:

- From the chapter content/ topic, define the core content circuit. Analysis of the logic structure of the core content circuit to create a framework for the selection, development of smaller content circuits.

- Analysis of the content characteristics of the content circuits in the chapter / topic to determine the knowledge composition: knowledge group knowledge of structure, anatomy morphology; group of knowledge about the process of biology; group of knowledge about scientific theory, group of knowledge about method of biology.

- Analyze the development of concepts in the content circuit in the General Biology program to determine the background knowledge available in the HS.

Step 3: Identify the types of experiential activity in the experiential learning cycle

Objectives: Analyze the knowledge characteristics in each content circuit and the development of the concepts in each content circuit as a basis for selecting the appropriate EA types.

Process:

- Analyze the characteristics of each content circuit:

+ Analyze the logical structure of the core content circuit to create a framework for the selection, development of smaller content circuits.

+ Analysis of content characteristics of the content circuits in the chapter/ topic to determine the knowledge composition: group of knowledge about the structure and anatomy morphology; group of knowledge about the biological process and disciplines; group of knowledge about scientific theory, group of knowledge about Biological Methodology.

+ Analysis of the development of concepts in the content circuit in the program Biology to determine the background knowledge already available to students.

- Identify the types of activities that correspond to the phases of each experiential learning cycle.

+ Determine the objective of each phase in the experiential learning cycle.

+ Select EA at each stage based on the target, characteristics of content, knowledge of students.

Step 4: Develop the process

Objectives: Establish the conditions and operation of the students corresponding to the goal of the experience period.

Process:

- Determining the conditions for organization of operation: time for organization of operation; identify the means of organization.

- Design learning tasks to orient the learning activities for students in the experiential phase.

- Identify the steps to perform the operation: specify the operation of the operation.

Step 5: Design criteria and tools for checking and evaluating students in the experiential learning cycle.

Objectives: Design criteria and tools to assess the level of knowledge, skills and ability to use knowledge of students; Measures of capacity created after the EA.

Process: Design criteria tables and corresponding assessment tools. To evaluate students, we identified the appropriate tools for each stage of the experiment and assessed the whole cycle.

➢ **Illustrative examples:**

Example 1: Designing EA in teaching for chapter II, section A "Conversion of material and energy for plants"

- Mineral nutrition in plants (4 weeks):

Phases	Targets	Activities
Concrete learning	- Able to survey the current use of fertilizer and plant growth in the area.	Field work
Reflective observation	- Able to analyze the evidences of lack or excess of nutrition in plants.	Discussion
Abstract conceptualization	- Able to analyze the role of minerals in plant life and the mechanism of absorption and transport of mineral elements depends on the characteristics of the root system, soil structure and environmental conditions. - Able to identify sources of nutritient supply for plants. - Able to present the role of nitrogen and the process of nitrogen conversion.	Mind-mapping
Active experimentation	- Able to design and conduct the experiment on the role of fertilizer with plants.	Project "Designing the water-based planting system"

Example 2: Designing EA in teaching "Chemical components of cells" – section Cellular Biology, 10th grade Biology curriculum

Phases	Targets	Activities
Concrete learning	- Able to define the carbohydrate, lipid, protein compound in cells. - Able to gain skills in experimenting and observing	Experiments
Reflective observation	- Able to determine the relationship between food and organic compounds. - Able to gain skill in writing reports	Discussion
Abstract conceptualization	- Able to analyze the structure and function of cacbohydrate, lipid, protein.	Mind mapping

Active experimentation	- Identify nutritional diseases and develop a diet plan for specific people. - Propagandize on prevention of overweight, obesity and malnutrition.	Case study Practical exercises

2.3. The process of training on skill of designing experiential learning activities for pre-service teacher in teaching Biology in high school

The design of the experiential activity in teaching is a complex skill consisting of component skills. We combine the experiential learning model and the lesson study model to provide knowledge about experiential activities and training on skill of designing experiential learning activities for PTs in teaching Biology in high school.

2.3.1. Training on skill of designing experiential activities for pre-service teacher in teaching biology in high school through experiential learning

The design of the experiential learning activities includes all the components. In order to train this subject for our PTs, we practice in the direction of experiential teaching, which means using the same experiential learning cycle to practice the experiential learning activities design. The training process is a two-cycle twist with 8 phases, in which the phase 1-3 is to form knowledge about the experiential learning activities, from phase 4-8 there will be training the organization skills, improve the design of the experiential activities.

Table 2. The process of training on skill of designing experiential learning activities in teaching Biology

Objectives	Phases			
	Concrete Experience	Reflective Observation	Abstract Conceptualisation	Active Experimentation
1. Forming the knowledge of the experiential learning activities and developing the framework of the experience cycle, and the skill to determine the type of activity in each phase of the experience cycle.	1. Play the role of student to participate in the implementation of a experiential learning activities by the teacher.	2. Discuss the activities of teachers and students in the experiential learning activities.	3. Read the materials on the experiential learning activities and experiential learning activities in teaching Biology.	4. Determine the framework of the experience cycle for the topic. Determine the type of activity in each phase of the experience cycle.
2. Training the organization skills, improving the design of the experiential learning activities	5. Design the process for the operation of the experiential learning activities.	6. Discussion	7. Attend lectures on the experiential learning activities and experiential learning activities in teaching Biology.	8. Operation of the experiential learning activities.

❖ ***Beginning of the experiential cycle***

The goal of initiating an experiential cycle is to create a learning problem that helps PTs recognize the importance of the learning cycle as a basis for selecting and designing learning activities for students in the teaching process.

Activity Card Game Set: The instructor prepares the activity cards, on which record activities that teach the topic of "Microorganisms and Applications" in the Microbiology section for 10th grade Biology curriculum (Unit 22 to 28).

Activity Card 1: Visiting the process of synthesis and decomposition of Microorganisms substances in the locality: making fish sauce, producing soy sauce.

Activity Card 2: Visiting, investigating pathogenic microorganisms in plants and measures.

Activity card 3: Collecting specimens and observations of nitrogen fixation microorganisms in nodule of legume.

Activity card 4: Discuss about the role of microorganisms in food production.

Activity card 5: Practice making fermentation products: yogurt, pickles.

Activity card 6: Observing the pictures of microorganisms in nature.

Activity card 7: Future Producer Contest.

Activity card 8: Making a comparison table aerobic respiration, anaerobic respiration, fermentation.

Activity card 9: Making a map of the process of synthesis and dissolution of microorganisms.

Acttivity card 10: Practice isolating and observing mold.

Activity card 11: Practice isolating and observing yeast.

Activity card 12: Practice isolating and observing bacteria.

PTs work in groups to select activity cards and arrange the activity cards into a cycle of activities. Explain the reasons for choosing and arranging activities.

Cycle 1: Forming the knowledge of the experiential learning activities and developing the framework of the experience cycle, and the skill to determine the type of activity in each phase of the experience cycle.

* Objectives:

- Analyzing the concept, nature and role of experiential learning activities.
- Raise students' awareness of the experience cycle.
- Create opportunities for students to think, share, and participate in the learning experiential process.
- Use knowledge to build an experiential learning cycle for a specific context of Biology in high school.
- Select and arrange appropriate activities for each phase of the experiential cycle.

* Process:

- *Phase 1: Concrete Experience*

+ PTs play the role of students participating in experiential learning activities organized by the lecturer of "Microorganisms and Applications" in the section of microbiology in 10th grade Biology curriculum (Unit 22-28). Lecturers select activities from the cards in the startup phase of the experience cycle: Practice to isolate fungal observations => Discussion => Mind Mapping => Future Producer Competition. Students actively participate in all stages from defining concept, planning, implementation and performance evaluation.

- *Phase 2: Reflective Observation*

+ Lecturers organize students' discussions about the feedback activities that have been involved in the specific experience phase. PTs discuss in groups of 4 - 6 PTs and complete the study card showing the name of the activity, steps of activities of teachers and students:

Activity	Name of activity	Teacher	Students
Activity 1			
Activity 2			
Activity 3			
Activity 4			

+ Compare experiment activities with other learning activities?

+ What are your perceptions of learning experience?

+ Share your thoughts and ideas about the similarities or differences between "learning by doing" and learning experiences.

+ If you have used the experience cycle in designing learning activities for students, share your experiences.

Phase 3: Abstract Conceptualisation

- Lecturers provide the content of the experiential activity: the concept, nature, role of the response activity, the framework design for the experience cycle.

- PTs read the material, generalizing the learning experience on the student card.

	Definition	Nature	Role
Experience			

- PTs read the literature on experiential learning activities in teaching Biology and determine the correlation between experiential learning activities and the content of knowledge (knowledge groups on anatomy, process of science, rules of biology, knowledge of scientific theory, knowledge of scientific methods) to the table:

Activity form	Content of knowledge	Development of student's capabilities
Observation		
Experiment		
Field		
Project		
.....		

What is the characteristic of experiential learning activities in Biology teaching?

Phase 4: Active Experimentation

Exercise: Select a specific content within the "Material and Energy Transition in Plant" section of 11th grade Biology curriculum and determine the mode of teaching (for the whole class or diversified teaching), defining the framework of the experiential cycle; Design the learning situations to motivate students, select and organize activities for the experiential cycle.

PTs use the knowledge they have learned to complete the exercises.

Cycle 2: *Training the organization skills, improve the design of the experiential learning activities*

** Objectives:*

- Design the process of experiential learning activities in Biology teaching.

- Design the methods and tools of assessment for students' competencies (observatory report, questionnaire, assignment, evaluation criteria).

- Organize the experiential learning activities in teaching biology.

** Process:*

- *Phase 5: Concrete Experiences*

Faculty gives assignments to students:

+ Design the process of experiential learning activities of the cycle for the specific content of the section within the "Material and Energy Transition in Plant" section of 11th grade Biology curriculum.

Phases	Name of activity	Objective	Time	Place	Methods and techniques	Process
Concrete Experiences						
Reflective Observation						
Abstract Conceptualisation						
Active Experimentation						

- *Phase 6: Reflective Observation*

PTs discuss and write reports regarding the the process of experiential learning activities in teaching Biology.

- *Phase 7: Abstract Conceptualisation*

PTs read the sample lesson plans and materials for the experiential learning activities in Biology teaching provided by the instructor; determine the common procedure for designing the experiential learning activities: determining the learning targets of the chapter, determining the basic content circuit and analyzing the characteristics of each circuit. Identify the types of activity in each stage of the experiential model, develop the process of activities, design the criteria and tools for the student evaluation task.

- *Phase 8: Active Experimentation*

- PTs organize the experiential learning activities, for example:

+ Organization of experiential learning activities at the imaginary classroom, in which the participating students will become the “teacher” for the others.

+ Exchange lesson plans and attend actual lessons taught by trained teachers.

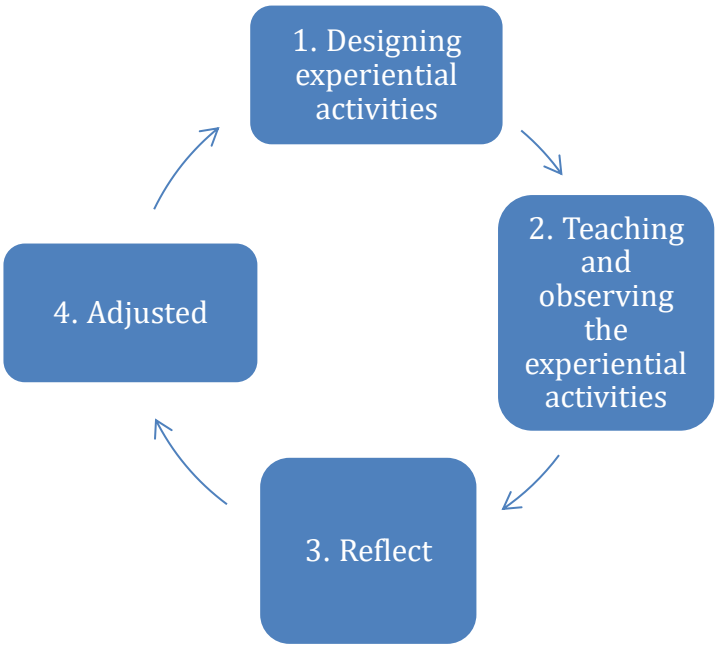
+ PTs self-organize the activities at actual high schools in (during their internship period).

- Modify the design of the activities, with more practical testing if possible.

- Plan for the design of the next experiential learning activities.

2.3.2. Developing on skill of designing experiential activities for pre-service teacher in teaching biology in high school through lesson study

We design the procedure to apply lesson sudy model to train the design skills of students in 4 steps:



Step 1: Designing the Experiential Activities

See process at 2.2

Step 2: Teaching and and observing the EA

A representative from the group will teach the topic of experiential activities, and other members of the group will attend to observe. In the course of the project, the members focus on "closely observing the classroom situations", ie not focusing on observing teachers but mainly observing the behavior, participation of students to have basis reviews EA has designed.

Step 3: Reflection and discussion of the EA

After implementation, the team members will discuss EA's design and organization. First of all, the instructor will self-assess, point out the advantages and disadvantages of the

EA process. Then, the other members will in turn give their personal reviews about the experiential activities, especially the classroom situations that arise during the organization. Questions raised for discussion: How well do students complete the lesson objectives? How to improve the lesson? What have we learned from this experience?

Step 4: Adjustment of the EA

EA will be edited based on the actual organization. After revision, you can continue to teach, reflect, and discuss (which are repetition of steps 3, 4, 5). The goal is to improve the EA, when EA is matched by the whole team, the cycle will stop and the team will store and share the EA and continue to plan for the EA next topic identification.

2.5. Evaluation of the achievement of EA design skills for Biology pedagogical students

2.5.1. Criteria for evaluating the design of experiential design

When building a scale that evaluates the achievement of EA design skills, we rely on the requirements for each skill, establishing criteria that determine the level of achievement of each skill component through training. To evaluate the skill expression, we divide the proficiency level of the components in each skill into three levels: No skill-level (M1 level); Adequate performance but with a lack of results (M2 level), proficient skills with high efficiency (M3 level).

2.5.2. Scale of skill evaluation

Levels of skill performance		*Determine the experiential cycles (A)*	*Determine the type of activity at each stage of the experiential cycle (B)*	*Build up the process (C)*	*Design criteria and toolkit for examining and evaluating students in experiential activities (D)*
4	Proficient	3	3	3	2-3
3	Skill acquisition	3	3	2	2
2	Low level	2	2	2	1
1	No expression	1	1	1	1

Chapter 3
PEDAGOGY PRACTICE

3.1. EXPERIMENTAL PURPOSES

Pedagogical experiments were conducted to verify the hypothesis of the subject by examining the feasibility and effectiveness of the training process design EA skills for PTs in teaching Biology in upper secondary schools.

3.2. EXPERIMENTAL SUBJECTS AND EXPERIMENTAL METHOD

The pedagogical experiments consisted of 2 experiments including the survey at Vinh University and the official experiment at 3 universities: Vinh University, he University

of Da Nang - University of Education, Hanoi Pedagogical University No 2.

- Experimental methodology: We use the empirical method to measure and evaluate the change of students in EA design skills after being trained. Evaluating the performance of each skill type before, during and after the experiment is used by the same assessor and the same skill assessment scale.

Test time measured		***Content rated***	***Test Measurement Tool***	***The validity of the tool***	***Experimental measurement methods***
Pre-test (1st)		- Skill single - Synthetic Skills	Test 1	Methodology Expert Testing and adjusting tool	Writing test
In test	After finishing the theoretical (2nd)	Skills corresponding single per post	Exercises the corresponding skill	- Methodology Expert -Testing and adjusting tool	Writing test
	After finishing the exercises (3rd, 4th)	Skills corresponding single per post	Exercises the corresponding skill	- Methodology Expert -Testing and adjusting tool	Writing test
After test (5th)		- Skill single - Synthetic Skills	Test 2	- Methodology Expert - Testing and adjusting tool	Writing test

3.3. EXPERIMENTAL RESULTS

3.3.1. Experimental survey

The results of the assessment of the skill components of the EA design skills of 76 PTs. By analyzing the results of the survey, we think that it is necessary to improve the process. After adjusting the process, we conducted the formal experiment on 472 PTs.

3.3.2. Official experiment

3.3.2.1. Assessing the development of EA's design skills

The results of the achievement statistics on EA's design skills through the tests are shown in table 3.5 below.

Table 3.5. Table aggregate results of EA design skills

Checks	Posts	The number and percentage of students achieving level i							
		Level 1		Level 2		Level 3		Level 4	
		Number	%	Number	%	Number	%	Number	%
1st	472	406	86	66	14	0	0	0	0
2nd	472	263	55,7	124	26,3	54	11,4	31	6,6
3rd	472	93	19,7	187	39,6	110	23,3	82	17,4
4th	472	52	11	53	11,2	169	35,8	198	41,9
5th	472	0	0	51	10,8	184	39	237	50,2

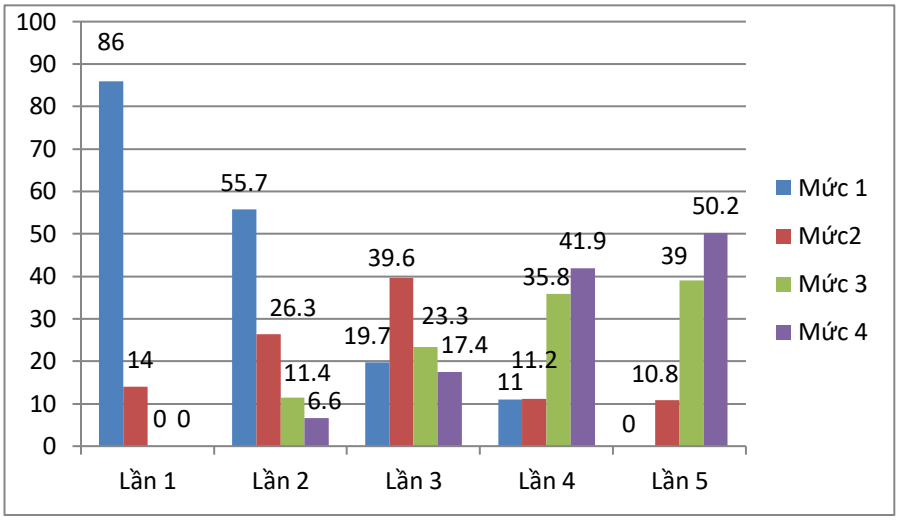


Figure 3.2. ***Graph the results of EA design skills skills***

Table 3.5 and Figure 3.2 show that, at the first test, 86% of unskilled PTs and 14% of low-skilled PTs did not achieve 3 and Level 4. Through the process of training, the rate of PTs with skills at 3 and 4 level increases, especially the PTs's skill mastering level in Test 2 (6.6%), Test 3 (17.4%), Test 4 (41.9%), Test 5 (50.2%). At the 5th test, the percentage of each level is: level 1 (0%), level 2 (10.8%); Level 3 (39%), Level 4 (50.2%). Thus, through the experimental results it can be seen that the skill has increased rapidly through the phases of the training process.

To assess the level of development of the skill through the training process, we compare the average value of the skill's level of achievement through the tests, with the use SPSS 18.0 software to calculate sample statistics. The results are shown in Table 3.6.*Table 3.6. Comparison of the achievement level of the EA design skills of the student through 5 tests.*

Statistical parameters	**1st**	**2nd**	**3rd**	**4th**	**5th**
N	472	472	472	472	472
Mean	1,14	1,69	2,38	3,09	3,39
Std. Error of Mean	0,016	0,042	0,046	0,045	0,031
Median	1	1	2	3	4
Mode	1	1	2	4	4
Std. deviation	0,347	0.916	0,990	0,983	0,675
Variance	0,121	0,839	0,980	0,967	0,456
Range	1	3	3	3	2
minimum	1	1	1	1	2
Maximum	2	4	4	4	4
Sum	538	797	1125	1457	1602

The results in Table 3.6 show that the difference in the average of the skill levels achieved by the PTs through the tests have a upward tendency (1.14, 1.69, 2.38, , 09 and 3.39). Standard deviation and variance across tests are within the range of reliability.

To test the significance of the difference in average plus the skill level achieved by the students over the tests, we used the T-test in pairs (*Compare Mean/Paired Sample T-test* in SPSS) for testing.

Hypothesis testing H0: No difference between EA design skills tests, H1: There was a difference between the EA design skills tests (with α = 0.05. presented in Table 3.7.

Table 3.7. The results show the difference in average of the skill levels achieved by the students through the tests

Paired Samples Test

		Paired Differences					t	df	Sig.(2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	KT2 – KT1	0,549	0,679	0,031	0,610	0,487	17,568	471	0,000
Pair 2	KT3 – KT2	0,695	0,461	0,021	0,737	0,653	32,754	471	0,000
Pair 3	KT4 – KT3	0,703	0,484	0,022	0,747	0,660	31,553	471	0,000
Pair 4	KT5 – KT4	0,307	0,466	0,021	0,349	0,265	14,310	471	0,000

The results shown in Table 3.7 show that the difference in average of the skill levels achieved by the students through the tests was 0.55; 0.61; 0.49; 0.40 with p (Sig. (2-tailed)) values less than 0.05. Reject hypothesis H_0:, accept H_1 the difference in average plus skill level achieved of the students through the tests are statistically significant. The test results show that the development of students' skills is influenced by the experimental component rather than by chance. The results reflect the effectiveness of the skill development process as proposed.

3.3.2.2. Evaluation of the achievement level within each component skill of the EA design skill

❖ *The ability to determine the framework of the experience cycle (A)*

The results of aggregated statistics on the level of skill tests that determine the experience cycles are shown in Table 3.8 and Figure 3.3.

Table 3.8. A summary of the results of skill tests identifying the experience cycles

Checks	Posts	The number and percentage of students achieving level i							
		Level 1		Level 2		Level 3		Level 4	
		Number	%	Number	%	Number	%	Number	%
1st	472	406	86	66	14	0	0	472	406
2nd	472	234	49,6	135	28,6	103	21,8	472	234
3rd	472	52	11	184	39	236	50	472	52
4th	472	9	1,9	88	18,6	375	79,4	472	9
5th	472	0	0	51	10,8	421	89,2	472	0

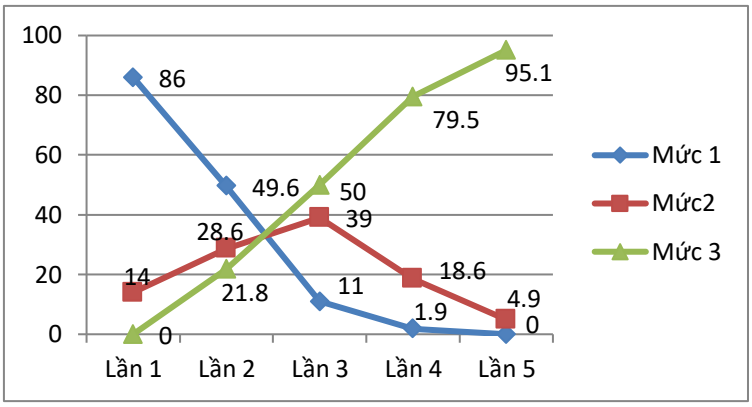


Figure 3.2. The graph of the results of the skill tests determines the experience cycles

Table 3.8 and Figure 3.3 show that the initial number of students who did not know how to determine the learning cycles was 86%, which then gradually dropped in the second test (49.6%), the third test (11%), the fourth test (1.9%) and zero percent in the fifth test. The percentage of students with skill level 2 increased rapidly in the first training period (from 14% to 28.6% in the second test), the third test was 39%, then experienced gradual decrease in next test. The percentage of students with skill level 3 increased sharply in the respective exams: 1 (0%), 2 (21.8%), 3 (50%), 4 %), 5 times (95.1%). Thus, the experimental results may increase rapidly through the phases of the training process.

To test the significance of the difference in average plus the skill level achieved by the students over the tests, we used the T-test in pairs (*Compare Mean/Paired Sample T-test* in SPSS) for testing.

Hypothesis testing H0: No difference between results of the skill tests determines the experience cycles skill tests, H1: There was a difference between the results of the skill tests determines the experience cycles skills tests (with $\alpha = 0.05$. presented in Table 3.7.

Table 3.9. The results show the difference in average of the skill levels achieved by the students through the tests

Paired Samples Test

		Paired Differences					t	df	Sig.(2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	KT2 – KT1	0,549	0,679	0,031	0,610	0,487	17,568	471	0,000
Pair 2	KT3 – KT2	0,695	0,461	0,021	0,737	0,653	32,754	471	0,000
Pair 3	KT4 – KT3	0,703	0,484	0,022	0,747	0,660	31,553	471	0,000
Pair 4	KT5 – KT4	0,307	0,466	0,021	0,349	0,265	14,310	471	0,000

The results shown in Table 3.7 show that the difference in average of the skill levels achieved by the students through the tests was 0,549; 0,695; 0,703; 0,307with p (Sig. (2-tailed)) values less than 0.05. Reject hypothesis H_0:, accept H_1 the difference in average plus skill level achieved of the students through the tests are statistically significant. The test results show that the development of students' skills is influenced by the experimental

component rather than by chance. The results reflect the effectiveness of the skill development process as proposed.

3.3.2.2. Evaluation of the EA design skill development within 9 students representative for 3 groups with different cognitive ability

Analysis of quantitative and qualitative results show that:

- In terms of EA design skills: Before the experiment, most students demonstrated skills at the M1 or M2 level. After the pedagogical impact of the EA design skill training, the percentage of students who achieved skills at M3 and M4 levels increased remarkably through two rounds of training. This result demonstrates the effectiveness of the training process for students in EA's design skills in teaching biology.

- In terms of morale and attitudes of learning: According to the assessment of the teachers participating in the experiment, most students are active, self-reliant and creative in the design and testing of the EA. Through direct observation and interviews, students are excited and confident in their works, and in the mean time they are able to define their own EA design skills through training.

Based on the above results, the training method of EA design such as the thesis presented has achieved double effect, enhancing both the EA design skill and the compassion for teaching career for these students. This can confirm the scientific hypothesis of the thesis is absolutely correct, feasible and effective.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

After a period of research, we have come up with the theoretical and practical conclusions as follows:

1. Experiential learning theory is an effective learning theory for the development of the students' competencies, in addition to its general ompetencies, which develops the specific ompetencies of Biology in the new general education curriculum. These include the ompetency to cognize the knowledge of nature, the ompetency to explore nature, the ompetency to apply knowledge to practical situation. Experiential activity is a tool for experiencing learning to help learners build their knowledge, form skills/ competencies, and qualities. Designing experiential activity is a series of experiential learning experiences consisting of four phases: specific experiences, reflection reflections, conceptual abstractions, positive experiments. Experiential activity design skills are important in the teaching competency of teachers and PTs.

2. A survey of 248 high school Biology teachers, 30 faculty members in Biology teaching methodology, 650 Biology PTs showed the awareness of common teachers and

biology PTs about experiential activity. In general, experiential activity design skills of PTs are low. It is therefore necessary to train the students and train teachers of experiential activity skills in teaching Biology.

3. Through the analysis of the content of biology and the theoretical analysis of experiential learning in teaching biology, we propose the experiential activity design process in the teaching of biology in schools in 5 steps: Target the chapter / topic, Define the basic content circuits; Determine the types of experiential activity in the experience cycle of each content circuit; Development of the process; Design criteria and toolkit for testing and evaluation in experiential activity. Thus, experiential activity design is considered to be the design of the learning cycle.

4. In practicing experiential activity design skills for PTs, it is important to implement the logic of the skill set. Based on the experiential activity design process, we determine the structure of the experiential activity design skills required to train the PTs with 4 component skills. Good performance of each skill and flexible coordination of these skills is the basic requirement in training experiential activity design skills.

5. The process of developing experiential activity design skills in teaching Biology students consists of two phases:

Stage 1: Training on skill of designing experiential activities for pre-service teacher in teaching Biology in high school through experiential learning.

Stage 2: Developing on skill of designing experiential learning activities for pre-service teacher in teaching Biology in high school through lesson study.

6. To assess the level of achievement of experiential activity design skills, the PTs has developed a set of criteria, evaluation scales and tools for assessing skills.

7. The results of pedagogical experiments have confirmed the feasibility and effectiveness of the project. That is, the use of experiential learning cycle and lesson model in the training process has developed the skill of experiential activity design for PTs in Biology.

2. Recommendations

Based on the results achieved and further studies in the future, we have the following suggestions:

1. " Experiential activity " content should be included in the module "Biology teaching method" in the Bachelor's program in Biology.

2. Educate teachers about experiential activity design and organization in teaching Biology.

3. Training should be provided to teachers at the experiential activity College of Education in order to change the teaching methodology, to provide students with skills in design experiential activity in the direction of professional development.