MINISTRY OF EDUCATION AND TRAINING
HANOI NATIONAL UNIVERSITY OF EDUCATION

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DEVELOP THE COMPETENCE OF APPLYING ACTIVE TEACHING METHODS FOR CHEMISTRY PRE - SERVICE TEACHERS AT UNIVERSITIES

***Major*: Chemistry Teaching Theories and Methodology**
***Code*: 62.14.01.11**

SUMMARY OF EDUCATION DOCTORAL THESIS

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LIST OF PUBLISHED WORKS
RELATING TO THIS THESIS

1. **Kiều Phương Hảo**, Đặng Thị Oanh (2012), *Đổi mới dạy học theo hướng phát triển năng lực cho sinh viên Sư phạm Hóa học (Renovation of Training in Student Competence Oriented Approach)*, Proceedings of Conference on Pedagogical Competence Development for Pre-service Chemistry Teachers, Hanoi National University of Education, December 2012, p189–197.
2. Nguyễn Thị Tâm, Nguyễn Thị Thanh Tú, **Kiều Phương Hảo** (2012), *Bước đầu nghiên cứu và vận dụng PPDH theo góc trong dạy học bài* "*Iot*" *chương 5, Hóa học 10 nâng cao (A First Step in Studying and Applying Teaching-in-Corners Method in Teaching the Lesson* "*Iot*"*, Chapter 5, 10th Grade Chemistry Textbook*, Proceedings of 9th Conference among Universities and Associate Colleges in North Central Region, 2012, p198–206.
3. **Kiều Phương Hảo,** Thái Hoài Minh (2014), *Vận dụng phương pháp dạy học theo hợp đồng trong học phần* "*Phương pháp dạy học hóa học ở trường phổ thông*" *(Applying Contract Teaching Method to the Course* "*Methods of Teaching Chemistry in High School*"*)*, Journal of Chemistry and Application (Volume 4/2015), p40–43.
4. **Kiều Phương Hảo**, Đặng Thị Oanh (2015), *Hình thành kĩ năng thiết kế kế hoạch bài học cho sinh viên sư phạm ở trường Đại học sư phạm (Building Lesson Plan Designing Skills for Pre-service Teachers at Pedagogical Universities)*, Journal of Science (Volume 8/2015), Hanoi National University of Education, p59–66.
5. **Kiều Phương Hảo,** Phạm Thị Bình (2016***),*** *Quy trình xây dựng BTTH trong dạy học học phần Phương pháp dạy học hóa học phổ thông (Process of Designing Practice Exercises in Teaching the Course Methods of Teaching Chemistry in High School)*, Journal of Science, Volume 6A/2016, Hanoi National University of Education, p87–93.
6. **Kiều Phương Hảo,** Đào Thị Việt Anh (2016), *Quy trình sử dụng phương pháp đóng vai kết hợp với phương pháp dạy học vi mô trong dạy học học phần Thực hành sư phạm góp phần phát triển năng lực dạy học cho sinh viên sư phạm khoa Hóa học (Process of Applying Role-Play Method Combined with Micro-teaching Method to the Course* "*Teaching Practice*"*, contributing to the Development of Teaching Competence for Pre-service Chemistry Teachers*, Proceedings of the Conference of Young Cadres from Pedagogical Universities Nationwide, ISBN: 978- 604 – 947 – 640 - 2, Tr361 – 372.
7. **Kiều Phương Hảo**, Phạm Thị Bình, Nguyễn Thị Huyền (2016), *Xây dựng bài tập tình huống trong dạy học phần hóa học phi kim lớp 10 THPT (Designing Case Studies in the Module Non-metals for 10th Grade*, Journal of Chemistry and Application (Volume 4/2016), p47–50.
8. **Kiều Phương Hảo,** Đặng Thị Oanh (2017), *Đề xuất cấu trúc năng lực vận dụng phương pháp dạy học cho sinh viên sư phạm khoa Hóa học ở các trường Đại học Sư phạm (Proposed Structure of Competence of Applying Teaching Methods for Pre-service Chemistry Teachers at Pedagogical Universities)*, International Conference on Development of Pedagogical Competence for Natural Sciences Teachers, Meeting the Requirements of Secondary Education Renovation at Hanoi National University of Education, p441–449.

RESEARCH PROJECTS

1. **Kiều Phương Hảo** (Project Leader), Đào Thị Việt Anh, Chu Văn Tiềm, Nguyễn Văn Đại (2015), *Vận dụng PPDH theo góc và PPDH theo hợp đồng nhằm rèn luyện kĩ năng dạy học cho sinh viên khoa Hóa học ở trường ĐHSP Hà Nội 2 (Applying Teaching-in-Corners and Contract Teaching Methods to Train Teaching Skills for Chemistry Faculty Students at Hanoi Pedagogical University 2)*, an Institutional-Level Prioritized Project at Hanoi Pedagogical University 2, Accepted and Classified as Excellent (9.5 points).
2. **Kiều Phương Hảo** (Project Leader), Phạm Thị Bình, Đào Thị Việt Anh, Chu Văn Tiềm, Nguyễn Văn Đại (2017), *Xây dựng bài tập tình huống trong dạy học học phần PPDH hóa học ở trường trung học phổ thông nhằm phát triển NLDH cho SV sư phạm khoa hóa học (Designing Case Studies for Methods of Teaching Chemistry in High School*, Institutional-Level Prioritized Project at Hanoi Pedagogical University 2, Accepted and Classified as Excellent (9.5 points).+

PREFACE

1. Rationale

In the context of globalization and the current explosion of knowledge all over the world, our society requires a dynamic and creative work force with adaptive competence (CP). Along with the renovation of the country, education renovation always attracts great attention of the Party and the State. The Vietnam's Education and Training Development Strategy from 2011 to 2020 has indicated: "*Education must produce the people with creative competence, independent thinking, civic responsibility, ethics and professional skills, foreign language competence, labor discipline, industrial behavior, self-employment capacity and ability to adapt to the changes in the labor market and competitiveness of the region and the world* ".In implementing the above mentioned strategy, the Education sector has been comprehensively renovated in terms of objectives, contents, curricula and textbooks, emphasizing the innovation of active teaching methods (TM) in the direction of proactively and creatively promote learners' self-learning competence.

For higher education, TM renovation in a learner-oriented approach has been implemented. Resolution No. 29 of the 11th Central Committee of the Communist Party of Vietnam on fundamental and comprehensive renovation of education and training indicates: "*Continue to strongly innovate teaching and learning methods in a modern approach; promote learners' positiveness, activeness, creativeness and ability to apply knowledge and skills; overcome one-way imparting methods and mechanical memorization. Focus on teaching learning and thinking methodologies, encourage self-learning, create a basis for learners to self-update and renew knowledge, skills, and build up capacity*". The Resolution requires Pedagogical Universities (Pus) in general and training institutions in particular to innovate in order to train and develop professional competence for students (STs).Therefore, it is necessary to have effective and practical measures for the renovation of teacher training at PUs, in which the innovation in methodology (ME) for the development of professional CPs (including, subject matter learning CP, functional CP, education CP, research CP, etc.), especially the teaching competence (TCP) for future generation of teachers is very important and practically meaningful.

Surveys on pedagogic students training programs of Vietnamese PUs in the last two years have shown that most of the programs are mainly developed in the CP approach. These programs should integrate theory and practice, balance student's time spent at lecture hall and working with highly qualified secondary school teachers. However, the gap between theory and practice remains a weakness in teacher training in Vietnam. Knowledge learned in college are not linked to the reality of the classroom due to limited time for teaching practice at secondary schools. Moreover, the teaching situation of the PUs or universities (UNs) recently has shown that the target of "vocational training" for pedagogical students has not been paid much attention. The surveys on Chemistry STs practicums at secondary schools in recent years indicates that despite showing few knowledge flaws STs are still lack of teaching skills (TS). Therefore, developing TCP for students has become a critical issue, requiring more in-depth research on development of this kind of competence for STs.

Based on the above reasons, we chose the topic: "***Develop the competence of applying active teaching methods for chemistry pre-service teachers at universities"***

2. Research Purposes

To study and propose measures to develop competence in applying teaching method (CATM) for pre – service chemistry teachers , contributing to the development of TCP and improvement of PUs training quality.

3. Research Objectives

3.1. Study the theoretical and practical basis

- **Study the theoretical basis of**: the development of TCP in the world and in Vietnam; CP and some issues of CP development; renovation of TM in CP development approach for students; some TMs and active teaching techniques at universities.

- **Study the practical basis of**: situation of CATM development for pre-service chemistry teachers under the training curriculum at universities. Situation of pre-service chemistry teachers' CATM.

3.2. Study and propose structure of CATM and a CATM evaluation toolkit for pre-service chemistry teachers

3.3. Propose measures to develop CATM for pre-service chemistry teachers

Measure 1: Develop the material "Training Chemistry Teaching Skills".

Measure 2: Apply experiential learning model in teaching the course "Methods of Teaching Chemistry in High School".

Measure 3: Use micro-teaching method combined with role-play method in the course "Teaching Practice".

3.4. Conduct pedagogical experiments to verify the feasibility and effectiveness of the proposed measures

4. Research Objects and Subjects

4.1. Research Objects

The pre – service chemistry teacher training process at universities.

4.2. Study Subjects:

- CATM of pre-service chemistry teachers at universities.
- Measures to develop CATM for pre-service chemistry teachers at universities.

5. Research Scope

This thesis is focused on CATM research to develop teaching TCP for pre-service chemistry teachers at universities.

Develop CATM for pre-service chemistry teachers at universities through Teaching Practice (TP) course and Chapter IV: "Chemical Substances and Elements Teaching Method" in teaching the course "Methods of Teaching Chemistry in High School".

6. Scientific Hypothesis

If develop the material "Training Chemistry Teaching Skills", conexperiential learning model is used in teaching the course "Methods of Teaching Chemistry in High School" and micro-teaching method combined with role-play method is appropriately applied in teaching SP course, *then* students' CATM will be developed, contributing to the development of pre – service chemistry teaching TCP.

7. Research Methodology

Combinations of the following method groups are applied:

***- Theoretical research method group**:* analyzing, summarizing, classifying, systematizing ... in researching relevant theoretical literatures.

- Empirical research method group:

+ Analyzing contents, structure of the courses "Methods of Teaching Chemistry in High School" and "Teaching Practice" at universities.

+ Investigating the situation of CATM development in teaching the courses "Methods of Teaching Chemistry in High School" and "Teaching Practice" at universities.

+ Expert method: Interviewing, exchanging with, and consulting experts.

+ Teaching experiment method: Conducting teaching experiments on the proposed measures at universities.

- Information processing method group: Using the statistics to process and analyze teaching experiment results to determine the thesis scientific hypothesis.

8.New contributions of the thesis

8.1. Systematizing and clarifying the theoretical bases related to TCP, CATM as well as the reality and the need to develop the CATM of pre-service chemistry teachers at universities.

8.2. Proposing the structure and contents of CATM in teaching pre-service chemistry teachers including 4 component competences in accordance with 10 criteria and indicators in 4 levels, on which an CATM evaluation toolkit is designed.

8.3. Proposing three measures to develop CATM in training pre-service chemistry teachers, namely:

Measure 1: Develop the material "Training Chemistry Teaching Skills"

Measure 2: Apply experiential learning model in teaching the course "Methods of Teaching Chemistry in High School".

Measure 3: Use micro-teaching method combined with role-play method in the course "Teaching Practice".

9.Thesis Structure

The Thesis includes **Preface** (5 pages), **Contents** (135 pages, divided into 3 Chapters), **Conclusions and recommendations** (3 pages).

There are also: List of abbreviations, list of tables, list of figures, published scientific works related to this Thesis, references and appendices.

Chapter 1
THEORETICAL AND PRACTICAL BASES OF TEACHING COMPETENCE, COMPETENCE OF APPLYING ACTIVE TEACHING METHODS IN PEDAGOGICAL STUDENT TRAINING

1.1. Research history of the development of teaching competence and capacity of applying teaching method for pedagogical students

1.1.1. International context

CATM is among the components of the TCP. In the 1960s, TCP development was considered as a critical task of the pedagogical schools in the Soviet Union and Eastern European countries.

As for Asian countries, teacher training programs have also focused on developing professional competence for students, emphasizing the development of TCP *through teaching practice and practicums.* Such as, the vocational education curriculum for pedagogical students of National Taiwan Normal University was designed based on teacher professional competence oriented approach. In particular, they focus on the following 5 key (core) competences: Planning competence, TCP, management competence, evaluation competences and professional competence. The Singapore teacher training programs, however, focuses on TCP development through teaching practicum and give prominence to professional knowledge (about 100-150 learning hours on teaching methods).

1.1.2. In Vietnam

TCP development has received a great attention for many years in our country from research on pedagogical skill system; researches on TCP for pre-service chemistry teachers; research on student competence development; researches on CP development for pre-service chemistry teachers.

Research on designing structure of CATM and proposal of measures to develop CATM for chemistry-teaching student are a new subject matter that has yet to be published in any research.

1.2. Competence, structure of competence, assessment of learner competence

1.2.1. Concept of competence

Competence is derived from the Latin word "competentia", meaning *meeting together*.

CP herein refers to performing competence as in the definition "CP is the mobilization, application of knowledge, skills and other personal attributes such as excitement, belief, willpower, etc., to the successful performance of activity, and effective task handling in a certain context."

1.2.2. Structure of competence

CP structure by component resources includes (1) *surface structure* (inputs) that consists of knowledge, skill, attitude and (2) *depth structure* (output). In another approach, the concept of CP structure consists of three main components in hierarchical structure, i.e., (1) *Components of competency* constitutes CP, (2) *Elements* are parts of competency or skill that make up each

component and (3) *Behaviors* are smaller parts separated from each element. In this thesis, in determining the structure of CATM for pre-service chemistry teachers, we use the CP structure consisting of three hierarchical main components.

1.2.3. Assessment of learner competence

1.3. Pedagogical competence, teaching competence, competence of applying active teaching methods and teaching competence orientations for pedagogical students

1.3.1. Pedagogical competence

Pedagogical competence is "the integration of multiple factors including knowledge, skills, and attitudes necessary for the successful performance of the professional tasks of pedagogical occupation in accordance with the standards and criteria set for those tasks"

1.3.2. Teaching competence and competence of applying active teaching methods

TCP is a system of personal attributes of each teacher to well fulfill their teaching work

CATM is construed as *the ability to select and use teaching methods appropriately in the arrangement of teaching activities of teachers.*

1.3.3. Teaching competence orientations for pedagogical students

1.4. Renovation of teaching methods towards the development of competency for pedagogical students

1.4.1. The basis for renovation of teaching methods in an learner competence oriented approach - Learning theories

1. Behaviorism theory: Learning is changing behaviors

Figure 1.1.Model of behaviorism theory

The teacher can *apply behaviorism theory with micro-teaching method to train the teaching skills for students in the "Teaching Practice" course and practicing contents of the courses under the Theory and Teaching Methods Department.*

2. Congnitivism theory: Learning is problem solving

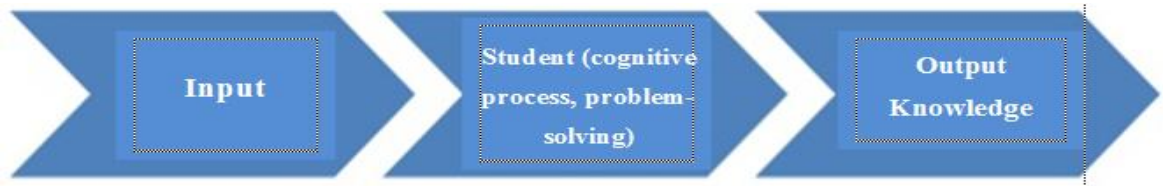


Figure 1.2.Model of cognitivism theory

The wdely methods and teaching perspective applying this theory that are of special interest can be counted as : *Problem raising and resolving teaching, activity-oriented teaching, teaching through research, discovery teaching, teamwork collaborative teaching, teaching via questions, teaching in corners, contract teaching, etc.*

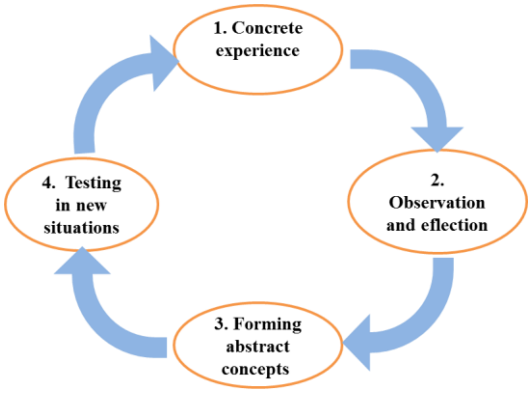
3. Contructivism theory: Learning is knowledge self-constructing

From the basis of constructivism theory, we *apply active teaching, experiential learning model and role-playing* in the design and implementation of lesson plans to

promote students' self-learning attitude, which will help students acquire knowledge, practice TS actively, thus contributes to the student CP development.

1.4.2. Introduction of experiential learning model and some active teaching methods at universities in a learner competence oriented approach

1.4.2.1. Experiential learning model



Model annotation:

1. **Concrete experience**
2. **Observation and reflection**
3. **Forming abstract concepts**
4. **Testing in new situations**

Figure 1.4. Kolb's experiential learning model

In addition, an overview of micro-teaching method, Role-play method, and Contract Teaching methods are also provided.

1.5. Current status of competence of applying active teaching methods and the development of competence of applying active teaching in training pre-service chemistry teachers at universities

1.5.1. Current status of developing competence of applying active teaching methods for pre-service chemistry teacher within university curricula.

We conducted surveys and interviews with 15 lecturers from Chemistry Teaching Method departments at Hanoi National University of Education, Hanoi Pedagogical University 2, Thai Nguyen University of Education, Hai Phong Education University, Hue University of Education, Quy Nhon University of Education, Ho Chi Minh City University of Pedagogy on the following contents: concept of CATM, models, method of CATM development, assessment of lecturers on CATM

1.5.2. Current status of pre-service chemistry teacher' competence of applying active teaching methods

1.5.2.1. Survey results and discussion

- **Awareness of students on the importance of developing CATM** *(Question 1, Question 2)*

100% of students agreed that CATM plays an important and very important role in the designing and implementing of lesson plans in teaching chemistry in high school.

- **Regarding CATM of students at the time of the survey** *(Question 3, Question 4, Question 5, Question 7)*

100% of students said that they had learned about the traditional and modern TMs listed in the survey questionnaire. However, in their practicums, the most preferned teaching method by students was presentation (3.87), followed by question and answer (3.84) and visual learning

(3.66). It could be seen that students mainly choose the traditional TMs rather than the active ones. Regarding their self-confidence in CATM, the majority of students rated themselves as less confident (60.82%) and not confident in their CATM.

- **Regarding difficulties experienced in applying active TMs in high school** *(Question 6)* Over 60% of students encountered such difficulties as: Lack of theoretical background on TMs, lack of practice in teaching (or delivering lectures) prior to teaching practicums, unable to choose appropriate TM for teaching contents in teaching practicums in high schools. The average point on CATM self-rated by the students was 2.11. This value leans to level 2, i.e., less proficient. Therefore, it is necessary to develop CATM for pre-service chemistry teachers.

- **Regarding the needs and desires of students in CATM development process** ***(Question 8)***

The desire that was most agreed upon by the student is the opportunity to experience the TMs through the lectures of lecturers (98.81%) and the availability of the TS training material (93.7%).

Through the analysis of survey results, we found that the development of CATM is necessary and meet the needs and desires of students. This is a practical basis for us to propose the measures that emphasize the facilitation of students to more practice and experience TMs and the support of chemistry TM materials.

Chapter 2
DEVELOP THE COMPETENCE OF APPLYING ACTIVE TEACHING METHODS FOR CHEMISTRY PRE-SERVICE TEACHERS

4.1. Analyzing objectives and structure of the courses "Methods of Teaching Chemistry in High School" and "Teaching Practice"

4.2. Structure of the competence in applying teaching methods for pre-service chemistry teachers

Structure of CATM plays an important role in developing CATM for pre-service chemistry teachers, which is significant to both lecturers and students.

4.2.1. Concept of competence in applying teaching methods

Based on the overview and analysis of CP and TCP concepts as indicated in Chapter 1, we propose the concept of CATM as follows:

The competence in applying TMs of pre-service chemistry teachers is the ability to ***appropriately the TMs***, ***effectively and successfully design and implement as well as assess the TMs*** *in teaching a particular item of Chemistry contents (e.g., a teaching excerpt,*

a lesson, a topic, etc.,) in high schools.

4.2.2. Principles of building the structure of competence in applying teaching methods

(1) Ensuring systematic and scientific integrity, (2) Ensuring reliability; (3) Ensuring suitability for students; (4) Ensuring practicality; (5) Ensuring diversity and comprehensiveness

4.2.3. Process of building the structure of competence in applying TMs for pre-service chemistry teachers

Step 1. Define the basis for building competence structure

Step 2. Build a draft of CP structure

Step 3: Seek expert advices on CP structure

Step 4. Edit CP structure

Step 5: Develop a tool for evaluating CP against the CP structure and conduct the experiments.

Step 6: Edit and complete CP structure

Table 4.1.A detailed description of the criteria and level indicators of CATM for pre-service chemistry teachers

Criteria	Levels			
	4	3	2	1
Competence in choosing TMs				
C1: Determination of lesson objectives/contents	Determining objectives for the lessons **correctly** and **completely** in consistent with knowledge and competence standards; describing right requirements for specifying objectives*	Determining objectives for the lessons **correctly** and **completely** in consistent with knowledge and competence standards; describing **incorrect** requirements for specifying objectives*	Determining objectives for the lessons **correctly** but **incompletely** in consistent with knowledge and competence standards; describing **incorrect** requirements for specifying objectives*	Determining objectives for the lessons **incorrectly** and **completely** in consistent with knowledge and competence standards; describing **incorrect** requirements for specifying objectives*
C2:Selection of the decisive TMs for the lessons/teaching contents	Selecting active and **appropriate** decisive teaching methods for the lessons/teaching contents	Selecting **appropriate but less active** decisive TMs for the lessons/teaching contents.	Selecting **less appropriate** but **less active** decisive TMs for the lessons/teaching contents	Selecting **inappropriate** and **inactive** decisive TMs for the lessons/teaching contents.
C3: Selection of additional teaching	Selecting **very appropriate** additional	Selecting **appropriate** additional	Selecting **less appropriate** additional	Selecting **inappropriate** additional

methods/techniques to the decisive TMs	teaching methods/techniques to the decisive TMs.	teaching methods/techniques to the decisive TMs.	teaching methods/techniques to the decisive TMs.	teaching methods/techniques to the decisive TMs.
Competence in designing teaching activities				
C4: Design of teaching activities within the decisive TMs	Designing the teaching activities **clearly** reflecting the nature and progress of the selected decisive TMs.	Designing the teaching activities **quite clearly** reflecting the nature and progress of the selected decisive TMs.	Designing the teaching activities **less reflective** of the nature and progress of the selected TMs.	Designing the teaching activities **not reflective** of the nature and progress of selected decisive TMs.
C5: Design of the teaching activities reflecting the collaboration between the decisive TMs and the additional teaching methods/techniques	Designing the teaching activities **clearly** reflecting the collaboration between the decisive TMs and the additional teaching methods/techniques	Designing the teaching activities **quite clearly** reflecting the collaboration between the decisive TMs and the additional teaching methods/techniques	Designing the teaching activities **less reflective of** the collaboration between the decisive TMs and the additional teaching methods/techniques	Designing the teaching activities **not reflective of** the collaboration between the decisive TMs and the additional teaching methods/techniques
Competence in implementing teaching methods				
C6: Implementing teaching activities in consistent with the selected and designed decisive TMs	Implementing **appropriate** teaching activities for the selected and designed lesson plans in a **flexible** and effective manner.	Implementing **appropriate** teaching activities for the selected and designed lesson plans in an **inflexible** manner.	Implementing **appropriate** teaching activities for the selected and designed lesson plans with **occasional mistakes and inefficiencies.**	Implementing **inappropriate** teaching activities for the selected and designed lesson plans in an **effective** manner.
C7: Implementation of the teaching activities reflecting the collaboration between the	**Flexibly combining** the TMs in an effective manner.	**Quite flexibly combining** the TMs in an effective manner.	**Managing to combine** the TMs but in a **less effective** manner.	**Not managing to combine** the TMs in an effective manner.

decisive TMs and the additional teaching methods/techniques				
C8: Use of teaching aids	**Regularly** using teaching aid in a very appropriate manner to facilitate the TMs.	**Occasionally** using teaching aids to facilitate the TMs.	**Rarely** using teaching aids to facilitate the TMs.	**Not** using teaching aids to facilitate the TMs.
Competence in assessing teaching methods				
C9: Evaluation and self-evaluation on TMs a teaching activities	**Regularly** making comments, self-comments on the appropriateness of TMs with the objectives, contents and learners.	**Occasionally** making comments, self-comments on the appropriateness of TMs with the objectives, contents and learners.	**Rarely** making comments, self-comments on the appropriateness of TMs with the objectives, contents and learners.	**Never** making comments, self-comments on the appropriateness of TMs with the objectives, contents and learners.
C10: Proposal of adjustment options to the design and implementation of TMs	**Regularly** proposing appropriate adjustments to the design and implementation of teaching methods	**Occasionally** proposing appropriate adjustments to the design and implementation of teaching methods	**Rarely** proposing adjustments to the design and implementation of teaching methods	**Not** proposing adjustments to the design and implementation of teaching methods

Notes:(*): *Specifying objectives in a competence-oriented approach, and for learners, where the objectives are described by quantitative and measurable verbs.*

4.3. Measures to develop the competence of applying active TMs for chemistry pre-service teachers

4.3.1. Measure 1: Develop the material "Training Chemistry Teaching Skills"

4.3.1.1. Principles of designing the material "Training Chemistry Teaching Skills"

Ensuring the integrity in terms of science, pedagogy, feasibility and aesthetics

2.3.1.2. Process of designing the material "Training Chemistry Teaching Skills"

Step 1. Determine the purposes and the fundamental for developing the materials

Step 2. Develop the material contents, including 3 chapters (chapter 1 –Lesson

plan designing skills, chapter 2 –Lesson plan implementing skills, chapter 3 –Case studies to practice TMs)

Step 3. Teaching experiment

Step 4. Seek expert advices

Step 5. Complete the material, officially put into use

2.3.1.3. Introduction of the material "Training Chemistry Teaching Skills" contents

- ***Structure of the material***

The document is divided into 3 chapters: **Chapter 1. Lesson plan designing skills**; **Chapter 2. Lesson plan implementing skills**; **Chapter 3. Case studies to practice teaching methods**

- ***Examples of the specific contents in the material "Training Chemistry Teaching Skills" (section 1.3, chapter 1 and section 3.4, chapter 3)***

4.3.2. Measure 2: Apply experiential learning model in teaching the course "Methods of Teaching Chemistry in High School"

4.3.2.1. The scientific basis for the application of experiential learning model

4.3.2.2. Some contents applicable to experiential learning model

4.3.2.3. The process of developing the competence in applying TMs for pre-service chemistry teachers through the experimental learning model in the course Methods of Teaching Chemistry in High School.

This process comprises of 4 steps as follows:

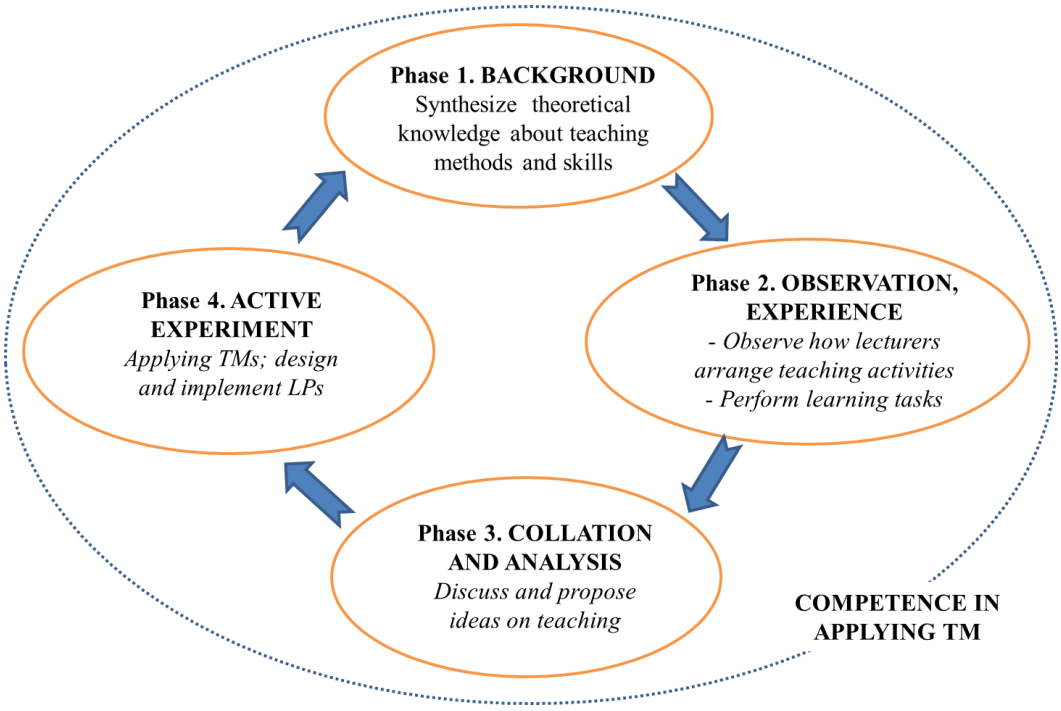


Figure 4.1.Experimental learning model in teaching the course Methods of Teaching Chemistry in High School

4.3.2.4. Explanation of the process of applying experimental learning model in teaching the course "Methods of Teaching Chemistry in High School".

a. Applying the contract TM

We illustrate the process of applying the experiential learning model to develop the competence in applying the contract TM in teaching lesson: "Method of Teaching Chemical Substances and Elements following the Key Theories", Chapter IV "Method of Teaching Types of Exercises on Chemical Substances and Elements" (2 periods of Theories,2 periods of practicing).

Phase 1 - Background: Students have been taught the theories of the contract TM though the content "Active Teaching Methods" in the course Teaching Methods 1. In this phase, lecturers can use the K-W-L worksheet prior to delivering lectures to obtain the very primary information on student knowledge background.

Phase 2 - Observation, experience: In this phase, students observe and understand the process of one-hour application of contract TM (consisting of several stages, namely (1) Introduction of Lesson Objectives, (2) Negotiation and Contract Signing, (3) Contract Performance, (4) Contract Liquidation; (5) Summary, (6) Self-Study Guide), and observe the contract frameworks between lecturer and students designed by the lecturer, including compulsory and optional tasks.

Contract: **METHODS OF TEACHING TYPES OF EXERCISES IN CHEMICAL SUBSTANCES AND ELEMENTS FOLLOWING THE KEY THEORIES** Duration:50 minutes – Full name:											
Tasks		Options	Group	🕑	✓	Answer			👍	👎	Self-rating
Tasks	Contents					🗝	✍	( )			
1	Define the tasks in lectures on chemical substances in high schools. Give examples	✪	🧍	7'		🗝					☺😐☹
2	Compare the similarities and differences in the contents and structure of the lectures on chemical substances and elements before and after the key theories.	✪	🧍	8'			✍				☺😐☹
3	Case studies	✪	👥	15'		🗝					☺😐☹
4	Assignments	✪	👥	10'			✍				☺😐☹
5	Design teaching games	🏃	👥	10'				( )			☺😐☹
6	Quiz	🏃	👥	10'				( )			☺😐☹

Optional tasks	Maximum time
✪ Compulsory tasks	Answer
Good progression	Shares with friends
Troubled	Correction by lecturer
✓ Completed	Teacher's instruction
☺ Very satisfied	Activity in groups of 6
😐 Ordinary	Activity in pairs
☹ Unsatisfied	Personal activity
Students need to perform 4 mandatory tasks and one optional task I commit to comply with this contract. STUDENT (Signature and full name)	LECTURER (Signature and full name)

Students have opportunity to experience contract TM by performing the specific tasks subject to the contract signed with lecturer

Phase 3 - Collation and Analysis: Lecturer should spend certain amount of time in theoretical lessons asking questions to students: *(1) Describe the name of the TM to be applied in the lesson; (2) Describe the process of this TM (the order of activities of lecturers and students during one lesson); (3) Indicate the strengths and weaknesses, and predict the advantages and disadvantages as well in applying this TM in high school; (4) Propose some contents in Chemistry lessons in high school where contract TM is applicable.*

Stage 4 - Active experiment: This phase is conducted during the practice hours of the course "Methods of Teaching Chemistry in High School". Lecturer requests students to apply contract TM in designing and implementing a Chemistry lesson plan in teaching chemistry in high school.

b. Applying teaching-in-corners method

We illustrate the process of applying the experiential learning model to develop the competence in applying the teaching-in-corners method in teaching the lesson "Method of Teaching Non-Metals Lessons" *(2 periods of theories,2 periods of practicing).* Phases 1, 2, and 3 take place in theories periods. Phase 4 takes place in practice periods.

Phase 1 - Background: Lecturers can use the K-W-L worksheet prior to delivering lectures to obtain the very primary information on student knowledge background.

Phase 2 - Observation, experience: During this phase, students enjoy the learning experience with teaching-in-corners method in the lessons of lecturer.

In the *activity: Study some remarkable teaching contents and methods of teaching lessons of non-metals (90 minutes)* to be used into corners by lecturer.

Lecturer can design the tasks at the corners for this activity as follows:

LEARNING CARD 1: OBSERVATION CORNER

* *Objectives*: Through watching an extract of teaching video on specific contents, draw conclusions on the applicable TMs to the lessons of non-metals.

* *Tasks:*

- Individually watching an extract of teaching video on "Chlorine" under the chapter "Halogens" in 10th grade Textbook, recording the activities of teachers and students. Identify which TM is used by the teacher in the extract

- Discussions in group to propose the TMs for lessons of non-metals.

* *Duration:*20 minutes.

LEARNING CARD 2: ANALYSIS CORNER

* *Objectives*: Studying 10th and 11th grades Chemistry Textbook, and the course book from the page 118 to 123 in order to identify remarkable contents for the lessons of non-metals, then propose the TM accordingly.

* *Tasks:*

- Individual tasks: Studying 10th and 11th grades Chemistry Textbook, and the course book from the page 118 to 123 in order to identify the remarkable contents in teaching the lessons on non-metals.

- Discussions in groups *(using the coverlet techniques)* to present the remarkable points in the TM for the lessons of non-metals then take notes on A3 papers.

*Duration:20 minutes.

LEARNING CARD 3:APPLICATION CORNER

* *Objectives*: Selecting appropriate TM with the objectives and contents of the lessons of non-metals in high school and being able to design the lesson plans using learner competence oriented TMs.

* *Tasks:*

Discussions in groups to select the TM for a specific content of the lesson of non-metals. Designing teaching excerpts for that content using learner competence oriented TMs

**Duration:*20 minutes.

Phase 3 - Collation and Analysis: Lecturer lets the student discuss as follows: *(1) Describe the name of the TM to be applied in the lesson; (2) Describe the process of this TM (the order of activities of lecturers and students during one lesson); (3) Indicate the strengths and weaknesses, and predict the advantages and disadvantages as well in applying this TM in high school; (4) Propose some contents in Chemistry lessons in high*

school where teaching-in-corners method is applicable.

At this phase, student competence in evaluating and adjusting the TMs is formed and developed.

Stage 4 - Active experiment: In the practicing periods of the course, lecturer requests students to apply teaching-in-corners methods in designing and implementing a Chemistry (non-metals) lesson plan in teaching chemistry in high school.

4.3.3. Measure 3: Use the role-play in combination with micro-teaching in the course "Teaching Practice"

4.3.3.1. The scientific basis for proposing the process employing role-play in combination with micro-teaching method

4.3.3.2. The process employing role-play in combination with micro-teaching method in teaching the course "Teaching Practice"

The process employing role-play in combination with micro-teaching method in the course "Teaching Practice" consists of 3 phases summarized in the following chart:

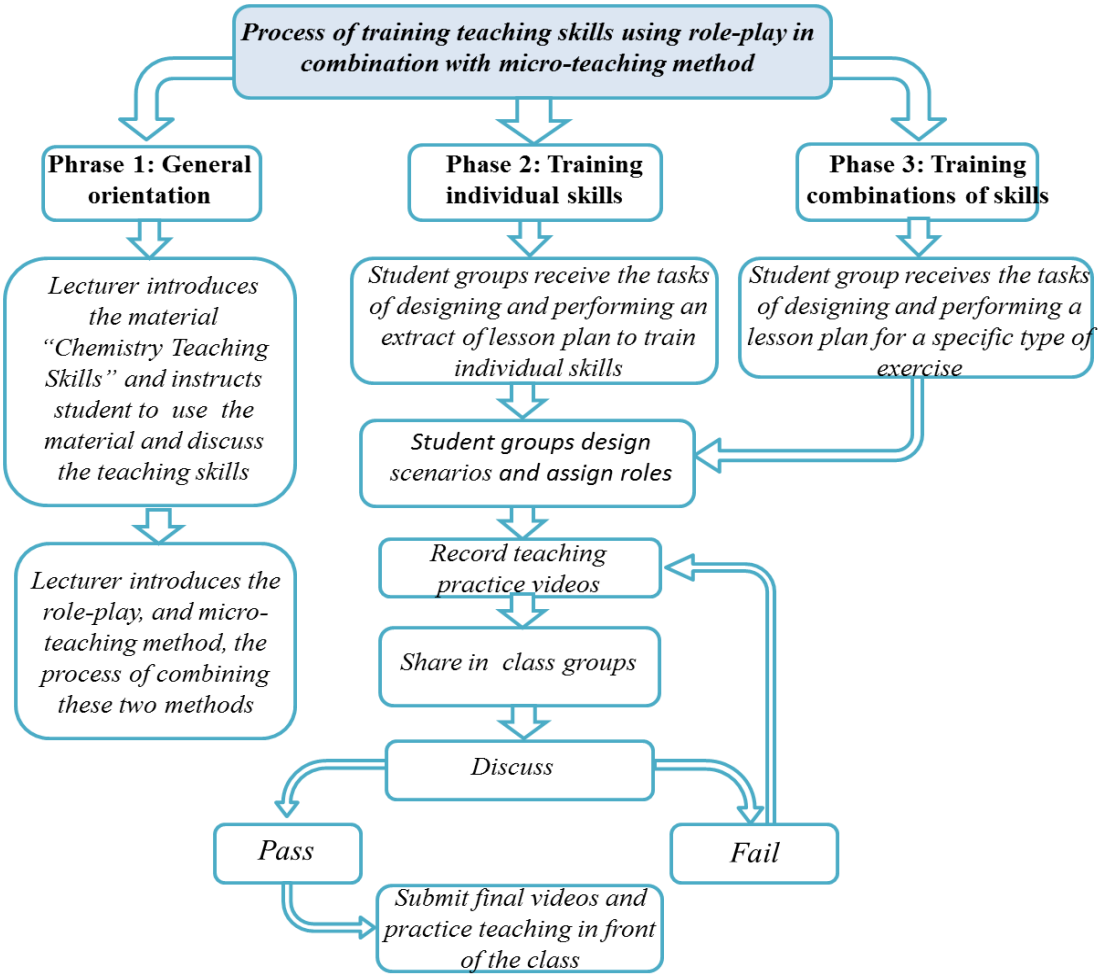


Figure 4.2.The process employing role-play in combination with micro-teaching method

4.4. Designing the toolkit to evaluate pre-service chemistry teacher's competence in applying TMs

For evaluating CATM of pre-service chemistry teachers, we propose to use some evaluation tools as follows: Observation checklist; Rubric; Case studies, Specially designed examinations; Competence evaluation scales

4.5. Designing illustrative lesson plan

In the framework of the thesis, we would like to present an illustrative lesson plan for the improvement and development of competence in applying teaching-in-corners and contract teaching methods through student experience in the lecturer's teaching periods using these two methods.

4.5.1. Plan for teaching the lesson "Method of Teaching Chemical Substances and Elements following the Key Theories", Chapter IV "Method of Teaching Types of Exercises on Chemical Substances and Elements" (employing contract TM)

4.5.2. Plan for teaching the lesson "Method of Teaching Non-metals Lessons", Chapter IV "Method of Teaching Types of Exercises on Chemical Substances and Elements" (employing teaching-in-corners method)

4.5.3. Plan for teaching the lesson "Training Skills at Applying Methods Teaching Chemistry" in the course Teaching Practice

Chapter 3

PEDAGOGICAL EXPERIMENTS

3.1. Purposes of experiments

The purposes of pedagogical experiments (PE) is to confirm the correctness of scientific hypotheses, and based on the analysis of PE results, we will able to assess the feasibility and effectiveness of the two measures to develop CATM for pre-service chemistry teachers.

3.2. Experimental tasks

3.2.1. Evaluate the material "Training Chemistry Teaching Skills"

3.2.2. Assess the feasibility and effectiveness of the proposed measures (measures 2 and 3)

3.3. Experiment subjects and locations

The selected subjects for PE are 3rd-year and 4th-year university students majored in chemistry pedagogy.

The experiment locations are the Faculties of Chemistry of the Pedagogical

Universities representative of 3 regions South, Central and North, namely Hanoi National University of Education, Hanoi Pedagogical University 2, Hue University of Education and Ho Chi Minh City University of Pedagogy

3.4. Experiment contents and methodology

Evaluate the material "Training Chemistry Teaching Skills"by the use expert method, ask for comments, evaluate using questionnaire.

Conduct exploring experiment in teaching the courses "Methods of Teaching Chemistry in High School" and "Teaching Practice" in the school year 2013 – 2014.Arrange the evaluation of student' results and collect lecturers and students' comments, thereby edit materials, processes and measure appropriately to conduct the experiments at the 4 universities: Hanoi National University of Education, Hanoi Pedagogical University 2, Hue University of Education and Ho Chi Minh City University of Education.

From post-PE data, we process the examination scores using mathematical statistics and applied pedagogy's research methodologyto describe and compare analytical data to evaluate the progression and deployment of student CATM.

3.5. Experimental assessment

3.6. Pedagogical experiment results and result analysis

3.6.1. Evaluation of Measure 1: Develop the material "Training Chemistry Teaching Skills"

100% of experts believe that this is a useful material that is practically significant to the development of student CP. After being edited, this material can be used for reference of university pre-service teachers in other related courses to train other skills for students, making students confident before their teaching practicums and later teaching professions at high schools.

3.6.2. Impact Assessment of Measure 2: Apply experiential learning model in teaching the course "Methods of Teaching Chemistry in High School"

3.6.2.1. Evaluation using post-experiment surveys

The experiment results show that over 90% of students are excited and very excited at the teaching-in-corners method and contract TM.

3.6.2.2. Evaluation using examinations

Table 3.1.The statistics on average competence points and parameters in the examinations under the course "Methods of Teaching Chemistry in High School'

Round	**University**	**PRI**		**POI**		**p**	**SMD**
		Avg	SD	Avg	SD		
1	HN1.1_EX	2.49	0.45	3.35	0.35		
	HN2.1_EX	2.01	0.47	3.06	0.27	1.30×10^{-6}	0.94
	HN2.1_CT	1.99	0.48	2.62	0.46		
	HUE.1_EX	1.91	0.40	3.08	0.25	4.10×10^{-6}	0.93
	HUE.1_CT	1.90	0.41	2.72	0.39		
	HCM.1_EX	1.94	0.45	3.14	0.31	3.48×10^{-6}	0.94
	HCM.1_CT	1.91	0.47	2.77	0.39		
2	HN1.2_EX1	2.03	0.41	3.09	0.26		
	HN1.2_EX2	2.06	0.36	3.07	0.22		
	HN2.2_EX	1.93	0.47	3.07	0.31	5.43×10^{-7}	0.99
	HN2.2_CT	1.90	0.49	2.63	0.44		
	HUE.2_EX	1.90	0.39	3.07	0.29	2.96×10^{-5}	0.96
	HUE.2_CT	1.89	0.40	2.74	0.35		
	HCM.2_EX	1.96	0.43	3.14	0.3	1.05×10^{-4}	0.98
	HCM.2_CT	1.95	0.44	2.79	0.36		

The statistics in Table 3.1 show that: The application of experiential learning model has contributed to the development of CATM for pre-service chemistry teachers.

Table 3.1- Classification of CATM of students participating in Round 1

Point	Level	Hanoi National University of Education				Hanoi Pedagogical University 2			
		No. of students		% students		No. of students		% students	
		POI	PRI	POI	PRI	EX	CT	EX	CT
3.50-4.00	4	6	0	50.00	0.00	4	2	10.26	4.88
2.50-3.49	3	6	5	50.00	41.67	35	29	89.74	70.73
1.50-2.49	2	0	7	0.00	58.33	0	10	0.00	24.39
0.00-1.49	1	0	0	0.00	0.00	0	0	0.00	0.00
Point	Level	Hue University of Education				HCMUP			
		No. of students		% students		No. of students		% students	
		EX	CT	POI	PRI	EX	CT	EX	CT
3.50-4.00	4	2	0	5.56	0.00	6	1	12.50	2.44
2.50-3.49	3	34	35	94.44	87.50	42	37	87.50	90.24
1.50-2.49	2	0	4	0.00	10.00	0	3	0.00	7.32
0.00-1.49	1	0	1	0.00	2.50	0	0	0.00	0.00

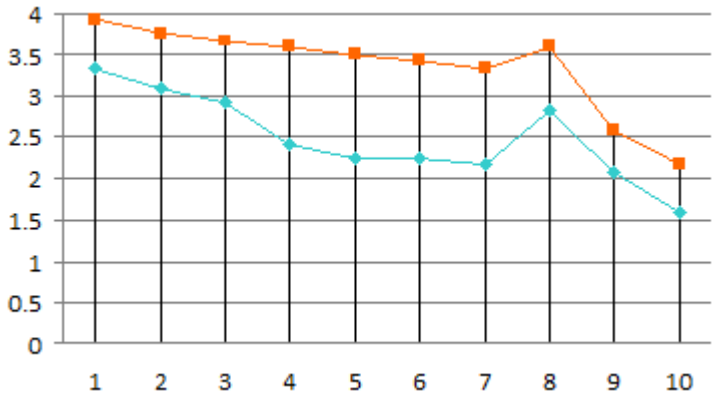


Figure 3.1.Pre-impact and post-impact of CATM on the experimental group of Hanoi National University of Education in Round 1.

3.6.3. Impact Assessment of Measure3: Use the role-play in combination with micro-teaching in the course "Teaching Practice"

3.6.3.1. Evaluation using class log.

It can be seen that with teaching log and class management on Facebook, developing CATM for students becomes more easily as lecturer can monitor their activities and give prompt feedback to help them adjust their own study. Moreover, posting videos of delivering lectures on Facebook helps lecturer and students save time so that more students can be taught in each lesson.

3.6.3.2. Evaluation using questionnaires

Table 3.2.Statistics on post-test surveys (on the use of the role-playing methodology combined with the micro-teaching method in the "teaching practice" module)

Contents	Yes, very much	Partially	No
1. The course objectives were clearly stated; teaching contents and methods that teachers used in the course were suitable	97.9%	2.1%	0%
2.The material "Training Chemistry Teaching Skills" is very useful for me	94.41%	5.59%	0%
3.Being trained in the teaching process according to the proposed teacher procedure is necessary for me	90.91%	9.09%	0%
4. I had difficulty learning the course *(if Completely True or Partially True, please specify the difficulties)*	6.29%	7.69%	86.02%
5.The use of this process in TP course is effective	96.5%	3.5%	0%
6.School facilities are adequate	75%	20%	5%
7.After the course, I can apply all the Chemistry teaching skills and combine the skills effectively	76.92%	13.99%	9.09%

8.After the course, I can design student competence oriented lesson plans	81.82%	18.18%	0%
9.I found that the course helped me to be more confident when delivering lectures	95.8%	4.2%	0%
10.This process should be continued for the students of next school years	100%	0%	0%

The results of the post-experimental survey showed that the objectives of the course were clear, the teaching contents and methods were appropriate and the material "Training Chemistry Teaching Skills" was very useful for students. Over 80% of students have asserted that they can design lesson plans in a student competence oriented approach and can combine teaching skills effectively. The course helped the students feel more confident, showing the effectiveness and feasibility of the process employing role-play in combination with micro-teaching method in the course Teaching Practice.

3.6.3.3. Assessment using competence points

Table 3.3.Tables of statistics on average competence points and parameters on the TP course examination

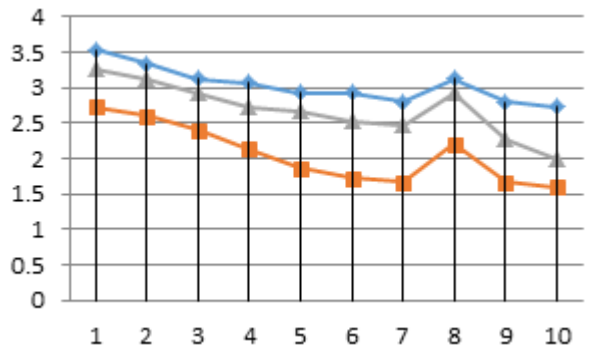
Round	**University**	**PRI**		**POI**		**P**	**SMD**
		Avg	SD	Avg	SD		
1	HN2.1_EX	2.07	0.36	3.04	0.27	5.52×10^{-3}	0.99
	HN2.1_CT	2.06	0.39	2.69	0.35		
	HUE.1_EX	2.13	0.44	3.21	0.26	2.81×10^{-3}	0.94
	HUE.1_CT	2.09	0.48	2.84	0.39		
	HCM.1_EX	2.15	0.39	3.19	0.20	6.46×10^{-4}	0.86
	HCM.1_CT	2.13	0.40	2.87	0.39		
2	HN.2_EX1	2.19	0.30	3.22	0.21		
	HN2.2_EX1	2.03	0.35	3.02	0.24	4.94×10^{-3}	0.96
	HN2.2_CT1	2.02	0.36	2.71	0.33		
	HN2.2_EX2	2.05	0.45	3.07	0.27	5.59×10^{-3}	0.94
	HN2.2_CT2	2.02	0.47	2.68	0.41		
	HUE.2_EX	2.05	0.43	3.13	0.24	3.11×10^{-3}	0.92
	HUE.2_CT	2.04	0.44	2.76	0.40		
	HCM.2_EX	2.10	0.39	3.08	0.27	4.06×10^{-3}	0.84
	HCM.2_CT	2.08	0.42	2.76	0.38		

The statistics show that: the application of role-play in combination with micro-teaching method has contributed to development of CATM for pre-service chemistry teachers.

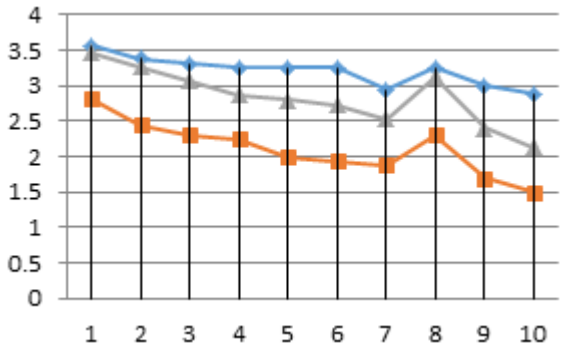
Table 3.10. Classification of CATM of students participating in Round 1

Point	Level	Hanoi Pedagogical University 2				Hue University of Education			
		No. of students		% students		No. of students		% students	
		EX	CT	EX	CT	EX	CT	EX	CT
3.50-4.00	4	0	0	0.00	0.00	5	1	31.25	6.67
2.50-3.49	3	14	11	93.33	73.33	11	11	68.75	73.33
1.50-2.49	2	1	4	6.67	26.67	0	3	0.00	20.00
0.00-1.49	1	0	0	0.00	00.00	0	0	0.00	0.00

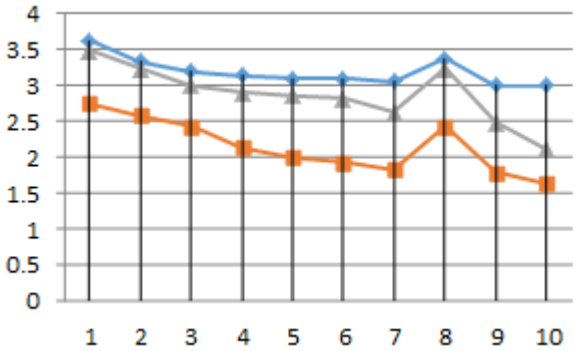
Point	Level	HCMUP			
		No. of students		% students	
		EX	CT	EX	CT
3.50-4.00	4	3	0	12.50	0.00
2.50-3.49	3	21	17	87.50	70.83
1.50-2.49	2	0	4	0.00	16.67
0.00-1.49	1	0	0	0.00	0.00



Hanoi Pedagogical University 2



Hue University of Education



HCMC University of Education

Figure 3.2.CATM of the EX – CT participating in the round 1PRI and POI

CONCLUSIONS

1. Conclusions

After a researching period on the thesis ""***Develop the competence of applying active teaching methods for chemistry pre-service teachers at universities***"", we come to the following conclusions:

1.1. Based on an overview of some topics surrounding TCP and TCP development theories, we realized that developing CATM for pre-service chemistry teachers is necessary, suitable with objectives of the courses under the department of Chemistry Theory and Teaching Methods and output standards for graduate pre-service teachers, and meets the requirements of secondary education renovation in the new phase.

The methods currently applied to TS training for development of undergraduate pre-service chemistry teachers' TCP has brought out certain effects to equip students with good knowledge and skills for teaching in high schools. However, a practical survey in which 15 teachers from pedagogical universities nationwide were interviewed in the process of training, fostering and developing TCP for pre-service chemistry teachers, 587 pre-service chemistry teachers were investigated on CATM status has pointed out the difficulties and needs of students in the development of CATM. Students still lack confidence in using methods of teaching chemistry in high schools. Therefore, Pus need to have innovations in developing students' TCP in general as well as the students' CATM in particular in terms of contents, methods, duration, and facilities.

1.2.On the theoretical and practical basis of the CATM development, we propose CATM concept and structure for pre-service chemistry teachers (with 4 competence components and 10 criteria, a detailed description of these 10 criteria in 4 levels) – this is a very important content which is the scientific basis to help us to propose pre-service chemistry teachers CATM assessment toolkit including: students' observation checklist, rubric, and competence assessment examinations as well as to propose three measures to develop CATM for pre-service chemistry teachers, which are:

Measure 1: Develop the material "Training Chemistry Teaching Skills"

Measure 2: Apply experiential learning model in teaching the course "Methods of Teaching Chemistry in High School"

Measure 3: Use the role-play in combination with micro-teaching in the course "Teaching Practice"

The material "Training Chemistry Teaching Skills" consists of 112 pages with detailed presentation of selective methods of teaching chemistry a long with 60 practice exercises to train student teaching skills. The material was evaluated to be effective and useful to lecturers in developing student CATM. Students also adopt this material as a handbook which makes them more confident before their teaching practicums and later teaching profession in high school.

The application of experiential learning model in the course "Methods of Teaching Chemistry in High School" should be taken in the proposed phrases. This activity will be more effective than learning theory, reading or listening lecture teacher, watching demonstration videos only. That requires the lecturers to constantly improve their own functional and professional skills, to be an model of applying active teaching methods, and to renew teaching methods because "we cannot give what we do not have".

The application of employing role-play process in combination with micro-teaching method in the course Teaching Practice should be implemented in a proper manner and should be ensured in terms of material facilities to support the home instruction for the students when setting up the scenario and recording teaching practice videos. In the process of training, students need to be guided, trained in attitude, professional commitment as well as being encouraged, cared, facilitated in self-training by lecturers. Once understanding the significance and importance of training teaching skills to Chemistry teaching in high school, students will have clear goals, greater motivation to overcome difficulties and fulfill the learning missions set out by lecturers.

1.3. We conducted experiments at Hanoi National University of Education, Hanoi Pedagogical University 2, Hue University of Education and Ho Chi Minh City University of Education , assessing student's CATM using competence assessment tools with 809 students (470 EX students and 339 CT students) such as questionnaires, competence evaluation tests, teaching records of students, and so on. The analysis of qualitative and quantitative results has shown the feasibility and effectiveness of CATM development measure for pre-service chemistry teachers.

2. Recommendations

Through the process of research and thesis completion, the author would like to make some recommendations as follows:

2.1. Continue researching on the application of experiential learning model to other courses under the Department of Chemistry Theory and Teaching Methods.

2.2. Continue implementing measures to develop CATM for pre-service chemistry teachers in all universities nationwide.

2.3. Universities should pay further attention to and create more facilities to support student self-learning and self-practicing activities.

2.4. It is necessary to evaluate students' CATM progression during their teaching practicums in high school in order to confirm the sustainability of CATM and to allow students to compare and self-evaluate when delivering lectures to rear audience instead of dummy students.