INTRODUCTIONS

1. REASONS FOR CHOOSING THE TOPIC

+ Pursuant to Decree No. 29 in 2013 of Political Bureau: "Education and training, along with science and technology, are top national policies", "considering investment in Education is one of the primary trends of development investment to facilitate the Education to develop and support the socio-economic development effectively.

+ In order to meet the requirements of education reform, one of indispensable works to develop the teacher staff's quality. Pursuant to Circular No. 30/2009/TT-BGDDT of Ministry of Education and Training on issuing regulation on Professional Standard of lower secondary teachers and upper secondary teachers (referred to as secondary teachers).

+ Pedagogical capacity consists of many skills associated with educational activities formed and developed during the process of teacher training and fostering. Pedagogical skills can only be formed by practicing, creation of pedagogical activities implementation in not only regular cases but also changing cases capacity. Fundamental pedagogical skill is specialized forms of individual in resolving mission of education and implementing teaching activity.

+ In the field of teacher training, many studies shows that: *the teaching in pedagogical establishments is focusing too much on basic subjects without paying enough attention to pedagogical profession, training program is too much of academic, vocational training is focusing too much on providing theories but not being closed to the current situation of mathematics teaching in high schools.*

+ Function is the main content in the Mathematics programs at secondary schools, not only at high school. Function teaching content purpose is not only to provide knowledge and basic skills for students, but also to form and develop thinking capacity, especially function thinking capacity right when students are introduced to Mathematics at the first period of time. Function teaching in secondary schools is the most various education content that provides many opportunities to students to develop basic capacity in Mathematics.

+ One of the reasons why mathematics teaching capacity of teachers currently does not meet the professional standards is: *Vocational training including training students with Mathematics teaching skill in pedagogical establishments has got disadvantages resulting in educated teachers' pedagogical capacity does not meet the requirement of Mathematics teaching in high school in a good way.*

For the reasons above, the topic chosen is***: Developing the teaching skills for pedagogical students suitable with the Vietnam Professional Standards for teacher by teaching the concepts of function in high school.***

2. PURPOSE OF THE RESEARCH

- Identifying skills in Mathematics teaching capacity that pedagogical students need to develop. Those skills is according to professional standards for teaching and are developed through function content teaching at high schools.

- Creating a set of criteria and an assessment tool of development level of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching. On that basis, some measures of development of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching are recommended.

3. PURPOSE OF THE RESEARCH

3.1. Making research on theoretical bases of development of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

3.2. Identifying expressions of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching that need developing.

3.3. Creating a set of criteria and an assessment tool of development level of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

3.4. Understanding the development level of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

3.5. Understanding the real situation of Mathematics teaching at some high schools basing on request of Mathematics teaching capacity (in accordance with professional standards for teaching through Function content teaching at high schools).

3.6. Recommending some measures of development of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

3.7. Pedagogical practice in order to feasibility and effectiveness of recommended measures.

4. OBJECT OF THE STUDY AND SCOPE OF THE STUDY

4.1. Object of the study

Development process of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

4.2. Scope of the study

Development of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

5. SCIENTIFIC THEORIES

If identifying skills or groups of skills in Mathematics teaching in general, the function subject in particular and proposing measures developing these skills (proposed in the dissertation), students will be developed lessons planning skills, teaching skills and reviewing the students' results of studying, simutaneously contributes to improve the quality of teacher training.

6. RESEARCH METHODS

6.1. Theoretical research method

6.2. Survey and inspection method

6.3. Pedagogical implementing method

7. ISSUES TO DEFENSE

7.1. Expression of Mathematics teaching capacity that pedagogical students can develop in accordance with professional standards for teaching through Function content teaching.

7.2. Feasibility and effectiveness of measures of development of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

8. CONTRIBUTIONS OF THE DESSERTATION

8.1. Clarifying rationale of development of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

8.2. Identifying elements of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

8.3. Creating a set of criteria and an assessment tool of development level of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

8.4. Recommending some measures of development of Mathematics teaching capacity for pedagogical students in accordance with professional standards for teaching through Function content teaching.

8.5. Illustrating feasibility and effectiveness of the measured through implementation process.

9. STRUCTURE OF THE DISSERTATION

Besides the Introductions and the Conclusions, the dissertation is divided into three chapters:

Chapter 1. Theoretical and practical foundation

Chapter 2. Some measures of developing the teaching skills for pedagogical students suitable with the "Vietnam Professional Standards for teacher'' by teaching the concepts of function in high school

Chapter 3. Pedagogical practice

Chapter 1 – THEORETICAL AND PRACTICAL FOUNDATION

1.1. OVERVIEW OF THE RESEARCH THESIS

1.1.1. Situation of overseas research

1.1.1.1. Teaching skill

Mathematics teaching skill has been paid many attention to and has been developed in various period of time by large number of psychologists and pedagogy researchers.

Since 1960, there have been some following works: Formation of pedagogical experience by Cuzơmina N.V (1961); Mathematics capacity psychology of students by Krutetxki V.A (1973); Mental characteristic of teachers by Gônôbôlin P.N (1976)…

In the work *"Formation of pedagogical skills and high techniques for students in the condition of higher education background"* by Kixêgôv X.I (1997), the author indicated the teaching capacity of teachers through more than 100 teaching capacity and pedagogical profession. Apđuliana O.A (1978) gave arguments and a system of teaching experience and separate education in the work *"Content and structure of pedagogical practice at Pedagogical University in the current time"*,

Output of teacher training is also impacted by model and form of training. In 1926, J.Watshon and A.Pojoux has proposed new perspective on teacher training: *Respecting real situation and splitting into small phases*. In this view, teacher training is changed from "Lesson – Class – Course – Year" form into "Credit" form.

This issue is discussed by UNESCO in the annual meeting in 1955. However; it was not until the seventeens, the issue *periodically training* was promoting to develop and implement through the implementation of *teacher training module* in each theory content.

1.1.1.2. Professional standards for teaching

Today, most of countries in the world such as USA, UK, Germany, Australia … have got professional standards for teaching. USA is the pioneer in creating professional standards for teaching at high schools, in which: National Board for Professional Teacher Standards – NBPTS – established in 1987 – recommended five core points for other states to manipulate. British professional standards for teaching (2007) is structured with three parts (fields) that related to each other, they are: Professional features; Knowledge and understanding of profession; Professional skills; Australia created The National Framework for Professional Standards for Teaching which covers 4 fields: *(i) Professional Knowledge; (ii) Professional Practice; (iii) Professional Values; (iv) Professional Relationships.*

In recent years there have been some research and drafts of ASEAN Mathematics teachers of Professional Standards. In detail: RECSAM is implementing the edition of Mathematics teaching standard (Sears-MT) for Southest Asia, in which 4 standards of Mathematics teachers are: *Learners understanding capacity; Mathematics understanding capacity; Learner's Mathematics studying understanding capacity; Information Technology using capacity.*

Therefore, professional standards for teaching is a tool of promoting the development of professional capacity of teachers meeting the conditions of each country.

From the research of teaching capacity and professional standards for teaching all over the world, we draw some following conclusions: *The orientation of training and fostering teachers that focuses on developing professional capacity has been cared by foreigns authors for ages and has been developed and completed through each period of time, along with having been attached to research on defining professional standards for teaching; Training and fostering teachers, especially Mathematics teachers, have to be attached by real state of education, by request of change in each developmen period of each nation; are concretized according to each region of each nation; Training teachers in the trend of intergrating and internationalizing the professional capacity (on ensuring scientific and professional characteristic), Paying attention to cultural features of each race, each local in each country in the world.*

1.1.2. Situation of domestic research

The research of manipulating classical theory on teaching capacity of the world into real state of teaching in Vietnam was expressed in the works of some authors: *Pham Van Hoan (editor in chief), Nguyen Gia Coc, Tran Thuc Trinh (1981); Nguyen Canh Toan (1987); Hoang Chung (1995)...*

Since the middle of 1990s of 20th century till now, many internal pedagogy and psychology researchers has made deep research and understanding of measures as well as teaching techniques for the highest effectiveness. Some model works can be named: *"Initial understanding teaching capacity of Psychology-Education teachers staff"* by Le Thi Nhat (1985); *"Training system of high school teachers in the manner of self-education with guidance, attached by long-term probation at high schools"* by Nguyen Canh Toan (1987); *"Issue of regularly pedagogical profession practice for students"* by Nguyen Quang Uan (1987)...

Through references, we found out that the research in those works were focusing in the orientation of:

+ Making research on elements of Mathematics teaching capacity that can be developed for pedagogical students;

+ Forming and fostering Mathematics teaching capacity for students of Mathematics teacher training;

+ Changing the content and manner of teaching the subject "Mathematics teaching method" in order to improve the practice of Mathematics teaching capacity for pedagogical students that contributes to improve the quality of High school Mathematics teacher training

Therefore, there are some domestic and foreign research referring to teacher training at Universities of Education, there are also profession standards for teaching and criteria for evaluating teaching capacity of teachers in accordance with the standard. However, there are not any works that make research on developing Mathematics teaching capacity through a detailed content. This is a gap in research. In order to narrow this gap, we focused on these points:

+ Identifying some teaching skills that need to be developed for Mathematics pedagogical students through Function content at high school in accordance with professional standards for teaching.

+ Based on the professional standards for teaching, creating a set of criteria and an evaluation tool of development of Mathematics teaching capacity for pedagogical students through Function content; evaluating the results in level forms.

+ Recommending some pedagogical measures in detail in or der to help Mathematics pedagogical students to achieve Professional standards for teaching through Function content; evaluating the results in level forms.

1.2. MATHEMATICS TEACHING CAPACITY AND SKILL.

1.2.1. Teaching capacity

According to the authors Pham Minh Hac, Tran Trong Thuy, teaching capacity consists of *(1) a thorough understanding of basic scientific knowledge, scientific education, (2) an understanding of students in the process of teaching and educating, (3) a thorough understanding of teaching methods and applying them effectively in educational reality, (4) communicating with students and their parents, (5) co-ordinating educational forces inside and outside the school, (6) organizing students' activities.*

The authors Le Van Hong, Le Ngoc Lan, Nguyen Van Thang and Bui Van Hue based on the unique functions of teachers to determine the structure of teaching capacity. To implement them, it is important to have a system of equivalent capacities to create capacity groups such as: (1) Teaching Capacity group includes: understanding capacity of students in the process of teaching and educating, knowledge and learning level of teachers, capacity of making studying documents, a thorough understanding capacity of teaching technique, language capacity; (2) Educational Capacity group includes: Capacity of making the development plan of students' personality, capacity of educational communication, capacity of friendliness with students, capacity of cleverly educational treatment; (3) capacity of organizing educational activities.

1.2.2. Mathematics teaching capacity

As we know, Mathematics teaching capacity consists of some fundamental capacities such as:

+ *Understanding capacity of students in teaching Mathematics*

+ *Capacity of preparation*

+ *Capacity of practicing*

+ *Capacity of organizing and managing*

+ *Capacity of reviewing*

1.2.3. Mathematics teaching skill

We all agreed with the concept that teaching skill has following characteristics

+ *Teaching skill is a system including implementing skills of distinctive teaching activities.*

+ Teaching skill maintains a close relation with teaching target- shown in the studying results of students.

+ Teaching skill connects with the collection of teaching actions thoroughly understood by teachers and the implementation must be proper under the constant condition and means.

In the thesis, we access to Mathematics teaching skill with the view: *Mathematics teaching skill represents the implementing capacity effectively of some manipulations or a series of manipulations' Mathematics teaching activity of teachers by choosing, applying Mathematics scientific knowledge and educational profession, methods and proper procedures to reach the teaching purpose as predetermined.*

1.3. CHARACTERISTICS OF PROFESSIONAL CAPACITY IN TEACHING MATHEMATICS

1.3.1. Professional standards for high school teachers

Professional standards for teaching for high school teachers can be simply understood as ***a career ladder*** that teachers always try to be in top during time of teaching (in which, level 1 is the minimum level required for teachers, and level 4 is the highest level). This ladder will help education management staffs and principals to evaluate and classify teachers, which is contributed to management, training planning, retraining and using teachers; used as a basis for building and developing programs for training and fostering teacher of universities and colleges of pedagogy and other training centers; used as a basis for developing preferential treatment regimens and policies for high school teachers.

To improve mathematics teaching skills for students of pedagogy schools as professional standards for teachers by developing Function teaching in high schools, we find out that: From professional standards for teaching, it is necessary to clarify characteristics of capacity of teaching Mathematics which is important to students through teaching contents of function.

1.3.2. Mathematics teaching skills in teaching Function is necessary to development for students in pedagogy schools according to professional standards for teaching.

With the aim to setting methods for developing mathematics teaching skills for pedagogical students according to standard of professional teacher, in scope of study of this thesis, we will focus on 3 group of skill and basic skills are clarified as following:

*** The first group** is ***group with skill of preparing teaching hours***

This group consists of **7 skills about developing teaching plan:** research skills of textbooks, textbooks for teacher and references; skill for determine targets, basic knowledge and focus of lesson; skill for predict time for activities in teaching lessons; Skill for review and learn by experience from class observation, watching video; skill for design list of questions in lesson; skill for putting mathematics contents in practice; skill for predict difficulties and common problems of students during teaching process and **2 skills ensure knowledge and curriculum:** skill for resolve exercises in textbook and practice books and reference book of Mathematics in high school; skill for using advanced mathematics in mathematics teaching in high school.

*** The second group** is ***group with skill of practising teaching hours***

This group consists of **3 skills about the implementation of teaching process**: speaking skill, writing skill, skill for drawing and arranging tables in teaching Mathematics, skill for organising and managing Mathematics teaching activities; skill for choosing and applying Mathematics teaching methods and **2 skills for using supporting means for teaching Mathematics**; skill for using items for teaching Mathematics; skill for exploiting and using informative technology to support for teaching Mathematics.

*** The third group** is ***group with skill of reviewing the result of teaching and studying mathematics***

This group consists of **3 skills about determining the reviewing method** for students: skill for reviewing diagnosis; skill for reviewing the process; skill for reviewing summary and **2 skills for designing the content of reviewing** the students' results of studying Mathematics: skill for designing the reviewing content of students' Mathematics knowledge; skill for designing the reviewing content about skill of Mathematics exercises solving of students.

1.3.3. Developing set of criteria reciewing the level of developing skills for teaching and studying Mathematics of pedagogical students according to professional standards for teaching.

1.3.3.1. Principles

- Constructing the code of criteria reciewing the level of developing skills for teaching and studying Mathematics of pedagogical students must base on requirements of teaching capacity in the third standard; educational capacity in the forth standard and professional development ability in the sixth standard from standard for teacher professional (including standards from 8 to 21; standard no.24, 25). The set of standards must ensure the scientific, realistic, feasible and usable features.

- The code of criteria reviewing the level of developing skills for teaching and studying Mathematics of pedagogical students must show the depth, closing to unique and basic skills creating teaching ability for teachers, helping pedagogical students can self-assess all skills for teaching Mathematics accurately.

1.3.3.2. Developing the set of standard

A – Skill group for preparing for teaching hours

Skill 1: *research skills of textbooks, textbooks for teacher and references*

Skill 2: *determine targets, basic knowledge and focus of lesson*

Skill 3*: predict time for activities in teaching lessons*

Skill 4: *design list of questions in lesson*

Skill 5: *putting mathematics contents in practice*

Skill 6: *review and learn by experience from class observation, watching video*

Skill 7: *predict difficulties and common problems of students during teaching process*

Skill 8: *resolve exercises in textbook and practice books and reference book of Mathematics in high school*

Skill 9: *using advanced mathematics in mathematics teaching in high school*

B - Skill group for practising teaching hours

Skill 10: *organising and managing Mathematics teaching activities*

Skill 11: *selecting and applying Mathematics teaching methods*

Skill 12: *speaking, writing skill, drawing and arranging tables in teaching Mathematics*

Skill 13: *using items for teaching Mathematics*

Skill 14: *using informative technology to support for teaching Mathematics.*

C – Skill group for reviewing the result of teaching and studying mathematics

Skill 15: *Reviewing diagnosis*

Skill 16: *Reviewing the process*

Skill 17: *Reviewing summary*

Skill 18: *Designing the reviewing content of students' Mathematics knowledge*

Skill 19: *Designing the reviewing content about skill of Mathematics exercises solving of students.*

1.3.4. The expressiong and reached level of some skills for teaching function which pedagogical students should be practised.

In the thesis, we select 5 out of 19 skills which is basic and necessary to be able to develop Mathematics teaching skills for pedagogical students through teaching the

content of function to surmount function teaching skills students are weak in the current stage.

1.3.4.1. Mathematics exercises resolving skill

For example, to assess mathematics resolving skill of students about the kind of exercise "*derivative and application*", lecturer require students to solve the following exercise:

Exercise 1. Depending on a, please surveying the variability of function $y = 4x^3 + (a+3)x^2 + ax$

Exercise 2. Give $f(x) = \dfrac{1}{1+x}$. Calculating $f^{(n)}(x)$.

Exercise 3. Resolving system of equations $\begin{cases} x\sqrt{12-y} + \sqrt{y(12-x^2)} = 12 \\ x^3 - 8x - 1 = 2\sqrt{y-2} \end{cases}$ $\left(x, y \in \mathbb{R}\right)$

- ***Level 1***:

- Exercise 1: Know how to apply the knowledge of quadratic trinominal to solve problems thoroughly.
- Exercise 2: Know how to use induction but just find out derivative level 1, 2, 3 of function and could not predict the general formula of derivative level n.
- Exercise 3: Struggle and have not figured out how to deal with the problem.

- ***Level 2***:

- Exercise 1: Know how to apply the knowledge of quadratic trinomial to solve problems Analyze the Teriary function thoroughly.
- Exercise 2: Know how to use induction to predict and prove the general formula.
- Exercise 3: From the equitation systems $\begin{cases} x\sqrt{12-y} + \sqrt{y(12-x^2)} = 12 & (1) \\ x^3 - 8x - 1 = 2\sqrt{y-2} & (2) \end{cases}$ these following solutions are found out yet could not solve the problem thoroughly.

The first solution:

Have: $x\sqrt{12-y} \le \dfrac{x^2 + 12 - y}{2}$ và $\sqrt{y(12-x^2)} \le \dfrac{y + 12 - x^2}{2}$ so $x\sqrt{12-y} + \sqrt{y(12-x^2)} \le 12$.

Therefore $(1) \Leftrightarrow \begin{cases} x \ge 0 \\ y = 12 - x^2 \end{cases}$ substituted for (2) we get $x^3 - 8x - 1 = 2\sqrt{10 - x^2}$ but have not figured out what the next step is.

The second solution:

+ Apply the inequation $\left(ax + by\right)^2 \le \left(a^2 + b^2\right)\left(x^2 + y^2\right)$, we have:

$$\left[x\sqrt{12-y} + \sqrt{y(12-x^2)}\right]^2 \le \left(x^2 + 12 - x^2\right)\left(12 - y + y\right) = 12^2 \Rightarrow x\sqrt{12-y} + \sqrt{y(12-x^2)} \le 12$$

From that, $(1) \Leftrightarrow \dfrac{x}{\sqrt{12-y}} = \dfrac{\sqrt{12-x^2}}{\sqrt{y}} \Leftrightarrow \begin{cases} x \ge 0 \\ x\sqrt{y} = \sqrt{\left(12-x^2\right)\left(12-y\right)} \end{cases}$

$\Leftrightarrow \begin{cases} x \ge 0 \\ x^2 y = 144 - 12x^2 - 12y + x^2 y \end{cases} \Leftrightarrow \begin{cases} x \ge 0 \\ x^2 + y = 12 \end{cases}$

Deduce from equatation (2): $x^3 - 8x - 1 = 2\sqrt{10-x^2}$ but have not figured out what the next step is.

The third solution:

+ Deduce from (1) $\sqrt{y(12-x^2)} = 12 - x\sqrt{12-y}$

Square two sides we got: $12y - x^2 y = 144 - 24x\sqrt{12-y} + x^2(12-y)$

$\Leftrightarrow 12x^2 - 24x\sqrt{12-y} + 12(12-y) = 0$ (4) but have not fingured out what the next step is.

- ***Level 3***: Solve all the problem's requirements creatively and generally.

Exercise 1: Domain R.

We have $y' = 12x^2 + 2(a+3)x + a$

Consider the quadratic trinomial y' có $\Delta' = \left(a-3\right)^2$

First case: $\Delta' = 0 \Leftrightarrow a = 3$ => $y' = 3\left(2x+1\right)^2 \ge 0 \ \forall x \in \mathbb{R}$ so the function is always increasing on R.

Second case: $\Delta' > 0 \Leftrightarrow a \ne 3 \Rightarrow y' = 0 \Leftrightarrow \left[\begin{array}{l} x = -\dfrac{1}{2} \\ x = -\dfrac{a}{6} \end{array}\right.$

Possibility 1: $-\dfrac{1}{2} < -\dfrac{a}{6} \Leftrightarrow a < 3$, we have the variation table:

x	$-\infty$		$-\frac{1}{2}$		$-\frac{a}{6}$		$+\infty$
y'		+	0	−	0	+	
y	$-\infty$	↗	$\frac{1-a}{4}$	↘	$\frac{a^3-9a^2}{108}$	↗	$+\infty$

Possibility 2: $-\dfrac{1}{2} > -\dfrac{a}{6} \Leftrightarrow a > 3$, we have the variation table:

x	$-\infty$		$-\frac{a}{6}$		$-\frac{1}{2}$		$+\infty$
y'		+	0	−	0	+	
y	$-\infty$	↗	$\frac{a^3-9a^2}{108}$	↘	$\frac{1-a}{4}$	↗	$+\infty$

Exercise 2: We have $f'(x) = -\dfrac{1}{(1+x)^2}; f''(x) = \dfrac{2}{(1+x)^3}; f'''(x) = -\dfrac{6}{(1+x)^4} = -\dfrac{2.3}{(1+x)^4}$

Apply Mathematical induction to predict and prove the general formula: $f^{(n)}(x)=(-1)^n.\dfrac{n!}{(1+x)^{n+1}}$

Exercise 3: Solve the problem completely in any one of two following methods:

Method 1. Consider the equation system $\begin{cases} x\sqrt{12-y}+\sqrt{y(12-x^2)}=12 & (1) \\ x^3-8x-1=2\sqrt{y-2} & (2) \end{cases}$

Condition: $-2\sqrt{3}\le x\le 2\sqrt{3}; 2\le y\le 12.$

We have: $x\sqrt{12-y}\le \dfrac{x^2+12-y}{2}$ and $\sqrt{y(12-x^2)}\le \dfrac{y+12-x^2}{2}$ so $x\sqrt{12-y}+\sqrt{y(12-x^2)}\le 12$.

Therefore $(1)\Leftrightarrow \begin{cases} x\ge 0 \\ y=12-x^2 \end{cases}$ substituted for (2) we have

$$x^3-8x-1=2\sqrt{10-x^2} \Leftrightarrow x^3-8x-3+2\left(1-\sqrt{10-x^2}\right)=0$$

$$\Leftrightarrow (x-3)\left(x^2+3x+1+\frac{2(x+3)}{1+\sqrt{10-x^2}}\right)=0 \quad (3)$$

Becasue $x\ge 0$, $x^2+3x+1+\dfrac{2(x+3)}{1+\sqrt{10-x^2}}>0$. Therefore $(3)\Leftrightarrow x=3$.

Substitude for the equation system and compare to the condition, we identify the solution: $(x;y)=(3;3)$.

Method 2:

Condition: $-2\sqrt{3}\le x\le 2\sqrt{3}; 2\le y\le 12.$

Apply the inequation $(ax+by)^2\le (a^2+b^2)(x^2+y^2)$, we have:

$$\left[x\sqrt{12-y}+\sqrt{y(12-x^2)}\right]^2\le (x^2+12-x^2)(12-y+y)=12^2\Rightarrow x\sqrt{12-y}+\sqrt{y(12-x^2)}\le 12$$

From that, $(1)\Leftrightarrow \dfrac{x}{\sqrt{12-y}}=\dfrac{\sqrt{12-x^2}}{\sqrt{y}}\Leftrightarrow \begin{cases} x\ge 0 \\ x\sqrt{y}=\sqrt{(12-x^2)(12-y)} \end{cases}$

$$\Leftrightarrow \begin{cases} x\ge 0 \\ x^2y=144-12x^2-12y+x^2y \end{cases} \Leftrightarrow \begin{cases} x\ge 0 \\ x^2+y=12 \end{cases}$$

Deduce from (2): $x^3-8x-1=2\sqrt{10-x^2}$

Because $x^3-8x-1\ge 0\Rightarrow x>2$ (by analyzing cubic function)

Function $f(x)=x^3-8x-1-2\sqrt{10-x^2}$ has $f'(x)=3x^2-8+\dfrac{2x}{\sqrt{10-x^2}}>0 \quad \forall x\in\left(2;\sqrt{10}\right)$

Therefore f(x) is always increasing on the domain $\left(2;\sqrt{10}\right)$.

On the other hand $f(3)=0$. Thus $x=3$ is the only root of the equation $f(x)=0$ on domain $\left(2;\sqrt{10}\right)$. Therefore, the only root of the equation system is: $(x;y)=(3;3)$

1.3.4.2. Question desigining skill on teaching Function

1.3.4.3. Skill applying theories of Function into practice during teaching

1.3.4.4. Information Technology exploitation and application skills for teaching Function

1.3.4.5. Skill designing evaluation contents on students' knowledge of Function

1.4. TEACHING FUNCTION AT HIGH SCHOOL AS PROFESSIONAL STANDARD FOR TEACHING

1.4.1. The formation and development of function in Mathematics

1.4.2. Contents and requirements of teaching function during teaching Mathematics at high school in Vietnam.

a. Contents of function in Mathematics in high school system of Vietnam.

Research on function is considered the main task throughout the program for high schools. Knowledge about function being introduced in secondary school:

Analyzing the function in high school is conducted in 2 stages: the first stage (grade 10 and grade 11), in which analyzing the function is conducted by using primary method for solving the function of algebra and trigonometry. The other stage (grade 12), in which students are taught about derivative as a general and effective tool to analyze the function.

b. Knowledge and skills required on teaching function during teaching Mathematics at high school in Vietnam.

1.4.3. The opportunities to develop the mathematical teaching skills for pedagogical students suitable with the Vietnam professional standards for teachers through the teaching real function in high school.

- Opportunity on knowledge content
- Opportunity on studying target
- Opportunity on teaching method

1.5. REAL SITUATION OF FUNCTION TEACHING ABILITY ACCORDING TO THE PROFESSIONAL STANDARD FOR TEACHING.

1.5.6. Survey and analysis results

- There are a number of teachers who are completely able to practice professional activities. However, teachers' restricted awareness leads to the infrequency or even the shortage of professional practice.

- Due to the limited ability, it is difficult for teachers to carry out some teaching activities. As the result, the frequency is still low.

- There are a great number of teachers aware of the position as well as the importance of some skills in the group of teaching skills but due to the limited ability the level of obtaining those skills is still low.

- In spite of being equipped with theories and understanding of Mathematics teaching activities, students do not have enough opportunities to practice while skills are formed only by the process of applying theories into real situations.

- Students are very struggled for: identifying objectives, basic knowledge and the focus of teaching lessons; designing question system; exploiting and using information technology for teaching; applying Mathematics contents into reality and making use of positive teaching methods in order to promote students' positive, activeness and creativity during their teaching of Function at High School.

Chapter 2: MEASURES OF DEVELOPING THE TEACHING SKILLS FOR PEDAGOGICAL STUDENTS SUITABLE WITH THE VIETNAM PROFESSIONAL STANDARDS FOR TEACHER BY TEACHING THE CONCEPTS OF FUNCTION IN HIGH SCHOOL

2.1. BUILDING ORIENTATION AND MEASURES

* ***Orientation 1***: Measures to innovate programs, universal textbooks after 2015

* ***Orientation 2***: Measures must conform to the output standard of the high school mathematics teacher training facilities; be compatible with the criteria and tools assessing the development level of mathematics teaching skill of pedagogical students according to professional standards of teaching.

* ***Orientation 3***: Measures must closely follow components of Mathematics teaching capability through function content according to identified professional standards which should be developed for Mathematics pedagogical students; in order to affect the basic components creating professional capability for students: Knowledge, Skills and ethical qualities.

2.2. SOME MEASURES OF DEVELOPING THE TEACHING SKILLS FOR PEDAGOGICAL STUDENTS SUITABLE WITH THE "VIETNAM PROFESSIONAL STANDARDS FOR TEACHER" BY TEACHING THE CONCEPTS OF FUNCTION IN HIGH SCHOOL

2.2.1. Measure 1: Create the potential of teaching function for students through problem solving practice

2.2.1.1. Bases for proposing measures

Improve the problem solving skills of students through the exploitation and systematization of exercise types, solution methods for each type of exercise, together

with notes about the knowledge and skills for each type of exercise in each topic to help students whenever facing a primary problem have a throughout view, figure out the nature, origin of the problem, even find out the organic relationship with series of other problems and if necessary, use mindset manipulation to specialize or generalize such problems so that they become new problems more "interesting" than the original problems. Therefore, help students meet the require of teaching problem solving for the pupils so as to not only provide a solution to the problem, but also to teach students how to think, how to find the problem solution.

2.2.1.2. The purpose of the measure

Helps students acquire knowledge about the function and have function problem solving skills competently.

2.2.1.3. The contents and measures to implement

- *Content:* To help students develop the potential of function teaching at high schools, we prepare some subjects for students to study as follows:

+ Subject 1: Variation; Graph; Some problems of function graph.

+ Subject 2: Domain of definition; Range of values; The maximum value - the minimum value of a function.

+ Subject 3: The applications of a function.

- *How to implement measures*:

We select the topic: "Find the maximum value and minimum value of a function" in the subject 2 for the students to practice exploitation, comply with the following steps:

A. Training the problem solving skills for students: Find the maximum value and minimum value of a function as the basis for teaching function well at high schools.

(1) Preparation: (This activity takes place a few weeks before the seminar)

(2) Conducting seminars in class

Results of the discussion:

- Students can create a grade of the problem from the solution of such problem

- Provide a solution method for each mathematics type of finding the maximum value and minimum value of a function.

- Help students develop the ability to study, analyze the program, content of textbooks

B. *Create situations for students to practice skills of anticipating and fixing common mistakes of pupils in the process of problem solving: Find the maximum value and minimum value of a function*

* Situation 1: Make mistakes in the process of change

* Situation 2: Make mistakes when using the basic inequalities but not pay attention to the conditions for the inequality to be correct.

* Situation 3: Make mistakes when using the monotony of function

* Situation 4: Make mistakes to prove the inequality by inductive method

* Situation 5: Make mistake when using the basic inequality but not pay attention to the conditions for mark of the inequality to belong to the referred range.

2.2.1.4. Conclusion

Measure 1 has contributed very significantly to the development of the teaching capacity for mathematics pedagogical students according to professional standards of teaching through teaching function content in secondary schools.

2.2.2. Measure 2: Train the skills of making questions for students and use the question system in teaching functions

2.2.2.1. Base for proposing measures

- In teaching, making questions is an important skill of the teachers. The question system helps pupils actively engage in learning activities, such as: thinking, exchanging and discussing to promote the interaction between pupils and teachers, pupils and pupils.

- Each learning content of mathematics can be considered as a problem that teachers guide students to resolve through the questions, exercises (solving exercises is actually answering the system question). Therefore, in teaching Mathematics, the skill of making and using questions is one of the important components of the capability of teaching Mathematics for students to be trained.

2.2.2.2. The purpose of the measure:

This method is to train pedagogical student’s capability of making questions and using the question system in teaching function, helping students self-explore, discover and acquire the new knowledge.

This measure directly affects 2 criteria in mathematics teaching capability: Build the question system in designing lesson plans of teachers; Use the question system to implement 4 tasks of teaching Mathematics as stated in the skills of conducting the class.

2.2.2.3. Contents and ways to implement measures

1) Equip students with the understanding of the meaning and effect of the questions in mathematics teaching.

2) Guide students know how to ask questions and use the questions in the practice of teaching function contents

3) Train students capability of making questions and using the question system through the situations of teaching how to draw graphs using transformations

2.2.2.4. Conclusion

Train the capability of making questions and using question system in teaching function helps mathematics pedagogical students develop some skills: Skill of making questions, skill of systematizing knowledge, skill of linking discrete events of mathematics, skill of generalizing, skill of creating a new problem from a specific problem ... the students' proficiency of teaching skill will significantly increase the effectiveness of teaching hours and stimulate the ability to explore, discover ; promote the transition from passive learning to self-discipline, positive, initiative and creative learning of pupils.

2.2.3. Measure 3: Train the students' function teaching skills associated with practice

2.2.3.1. Base for proposing measures

a. The reality of the applying mathematics to the practice of teaching in mathematics at high schools.

According to the reality of the current teaching, teachers only care and pay attention to the completion of the theoretical knowledge specified in the program and textbooks without really paying attention to the problems of experimental content

b. From the number of problems of experimental content in the function content of the mathematics program and textbooks at high schools at the present.

- In 10th Grader's Algebra textbook, the problems of experimental content in the function subject are only mentioned through 2 examples and an activity at §1 Function, Chapter II – First Order Functions and Quadratic Functions

- In 11th Grader's Algebra - Analysis textbooks:

+ An example of further readings

+ An example suggests the motivation of building the derivative concept, secondary derivative.

- In 12th Grader's Analysis textbook: The problems of experimental content are mentioned more with the example of maximum value, minimum value of continuous functions on a segment; The problem of "compounding interest" in the exponential equation is proposed for the purpose of introducing the concept of exponential equations through this problem.

c. Orientation of Mathematics education associated with the actual life.

According to the Resolution of the 8th Congress of the 11th Central Executive Board (XI), No. 29-NQ / TW dated on 04/11/2013 about the fundamental, comprehensive innovation of education and training. Our Party has stated: "Development of education and training is improving people's knowledge, training human resources, fostering the talents. Transfer the education process from mostly equipping knowledge into comprehensive development of capability and quality of learners. Learning coupled with practice; Theory associated with the practice; school education combined with family education and social education"

In 2012, Vietnam participated in international student assessment (PISA). This project focused on four main capabilities: Science, Comprehensive Reading, Mathematics, and the ability to handle the situation.

d. The actual status of application of mathematics teaching associated with the practice of high school teachers

According to the survey results of high school teachers, together with that of lecturers and mathematics pedagogical students demonstrated in the questionnaires in Appendix 01 and Appendix 02 presented in Section 1.5.6, we find that: For the team of lecturers' meeting of the requirements of educational reform in 2015, it is necessary that the team of lecturers foster students' awareness and skills of using mathematics in the practice in the future's teaching by helping students actively study applications of mathematics knowledge into the practice

From the above basis, we determine that: The training students' habit and skills of practicing mathematics teaching associated the practice in function contents is the necessary measure to develop teaching capability for students to meet innovation requirements of Mathematics programs, textbooks after 2015 and comply with the professional standards of teaching through teaching function content at high schools.

2.2.3.2. The purpose of the measure

This measure is to equip and train student's skills of teaching mathematics associated with the practice in Function contents

2.2.3.3. Contents and ways to implement, measures

1) Exploit and create problems of experimental content about the topic of Function through textbooks and references at high school

2) Equip students with the mathematical modeling process

3) Train for student teachers practice teaching mathematics content associated with the experimental functions through a number of specific activities following

a) Training for Teachers of Mathematics students explore some experimental situations suggestive questioning motor learning in teaching function

b) Train mathematics pedagogical students to explore some experimental situations to test the level of understanding and applying knowledge acquired of students in teaching function contents.

2.2.4. Measure 4: Organize students to practice skills to exploit information technology in teaching Functions

2.2.4.1. Base for the proposing measures

a) From the current status of teaching supportive equipment and the ability to exploit, use IT of Mathematics teachers at High Schools

b) The use of teaching, studying supportive devices and the ability to exploit and use IT of vocational training teachers at pedagogical colleges.

c) From the investigation, survey results.

2.2.4.2. The purpose of the measure:

This measure is to equip and train mathematics pedagogical students' ability to exploit and use IT in teaching Function contents at high schools.

2.2.4.3. Contents and ways to implement measures

a. The necessary skills when using IT in Mathematics teaching

• *The skill of exploiting IT application to support arousing motivation in Mathematics teaching;*

• *The skill of exploiting IT application to support activities of consolidating and memorizing knowledge;*

• *The skill of exploiting IT application to support teaching review and summarization;*

• *The skill of exploiting IT application to support examination and assessment of Mathematics results.*

We conduct the process of formation and training mathematics pedagogical students' above basic skills through two activities of vocational training of mathematics teaching:

1 - Design scenarios of Mathematics lesson through activities:

2 - Carry out Mathematics teaching activities with IT support

b. Form and train students' skills of exploiting IT application to support teaching function contents through a number of specific situations

c. Guide students to design and use mind maps in circuit design in planning the review of chapters 1: Applying the derivative to survey and draw graph of a function.

2.2.5. Measure 5: Train students to apply some of the valuation techniques in line with approaching capability of teaching function

2.2.5.1. Base for proposing measures

According to Mr. Nguyen Ba Kim (2011): "Evaluation is the process of forming opinions, judgments about the work results, based on the analysis of the information collected, collated with the objectives and criteria stated out, in order to propose appropriate decisions to improve the situation, adjust to improve the quality and work efficiency. "

Test and evaluation a mutual relationship that is very close and intimate. Check the direct impact on the assessed object (Pupils) and have "measures", the measures collected are essential materials for evaluation stage.

2.1.5.2. The purpose of the measure

This method is to train mathematics pedagogical student's some design techniques to test and to assess pupils' academic performance in high school function teaching, helping students have timely adjustments in the work of teaching later.

2.2.5.3. Contents and ways to implement measures

The thesis focuses on training students to design process for the examination and assessment of pupils regarding written test method (objective multiple-choice test; constructed-response test; objective multiple-choice combined with constructed-response test) and they are illustrated over some specific examples, comply with the steps.

A. Process design of test topics for high school pupils' mathematics results assessment

1) Define the purpose of testing
2) Select test methods
3) Establish matrix for testing
4) Compile matrix questions
5) Build answers and grade scale

B. Application of the test topics for pupils' academic results assessment in function content teaching at high schools

Chapter 3: PEDAGOGICICAL PRACTICE

3.1. PURPOSES OF THE PRACTICE

3.1.1. Pedagogical practice purposes

- To test the thesis's scientific hypothesis.
- To examine the feasibility and effectiveness of the pedagogical measures proposed in the thesis.

3.1.2. Pedagogical practice tasks

- Compile experimental documents and conduct experimental teaching.

- Demonstrate the application of pedagogical methods in teaching content of "Teaching the function topic at high schools" for mathematics pedagogical students.

- Collect and process experimental results to examine the feasibility, science and effectiveness of the proposed measures.

3.2. EXPERIMENTAL SUBJECTS AND PLANS

The experimental organization is conducted at three universities:

1 - University of Hai Phong;

2 - Pedagogical University - Thai Nguyen University;

3 - Hanoi Pedagogical University 2.

3.3. EXPERIMENTAL CONTENT (Through Pedagogical practice lesson plans)

3.4. TEST AND ASSESSMENT OF EXPERIMENTAL RESULTS

3.4.1. Test content

Through tests and End of module tests

3.4.2. Test results of the experimental class and the control class

Table 3.1 - Results of the test point number 1

Điểm	Số lượng		Phần trăm	
	Lớp TN (213 SV)	Lớp đối chứng (224 SV)	Lớp TN (213 SV)	Lớp đối chứng (224 SV)
A (Từ : 8,5 đến 10)	36	29	16,90%	12,95%
B (Từ : 7 đến 8,4)	95	97	44,60%	43,30%
C (Từ : 5,5 đến 6,9)	70	77	32,86%	34,38%
D (Từ : 4 đến 5,4)	12	21	5,63%	9,37%
F (Từ : 0 đến 3,9)	0	0	0	0

Table 3.2 - Results of the test point number 2

Điểm	Số lượng		Phần trăm	
	Lớp TN (213 SV)	Lớp đối chứng (224 SV)	Lớp TN (213 SV)	Lớp đối chứng (224 SV)
A (Từ : 8,5 đến 10)	39	29	18,31%	12,95%
B (Từ : 7 đến 8,4)	100	100	46,94%	44,64%
C (Từ : 5,5 đến 6,9)	65	76	30,52%	33,93%
D (Từ : 4 đến 5,4)	9	19	4,23%	8,48%
F (Từ : 0 đến 3,9)	0	0	0	0

Table 3.3 - Results of the test point number 3

Điểm	Số lượng		Phần trăm	
	Lớp TN (213 SV)	Lớp đối chứng (224 SV)	Lớp TN (213 SV)	Lớp đối chứng (224 SV)
A (Từ : 8,5 đến 10)	42	31	19,72%	13,84%
B (Từ : 7 đến 8,4)	102	95	47,89%	42,41%
C (Từ : 5,5 đến 6,9)	65	80	30,51%	35,71%
D (Từ : 4 đến 5,4)	4	18	1,87%	8,04%
F (Từ : 0 đến 3,9)	0	0	0	0

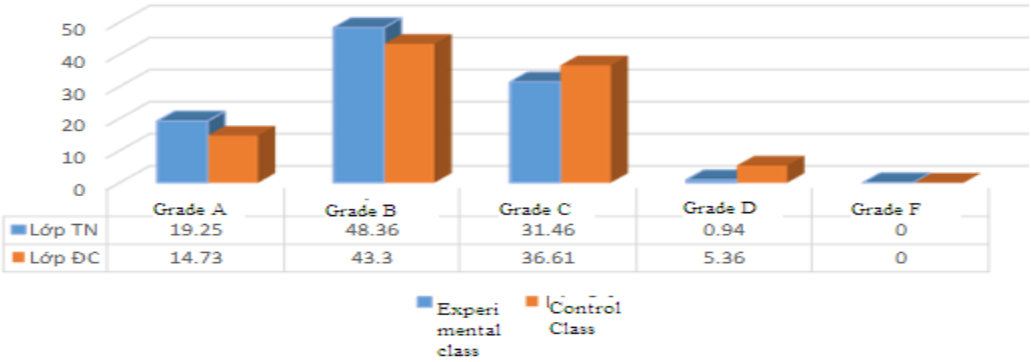
Table 3.4 - Scores module specific teaching methods

Điểm	Số lượng		Phần trăm	
	Lớp TN (213 SV)	Lớp đối chứng (224 SV)	Lớp TN (213 SV)	Lớp đối chứng (224 SV)
A (Từ : 8,5 đến 10)	41	33	19,25%	14,73%
B (Từ : 7 đến 8,4)	103	97	48,36%	43,3%
C (Từ : 5,5 đến 6,9)	67	82	31,46%	36,61%
D (Từ : 4 đến 5,4)	2	12	0,94%	5,36%
F (Từ : 0 đến 3,9)	0	0	0	0

3.4.3. The result of the knowledge gained by control class and experimental class

3.4.3.1. Quantitative analysis

Chart of the percentage of End of module test results



3.4.3.2. Qualitative analysis

In parallel to the quantitative analysis, assessment, we conduct the qualitative analysis, evaluation of experimental results based on the results of the process evaluation; through direct exchange and questionnaire for students, lecturers and pedagogic practice instructors.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The thesis has obtained the following results:

- Clarify the theoretical basis of developing the capability of mathematics teaching for pedagogical students according to the professional standards of teaching through function teaching.

- Identify the component skills in capability of mathematics teaching according to the professional standards of teaching necessary to develop for pedagogical students Function teaching

- Develop criteria and assessment tools of development level of mathematics teaching skill of pedagogical students teaching according to the professional standards of teaching through function teaching.

- Recommend 5 specific measures to develop mathematics teaching skill for pedagogical students teaching according to the professional standards of teaching

through function teaching. We applied pedagogical measures in teaching module “Teaching method of specific contents of Mathematics" for the topic content” function teaching" for mathematics pedagogical students.

- Pedagogical experimental results partly illustrated the feasibility and effectiveness of the measures implemented. Lectures used such measures quite effectively in teaching, contributing to training of teaching skills for mathematics pedagogical students.

- The thesis can be used as reference material for lecturers, mathematics pedagogical students.

Recommendation

To develop Mathematics teaching skills for pedagogical students according to the professional standards of teaching in an effective way, we propose a number of recommendations as follows:

- In the process of teaching mathematics pedagogical students, lecturers need to have specific goals about teaching skill, spend the proper time on training students’ teaching skills through professional subjects (Teaching method of Mathematics, primary algebra, primary geometry, problem solving practice,...). Simultaneously need to develop self-learning materials with instructions for such subjects in high school teacher training program.

- Build Websites to support mathematics pedagogical students

- For the contents of module: Mathematics teaching method (the specific contents), it necessary to supplement the set of criteria and tools to assess the development level of mathematics teaching capability for pedagogical students according to the professional standards of teaching.