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**TEACHING ADVANCED GEOMETRY IN UNIVERSITY FOR MATH
PEDAGOGICAL STUDENTS IN THE DIRECTION OF PREPARING
GEOMETRY TEACHING CAPACITY AT HIGH SCHOOL**

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INTRODUCTION

I. Reason for choosing the topic

“Education development strategy 2011-2020” of the Government includes overall target until 2020. *“Renovate basics and the entire education in the manner of standardization, modernization, socialization, democratization, international integration, adaptive to socialist – oriented market economy, education development associated with development of science and technology, concentration on quality upgrade, especially quality of ethical education, way of living, capacity for creating ,practice skill to, on the one hand, meet the requirements of socioeconomic development, promoting industrialization-modernization of the country, ensuring national defense and security; on the other hand, must focus on meeting demands of each learner for development, people with gift can develop their talent”*[7, p. 8]. According to Prof. Pham Minh Hac [82], one of 3 things needed to carry out immediately to reach the goal of renovating education is to reorganize, strengthen teachers in terms of quality and skills because they are the ones to implement and ensure the success of renovation. On 22/10/2009, Ministry of Education and Training issued Circular 30/2009/TT-BGD ĐT regulating Professional standard for both teachers of primary education and high school education. The circular indicated in detail basic requirements for secondary school teachers in term of quality as well as professional capacity including 6 standards, 25 criteria. Especially, standard 3 concerning teaching capacity including 8 criteria that high school teachers need to have, which states that *“teacher must have suitable teaching method; accurate, systematic knowledge about subject, reasonable application of knowledge on a fundamental, modern, practical basis”*. In order to achieve those requirements, teaching students need to be equipped with basic knowledge about specialty, professional knowledge when being studying at universities educating teachers (hereafter abbreviated to UsE (universities of

education)) so the issue of upgrading quality of training teachers at Universities of education becomes a strategic duty concerned by the government .

The 8th conference of central executive committee (11/2013) session XI issued Decree No. 29- NQ/ TW on “*Renovate basics and the entire education, meet the requirements of standardization, modernization, socialization under the condition of socialist-oriented market economy and international integration*” [40]. The decree determined the target of creating basic, strong changes concerning quality, effectiveness of education and training, also developing education with characteristics of open, real studying, industry, good teaching, good studying, good managing and brought forward 9 tasks, solutions to implement; in which, developing teachers and managing officials, meeting requirements of renovating education and training is one of critical solutions. As we know, math training program of UsE is divided into 2 main parts: basic scientific subjects to provide basic and professional knowledge concerning advanced math and primary math; educational scientific subjects: psychology, pedagogy, teaching methods... to produce teaching knowledge. Currently these 2 parts are presented almost parallel. This leads to 2 problems: Firstly, content of advanced math is independent, has little association with general math, usually appropriate with a few good students who have ability and are oriented to math research. For most of students, with target to teach at high schools, usually have a thought that learning is only for passing exam, which leads to no motivation, being not proactive in studying and resulting in their acquiring knowledge of the subject is limited; Secondly, independently teaching subjects of math teaching methods leads to an unconnected look toward math of students, unclear, non-systematical. To solve above issues, Universities of education need to renovate teaching and studying methods, renovate teaching program, teaching curriculum, need to combine cleverly teaching content of

basic scientific subjects with educational scientific subjects, take advantage of vocational elements when researching basic scientific subjects. Each teacher of basic scientific subjects must be example of teaching methods, self-learning and self-studying methods for students to be able to learn not only pure scientific knowledge, but also teaching skills to be able to apply to future work. Integrating vocational elements when researching basic scientific subjects helps students grasp thoroughly content of subject, creating motive, eagerness to study, and promoting proactivity, self-awareness, enthusiasms of students.

Nowadays, due to knowledge and science, technology constantly changes so the school no longer can provide everything for learners but basic knowledge, skills henceforth learners will develop them through proactive, creative activities of themselves. Students need to study “for real”, which means finding, selecting practical contents for themselves to work “for real”, useful for the society after graduation.

However, for a long time, connection between basic scientific subjects and educational scientific subjects at Universities of education is still of little interest. Students have not realized the role of advanced math in university. The contents of advanced math in general, advanced geometry in particular in Universities of education are presented almost separately from high school math, with main content based on axiom. This approach has an advantage of giving students systematical thinking when studying math, by still unfamiliar with them so making it difficult for students to understand advanced math at university level and the application of that knowledge to high school teaching in reality still has many limits. In scientific conference “Upgrade quality of teaching profession for students in universities of education” held on 28/01/2011 in Hanoi, Prof. Phan Trong Luan said, students from universities of education had increasingly diverged from the goal of training and had separating thinking [83, p. 21]. Through instructing students to pedagogically

practice, we realized that the ability to take advantage of advanced math application to reality still has many difficulties. Fundamental reason is that they had not have access to pedagogical direction when researching these subjects. This is limit of teacher in front of requirements for renovating programs, contents and high school math teaching method .

Advanced math, in addition to providing basic and deep knowledge for students, has great capacity for training students in terms of professional capacity, especially capacity for teaching geometry. Advanced geometry includes Affine and Euclidean geometry, projective geometry which are important modules in high school teacher training program. Advanced math studies space in general case of n dimensions so the properties are systematic and logical. Space in high school geometry can be considered as Euclidean space of 2 or 3 dimensions. Hence problems in advanced geometry can be specially changed into problems of high school geometry and vice versa, problems of high school geometry can be generalized into problems of advanced geometry. Looking at problems of high school geometry under the view of advanced math gives student the ability to orient, know how to scientifically use their knowledge to find out the solution. Moreover, scientific language of advance geometry helps student be able to change it into language of high school geometry. So if approaching pedagogical direction when learning and studying advanced geometry, students will be trained on ability to analyze high school math, generalize and similarize, pedagogically transform from science into imparted knowledge, helping cultivating ability to self-study, self-learn and step by step take control of teaching activities, complete professional capacity .

On the achievement above, we choose the research topic:

“TEACHING ADVANCED GEOMETRY IN UNIVERSITY FOR MATH PEDAGOGICAL STUDENTS IN THE DIRECTION OF PREPARING GEOMETRY TEACHING CAPACITY AT HIGH SCHOOL”

II. Research background:

Research on issues relevant to strengthening profession while teaching advanced math in universities of education have been of interest in recent years. Until now, there are many scientists researching this issue, such in materials [14], [26], [35],[32], [61]...In [61], authors Chu Trong Thanh, Tran Trung make it clear about modern math basis in terms of some content of high school math. For which, high school math is shown by modern math, helping teachers have unified, overall and deep view. By which, teachers can direct, promote appropriate knowledge when teaching each particular problem. In [35], authors Nguyen Van Mau, Nguyen Dang Phat, Do Thanh Son point out various applications of transformation in advanced geometry in high school problem-solving in terms of plane and space. According to authors, from overall properties in advanced geometry, if appropriately exploiting we totally can transform the advanced problem into high school language. They are useful references for teachers and high school students. Some books of advanced geometry are published in recent years such as “*Advanced geometry exercises*” by Nguyen Mong Hy [25], “*Affine geometry and Euclidean geometry and exercises*”[3] by Pham Khac Ban, Pham Binh Do... In here, authors focus on providing some particular exercises to apply knowledge of advanced geometry after each chapter but mainly specialize advanced geometry problems into high school geometry. Besides, there are some writings on journals, some articles on internet having focused on some aspect of this issue.

In terms of researching, training math student, in the direction of developing professional capacity, scientists like Dinh Quang Bao, Nguyen Ba Kim, Dao Tam, Bui Van Nghi... all have research works like in materials

[2],[13],[30],[39],[48],[54]... Besides there are some articles on journals like Education Science, Education Journal, some articles on yearbook of national, international conferences concerning this issue.

By studying materias, we have some opinions :

- In universities of education, teachers teaching basic scientific subjects, in addition to equipping foudning basic knowledge playing important role in forming and developing profesisonal capacity for student. Because teaching content of basic scientific subjects need to be filled with vocational teaching.

- Basic tasks of vocational training for students through educational scientific and basic scientific systems is going through channels related to that science, enabling students to analyze, identify high school math, finding connecition between 2 programs.

- The pedagogical transformation from advanced math knowledge to high school math knowkedge in textbooks needs to have the involvement of teachers teaching advanced math. In universities of educationl, need to teach basic scientific knowledge in the direction of professional capacity for students.

- On the basis of guaranteeing knowledge of basic curriculum or specialist, need to select and consider weight of knowledge to directly or indirectly serve lectures in high school...

There are many doctoral thesis exploiting this issued such as *strenghtening pedagogical direction in teaching generaml algebra through establishing some special subjects for advanced math students of College of education* by Đang Quang Viet, *Teaching advanced algebra of universities of educaiton associated with math programs at high schools* by Nguyen Van Dung, *Establishing and carrying out some special subjects for math students of univeisties of education to teach statistics-propabilitymath in high school* by Pham Van Trao, *Strengthening pedagogical connection between teaching content of set theory and logic, algebra structure with arithmetics content*

teaching in primary school math for students of primary education faculty in universities of education by Nguyen Thi Chau Giang, *Professional skill training methods for math pedagogical students through teaching primary math and math teaching methods in the universities* by Nguyen Chien Thang...

Whereby, we learn some ideas about advanced math teaching in the direction of connection with high school math, such as:

- Study methods to construct modules or special subjects for teaching specific knowledge related to content of high school math.
- Study how to instruct math students to self-learn, self-study content of advanced math in the direction of connection with high school math content.
- Study and apply new teaching methods (cooperative teaching, teaching by project...) to teaching some specific subjects in advanced math in universities.

In short, researching and exploiting connection with high school math in the course of teaching university-level advanced math has been focused by many authors. However there aren't any materials researching in detail, completely in terms of teaching advanced geometry in universities of education in the direction of forming capacity for teaching geometry in high school (hereafter we call it "Capacity of high school geometry" for pedagogy students.

III. Goal of researching

Make clear some element of capacity for teaching high school geometry and methods for teaching advanced math in universities in the direction of preparing capacity for teaching high school geometry for pedagogical students or in high schools.

IV. Subject of research, object of research, range of research:

4.1. Subject of research: Some methods for teaching advanced geometry for math pedagogical students and components of capacity for teaching high school

geometry for students through teaching advanced geometry in universities of education.

4.2.Object of research:

In the process of teaching advanced geometry in the training program for math students of universities of education.

4.3. Range of research:

Capacity for teaching high school geometry can be formed and developed for math students of universities of education through teaching advanced geometry in the direction of training math students the capacity for teaching high school geometry.

V. Scientific theory

If can determine components of capacity for teaching high school geometry and bring out appropriate pedagogical methods, then can prepare capacity for teaching high school geometry through teaching advanced geometry, contributing to upgrading quality of training professional capacity for math pedagogical students, meeting requirements for teaching in high school.

VI. Research task.

- Make clear problems related to thesis topic : capacity, professional capacity, teaching capacity... of math pedagogical student.
- Research components of capacity for teaching high school geometry of math students of universities of education that can be developed through advanced geometry.
- Find in reality of teaching advanced geometry in universities of education in the direction of exploiting, applying knowledge of advanced geometry to teaching high school geometry.
- Research, make clear of ability of advanced geometry to train capacity for teaching high school geometry for students.

- Propose methods for teaching advanced geometry in the direction of teaching high school geometry for math pedagogical students.

- Carry out pedagogical experiment to first step verify the possibility of the method proposed.

VII. Research method

7.1. Group of methods for researching theory

Research materials (books, journal, internet)

7.2. Group of methods for researching practice

Methods for inspecting, observing; specialist method, pedagogical experimental method.

VIII. Contributions of the thesis

8.1. In aspect of theory

- The thesis shows a conception of capacity for teaching high school geometry of math student of universities of education.

- Make clear of contents of advanced geometry that can be exploited to prepare capacity for teaching high school geometry for students and contents of high school geometry in the direction of connection with advanced geometry.

- Plan for teaching advanced geometry in the direction of preparing capacity for teaching high school geometry for math students of universities of education.

8.2. In aspect of practice

- Point out one more way for students to learn effectively advanced geometry.

- Proposed solution contributes to enhancing professional level for math pedagogical students, helping them be able to better exploit the ability to apply advanced geometry to train capacity for learning math of student at high school.

-Examples and pedagogical experimental special subjects are useful references in training capacity for teaching for math students of universities of education.

IX. Theoretical points proposed to defense

- The outlook on capacity for teaching high school geometry of math students of universities of education can be prepare via teaching advanced geometry.

- The ability of advanced geometry in preparing capacity for teaching high school geometry for math students of universities of education.

- Methods for teaching advanced geometry in the direction of preparing capacity for teaching high school geometry for math students of universities of education.

X. Structure of the thesis

The thesis includes 3 chapters, besides there are also introduction, conclusion and recommendation, appendix and references.

Chapter I - Theoretical and practical basis.

Chapter II – Methods for teaching advanced geometry in university for math pedagogical students in the direction of preparing capacity of teaching geometry in high school.

Chapter III - Pedagogical experiment.

CHAPTER I

THEORETICAL AND PRACTICAL BASIS

1.1. Some features about the formation and development phases of geometry subjects

Based on materials on math history and geometry history, we see that Geometry formed and developed basically through 2 main phases, which are: Ancient geometry studies unchangeable quantity with basic conceptions of geometrical shapes like: Point, straight line, triangle, cone ... and modern Geometry, starting at 17th century, with creation of mathematics of variable change and the appearance of Analytic geometry, using new tools such as vector and coordinates and developing more new geometry subjects.

1.2. Some tendencies to renovate the teaching of advanced math in universities of education

- Make clear of math basis, under the point of view of modern math, of some math contents of high school.
- Use tools of advanced math to solve problems and create high school math problems.
- Compile curriculum of advanced math taught in universities under lectures in more friendly language compared to that of high school math.
- Intensify interdisciplines.

1.3. Professional capacity of teacher

1.3.1. Capacity

Capacity is combination of characteristics, physical properties of individual suitable for typical requirements of a specific activity, in order to ensure high effectiveness of the activity.

1.3.2. Professional capacity. *Professional capacity is “ the correspondence between human physical characteristics and professional requirements” [12].*

1.3.3. Professional capacity of teacher

Professional capacity of teacher is understood as “An determined combination of physical qualities of characteristics, these qualities are conditions to achieve high results in teaching and educating children”. [11]

1.3.4 Professional standard of high school teachers in Vietnam

Currently, to concretize requirements for qualities and capacity of teachers, appropriate to education level, Ministry of education and training has issued Circular No. 30/2009/TT-BGDĐT, on 22/10/ 2009 regulating Professional standard of teachers of secondary school and high school (Teacher standard) [5]. They are system of requirements on areas that teachers need to have to meet goal of the education level.

1.3.5. Requirements for teaching capacity of students of universities of education

Output standard of students graduating from universities of education in Vietnam.

“Output standard” is system of basic requirements on ethical qualities and educational capacity that students must have when finish training course to be able to perform duties, functions of high school teacher at the level of at least passing the requirements. The purpose of output standard is to instructing in detail training activities, vocational training, in the process of training in universities of education. Therefore need to describe more specifically main constituents of profession quality like: knowledge, skill, attitude and specific steps of training skills to processise closely with specific indicators for each unit knowledge and skill. On that basis, in 2011, Ministry of Education and Training steered to complete research on Output standard of university level of High school teacher training major. The output standard of students graduating from universities of education make references to and have similiarities with Teacher standard, only different in terms of level of equirement of targets, ensuring after graduating,

student can work to the least level in teacher grade scale according to teacher standard.

Standard 4: TEACHING CAPACITY

Target 1. *Knowledge, skill of interdisciplinary, supplementary science.*

Target 2. *Knowledge, skills in subjects to be taught in high school.*

Target 3. *Capacity of developing subjects program.*

Target 4. *Capacity for applying methods, means and forms of organizing and teaching subjects.*

Target 5. *Divided teaching capacity.*

Target 6. *Integrated teaching capacity.*

Target 8. *Capacity for making and performing teaching plan.*

Target 9. *Capacity for evaluating academic results for students.*

Output standard frame of students graduating from universities of education is one of main fundamentals for us to research and put forward constituents of capacity for teaching high school geometry of math students of universities of education.

1.4. Capacity for teaching math of pedagogical students

Capacity for teaching math of pedagogical student is combination of:

- Knowledge and understanding of math: Have sufficient knowledge expected to be used in tasks that must be done by students.
- Knowledge and understanding of math frame program: The ability to interpret correctly intentions of official frame program of relevant math subject in the way that teachers create connection between students required to do things presented in official frame program of math subject.
- Understand how student thinks: the ability of understand thinking of students, the ability to explain and differentiate what students actually can do.

- Know how to design the teaching: the ability of teacher to react to what student did and to promote students' thinking.

Prepare teaching capacity for pedagogical students: We think that “*preparation*” teaching capacity for pedagogical students is activities of teachers and students in the course of teaching in university for the purpose of forming, developing constituents of teaching capacity, meeting requirements of output standard for university-level of pedagogy area of training high school teachers.

1.5. Some constituent of high school geometry teaching capacity of math students of universities of education

In our opinion, constituents of high school geometry teaching capacity that can be formed and developed through teaching advanced geometry in universities of education are: *knowledge and understanding of advanced geometry; Knowledge and understanding of high school geometry; capacity for organizing activities for understanding in teaching geometry; capacity for cultivating geometrical thinking for students; capacity of pedagogical transform; capacity for approaching and discovering in teaching geometry; capacity of connecting math with reality.*

Division of constituents is only relative, the constituents may have some common features, complementing one another.

1.5.1. Knowledge and understanding of geometry

Pedagogical students' understanding of advanced math in general, advanced geometry in particular, is shown in two aspects:

- Grasp thoroughly scientific content of the subject.
- Understand knowledge content of the subject (if any) connected with high school knowledge content and methods for exploiting such knowledge in the reality of teaching job in the future of themselves.

That not only does not decrease scientific quality of advanced math module but also helps students realize the potential ability of this subject in

developing professional capacity of themselves. Whereby promoting voluntary, effective learning spirit. Now, we will analyze content of advanced geometry in the direction of exploiting applications to high school geometry.

A. Objects and relationship of high school geometry can be viewed as a separate case of objects, relationship of advanced geometry.

B. Exploit transformations of advanced geometry to solve problems of high school geometry.

C. Exploit affine coordinates.

D. Discover similar math problems.

E. Discover new math problems.

1.5.1 Understand high school geometry

As analyzed in 1.4, knowledge and understanding of high school geometry of math pedagogical student are shown in some aspects: Knowledge and understanding of point of view, goal, content, method for building high school geometry program and relation with corresponding advanced geometry; knowledge and understanding of method for exploiting knowledge from textbook on point of view of modern math knowledge and math methodology knowledge. Whereby have accurate, systematic view about the subject, engraving internal and interdisciplinary relations; creating basis for knowledge standard, skill, attitude requirement of the subject.

Some contents implicitly express conception of advanced geometry: Direction of vector; summation of 2 vectors; length of vector; definition of transformation; 2 equal figures; similarity and similar figure...

Analysze high school geometry content in the direction of connection with advanced geometry

A. Objects and relationship of high school geometry can be used as visual means forming objects, relationship of advanced geometry.

B. Objects and relationship of high school geometry are used to develop

new relational objects by using invariance of transformation.

Based on essential foundation which is knowledge and understanding of advanced geometry and high school geometry in interdependent relationship, to teach well high school geometry, students need to train their ability to connect contents and methods as well between these 2 subjects. *Ability to connect between advanced geometry and high school geometry is understood as the ability to exploit content, research method of advanced geometry in teaching high school geometry and the ability to exploit the content, research method of high school geometry in teaching advanced geometry of students.* Understanding that connection is an condition to help students organizing activity of class well, developing thinking for student, designing the lecture suitable for students...Whereby do the geometry teaching job better in high school. We will analyze specific effect of this connection for development of some components of high school geometry teaching capacity mentioned above:

1.5.3. Capacity for organizing perceiving activity in teaching geometry

Capacity for organizing perceiving activity in teaching is a combination of psychological chrateristics of teacher, selecting methods for instructing students to do perceiving acts through activities for the purpose of developing intelligent qualities and characteristics for students.

Some modes of developing capacity for organizing perceiving activity through teaching advanced geometry for math students from universities of education:

Use objects of high school geometry as motivational situations leading to corresponding objects in advanced geometry; use tools of advanced geometry to solve high school math problems; Change forms of high school geometrical problems based on knowledge of advanced geometry; Determine original knowledge of knowledge needed to be found.

1.5.4. Capacity for training geometrical thinking for students

Some modes of preparing capacity for training geometrical thinking for math students from universities of education in the process of teaching advanced geometry:

- Teachers need to create situations with conflicts, difficulties, mistakes... on the basis of exploiting curriculum and the practice as well.

- Teachers need to enable students to self-learn, self-discover, find out new knowledge, dig deeper, overturn the problem to be able to grasp thoroughly.

- Teachers need to enable to students to study separate cases.

1.5.5.Capacity for pedagogical transformation

Pedagogical transformation from scientific knowledge into textbook knowledge is understood as streamlining teaching contents, for the purpose of simplifying the weight and difficult level of teaching contents to be appropriate to the ability to perceive of learner. In this research, in our opinion, need to have a pedagogical transformation in the direction of : From knowledge of high school math into knowledge of advanced math. In the process of teaching advanced math at university level, teachers can use contents of high school math that students have carefully taught such as visual images, motivating similar contents of advanced math. Through specific images, by thinking methods like generalization, similarization...change into knowledge of advanced math. According to us, that is pedagogical transformation from low level to the high one.

Some modes of training capacity for pedagogical transformatoion for math pedagogical students in the process of teaching advanced geometry: Exploit solutions for high school math problem by using advanced math knowledge, modern math, then change to solution for high school math; Use invariables of mappings to orient correctly and promote correct knowledge to solve problems set forth; Use models of advanced math, modern math for one object, mathematical relationship and finding out how to express them in high

school language to train students to discover new math problems...

1.5.6. Capacity for access and discovery in teaching geometry

Can understand that *Capacity for access and discovery in teaching math* as a combination of features, psychological properties of math teacher appropriate for requirements of instructing students to access to activities of discovering new knowledge.

Some modes of training capacity for access and discovery:

+ Instruct students to start at specific separate cases and the generalize into conceptions of advanced math.

+ Instruct students to take specific examples in high school math to illustrate relatively abstract conception of advanced math.

1.5.7. Capacity for connecting math with reality

In our opinion, *capacity for connect math with reality* is understood as individual psychological characteristics meeting requirements of using mathematical thinking, mathematical tools appropriate to influence, study, change, arrange objects in reality for the purpose set forth.

Some modes of training math students in capacity for connecting math with reality: Train students in some basis for dialectical thinking on application of math; practice mathematically modeling some situations associated with learned mathematical knowledge; find out origin of math knowledge; history of math; expand range of applying math knowledge to reality....

1.6. Survey reality of teaching advanced geometry in the direction of preparing professional capacity for math students in some universities of education.

We will survey for purpose of finding out opinions of teachers and students on the necessity of teaching basic scientific subjects in general, advanced geometrical subjects in particular, in the direction of preparing professional capacity for math pedagogical students in universities of education and actual state of training some constituents of professional capacity through

teaching basic scientific subjects. Results of the survey firstly show that teaching advanced geometrical subjects in the direction of connection is a demand of reality.

CHAPTER II

THE TEACHING MEASURES OF ADVANCED GEOMETRY IN UNIVERSITY BY TEND OF PREPARING FOR THE MATHEMATICS PEDAGOGICAL STUDENTS WITH CAPACITY OF TEACHING GEOMETRY IN HIGH SCHOOL

2.1 Some rules for supplying building methods:

2.1.1 Rule 1.

The methods focus on taking shape and development ability of teaching High school geometry for mathematics students of universities of education.

2.1.2 Rule 2.

The proposing methods in order to improve self- educated awareness, participate science research and practice professional capacity for the mathematics students of Education University. Thanks to, contributing in help students apprehend knowledge well, mathematics and complete the other duties of subjects in University.

2.1.3 Rule 3

The method is carried out basis on achievements of modern science and the theory of universities of education, having inherit nature of methods which is used.

2.1.4. Rule 4

The proposing methods must have effect in program condition, facility of university.

2.2 Methods

2.2.1 Method 1: Building some situations for students practice activities of relationship exploitation between advanced geometry and high school geometry.

2.2.1.1 Object of method

Implementing this method in teaching process of Advanced Geometry in order to open students in the first studying of relationship exploitation between Advanced Geometry and high school Geometry.

2.2.1.2 Content of method

The first, in teaching process, teachers can use objects in high school geometry as visual pictures to illustrate for every content, knowledge advanced geometry.

The second, in teaching process, teachers can use knowing beforehand notions in high school geometry, and then have development, tectonics for similar notions of advanced geometry.

The third, in teaching process, teachers make condition for students to use tools of advanced geometry to orient, search solution of mathematical problem and then change language into suitable solution with high school

For example 2.4 Mathematical problem of butterfly in high school, with content as following:

Give circle (S), a chord AB have the H general point. Through H draw 2 chord arbitrary CD and EF. Put $P = CE \cap AB$; $Q = DF \cap AB$; $R = CF \cap AB$; $T = DE \cap AB$.

Prove that: H is the central point of intercepts PQ and RT.

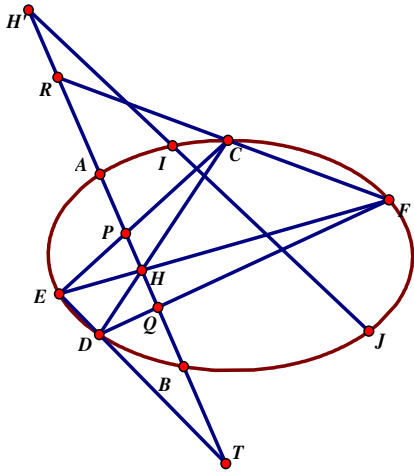
Firstly, we can move this mathematical problem into a problem of projective geometry, is:

In Euclidean plane E_2 , complement endless straight line Δ to have picture plane P^2 . At that time, circle in E^2 become oval pass 2 points cyclic I, J. Calling $H' = AB \cap \Delta$.

At that time, given problem into projective problem as follows: giving oval line (S), I, J is 2 xiclic point. $AB \cap IJ = H'$. H is point so that $[ABHH'] = -1$. Through H drwaw 2 chords arbitrary CD and EF. Putting $P = CE \cap AB$; $Q = DF \cap AB$; $R = CF \cap AB$; $T = DE \cap AB$.

Demonstration that : $[PQHH'] = [RTHH'] = -1$

Solution :

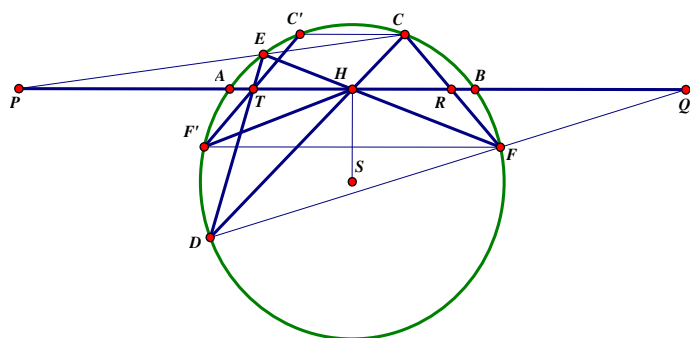


Application the second Desargues theorem, for geometry of 4 overal tops CEDF with straight line AB, we get 4 couple of points (A,B),(P,Q),(R,T),(H,H), is 4 couple of points in the same involutory projective Relationship. In other words, involutory method between the above couple of points receive H as a motioness point. That $[A,B,H,H'] = -1$. Infering H' is the second motionnes point. So $[P,Q,H,H'] = [R,T,H,H'] = -1$.

Thence, move the result to Euclidean plane, H is the central point of both PQ and RT.

Based on solution in projective geometry, we change explanation into high school geometry:

Involution with pair of points (A,B) suggests us to consider f as SH axial symmetry. At the time $f(F) = F'$, $f(C) = C'$. We prove $f(R) = T$. Yet $R = CF \cap AB$; $f(R) = f(CF) \cap f(AB) = C'F' \cap AB$. Or need to prove F', T, C' in straight line. Due to nature of axial symmetry, we have $\widehat{AHF'} = \widehat{BHF}$ (1); $\widehat{HFC} = \widehat{HF'C'}$ (2) $\widehat{BHF} = \widehat{TDF'}$ for blocking arcs with equal dimensions so $\widehat{AHF'} = \widehat{TDF'}$ or quadrilateral THDF' is inscribed quadrilateral . Accordingly $\widehat{HF'T} = \widehat{HDT} = \widehat{HFC}$ (3). From (2) and (3), we have $\widehat{HF'T} = \widehat{HF'C'}$ or matter to be proved



Like this, we can realize, this tend help students prepare pedagogical converting ability from advanced geometry solve problems high school geometry effectively.

The fourth, students is practiced generalization ability from mathematics problem of flat Geometry into space Geometry and Advanced Geometry.

Because of substance of Advanced Geometry is studying natures of objects in space of n side, it is general mathematics problem. So, if students have studying of mathematics problems carefully, notions of Advanced Geometry, they will take the basis attribute and impression method of feature. So, when precede a mathematics problem of high school GEOMETRY, students know how to associate to give mathematics problem into general case, from general solution method, move language into solution method of PT.

For example 2.5. Returning example 2.4, we realize that after moving mathematics problem into projective geometry and solve mathematics problem by Advance Geometry, students suggest about how to solve that mathematics problem in high school on one side. On the other hand, from the general mathematics problem, students can still specialize in the other case of quadratic line to have a various exercise system: *The butterfly mathematics problem with the couple of straight line, the butterfly mathematics with elip, the butterfly mathematics with Hyperbole, the butterfly mathematic with parabol.*

After students can open widen dimension, generalize the mathematics problem.

2.2.3.Method 3: *Complementing topics in documents to lead students to teach*

oneself subjects by strengthening way of exploitation activities of relationship between advanced geometry and high school geometry.

This method is in order to help students in practicing through activities, one-self educative ability, one-self studied.

2.2.4 Method 4: *Organization for the mathematics teaching students in practicing activities that combine with advanced geometry and high school geometry through seminar science.*

2.2.4.1 Object of method

This method is in order to practice pedagogical converting ability. Through seminar activity, students still develop organization ability of perception activities, foster thought of criticism, dynamic thought, independent ability action... and help students familiarize oneself with studying method in groups as well as self educated, one-self studied and presentation ability before crowd.

2.2.4.2 Contents of method

According to our research, the following topics of Advanced Geometry can use method of seminar:

Topic 1: Analysis problems in program of High School basis on thought of Advanced Geometry.

Topic 2: Classification and solution topics of High School and studying its relationship with Advanced Geometry.

Topic 3 : Research immutabilities of detail change groups on Affin spaces and Eculide spaces.

Topic 4: Excavation and solution problem basis on thought of Advanced Geometry and converting into languages of Advance Mathematics.

Topic 5: Creativity new mathematics basis on Advanced Geometry.

Specify theoretical basis and provide illustration ...

Method 4 serves the purpose of organizing students to learn proactively, creatively, showing their ability and also helping them grasp how to organize group activity so afterwards they can apply to teaching math in high school. This teaching method shows highly fragmenting characteristic in students. Organizing group discussion with the presence of teachers for the purpose of maximizing number of students is reported to the crowd for number of students report is not many, besides lecturers can evaluate more accurately capacity and contribution of each individual.

2.2.5. Method 5: *Training the ability to connect math with the reality for pedagogical students based on ideology of advanced geometry.*

2.2.5.1. Goal of the method

This method serves the purpose of developing capacity for connecting math with reality as well as the professional reality of students.

2.2.5.2. Content of the method

(1) Train students in dialectical thinking basis through reasonably installing into advanced geometry lectures.

(2) Create opportunity for students to model math in practical situations.

(3) Through lectures, make clear of origin of development of math knowledge for students.

(4) Exploit, expand the range of applying math knowledge to reality.

Example 2.16. Consider problem: Given that O is the point in triangle ABC. Call S_1, S_2, S_3 respectively areas of triangles OBC, OCA, OAB.

Prove $S_1 \overrightarrow{OA} + S_2 \overrightarrow{OB} + S_3 \overrightarrow{OC} = \vec{0}$

Solution : Call S is area of ABC triangle.

Draw $ON \parallel AB$; $OM \parallel AC$; OO' and BB'

perpendicular với AC . We have:

$$\overrightarrow{AO} = \overrightarrow{AM} + \overrightarrow{AN} = x \overrightarrow{AB} + y \overrightarrow{AC}; x = \frac{AM}{AB}; y = \frac{AN}{AC};$$

$$x = \frac{AM}{AB} = \frac{ON}{AB} = \frac{KO}{KB} = \frac{OO'}{BB'} = \frac{S_2}{S}$$

Similar $y = \frac{S_3}{S};$

$$\overrightarrow{AO} = \frac{S_2}{S} \overrightarrow{AB} + \frac{S_3}{S} \overrightarrow{AC} = \frac{S_2}{S} (\overrightarrow{OB} - \overrightarrow{OA}) + \frac{S_3}{S} (\overrightarrow{OC} - \overrightarrow{OA})$$

hay $S_1 \overrightarrow{OA} + S_2 \overrightarrow{OB} + S_3 \overrightarrow{OC} = \vec{0}$

We can solve this mathematic problem by a method

Method 1: We take special case, if O is a point of triangles sides ABC under equal corners is 120° (O is centre of three circumscribed circle equilateral triangles have side in turn is AB, BC, CA erect outside triangles) infer formula become:

$$\frac{OA \cdot OB \cdot OC \cdot \sin 120^\circ}{OA} \overrightarrow{OA} + \frac{OA \cdot OB \cdot OC \cdot \sin 120^\circ}{OB} \overrightarrow{OB} + \frac{OA \cdot OB \cdot OC \cdot \sin 120^\circ}{OC} \overrightarrow{OC} = \vec{0}$$

$$\Leftrightarrow \frac{1}{OA} \overrightarrow{OA} + \frac{1}{OB} \overrightarrow{OB} + \frac{1}{OC} \overrightarrow{OC} = \vec{0}$$

This result bring to a familiar physical knowledge is that if action in a thing with three equal strengths and make together corner 120° , thing at rest.

Method 2: Similarization by structure into mathematics problem with quadrilateral.

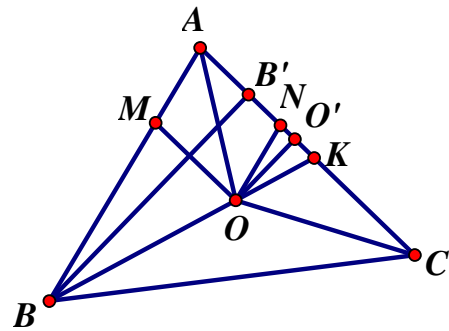
Let O is a point in the tetrahedron $ABCD$. Call V_1, V_2, V_3, V_4 in turn are volum of tetrahedrons $OBCD, OCDA, ODAB, OABC$.

Show that $V_1 \overrightarrow{OA} + V_2 \overrightarrow{OB} + V_3 \overrightarrow{OC} + V_4 \overrightarrow{OD} = \vec{0}$

Method 3. Generalize to problem with complex.

Let O is a point in the $(n-1)$ -complex $S(A_1, A_2, \dots, A_n)$ in $(n-1)D$ space A .

Call V_i is volum of $(n-1)$ -complex that reduces $A_i, S(O, A_1, A_2, \dots, \widehat{A}_i, \dots, A_n)$



Show that $V_1 \overrightarrow{OA_1} + V_2 \overrightarrow{OA_2} + \dots + V_n \overrightarrow{OA_n} = \vec{0}$

Prove

We have A_1, A_2, \dots, A_n is n of independent points to create an object affine of affine space A.

Suppose $\overrightarrow{A_1 O} = x_2 \overrightarrow{A_1 A_2} + \dots + x_n \overrightarrow{A_1 A_n}$

$x_2 = \frac{OO'}{A_1 A_2}$ with O' is projection of O by direction $A_1 A_2$ down (n-2) – flat contains

$S(A_1, \widehat{A_2}, \dots, A_n)$.

Because triangle OO'H similar with triangle $A_2 A_1 H_2$, so we have:

$$x_2 = \frac{OO'}{A_1 A_2} = \frac{OH}{A_2 H_2} = \frac{d(O, \alpha_2)}{d(A_2, \alpha_2)} = \frac{V_2}{V}$$

Similar theory we have: $x_i = \frac{V_i}{V}$ ($i = 1, \dots, n$); So:

$$\begin{aligned} \overrightarrow{A_1 O} &= \frac{V_2}{V} \overrightarrow{A_1 A_2} + \dots + \frac{V_n}{V} \overrightarrow{A_1 A_n} \Leftrightarrow V \cdot \overrightarrow{A_1 O} = V_2 \overrightarrow{A_1 A_2} + \dots + V_n \overrightarrow{A_1 A_n} \\ &\Leftrightarrow V \cdot \overrightarrow{A_1 O} = V_2 (\overrightarrow{OA_2} - \overrightarrow{OA_1}) + \dots + V_n (\overrightarrow{OA_n} - \overrightarrow{OA_1}) \\ &\Leftrightarrow (V - V_2 - \dots - V_n) \cdot \overrightarrow{OA_1} + V_2 \overrightarrow{OA_2} + \dots + V_n \overrightarrow{OA_n} = \vec{0} \\ &\Leftrightarrow V_1 \overrightarrow{OA_1} + V_2 \overrightarrow{OA_2} + \dots + V_n \overrightarrow{OA_n} = \vec{0} \end{aligned}$$

We have a fact needed to be proved:

Ideologies of measure 5 contribute a part in education infer measure for students of math teaching. Having the qualifications, because is an integral part of life, is an effective tool to solve problems not only in the internal math but also the other sciences as well as in fact. Research, teaching of math in the school need to tend availability of math to bring into play it 's potential strength in all fields of society. That is indispensable tent in changing of math education in universities and high school.

Chapter III. PEDAGOGICAL EXPERIMENT

3.1. Purpose of the experiment

Pedagogical experiment to initially test the feasibility and effectiveness of implementing a number of measures proposed in the thesis. From which to draw some initial conclusions and supplement recommendations for :

- Contributing to teach advanced geometry at university more effectively.
- Enhancing the ability to practice of math pedagogical students in analyzing curriculum content , textbooks .
- Contributing to build projectional capacity for math pedagogical students.

3.2. Contents of the experiment

Content 1. Experiment on organization of teaching some contents advanced geometry in program of university by tent of preparing for the math teaching students.

Content 2. Experiment on organizing seminars, group discuss about topic with contents of advanced geometry of subject by tent of preparing the teaching ability high school geometry for the math teaching students.

Content 3. Lead students to make graduation thesis by tent of studying topic. Implementing some contents by tent of researching topic for making graduation thesis of students.

3.3. Organize experiment

Content 1 is carried out for the second- year students in program of math teaching training at Hai Phong University and Hong Duc University, Thanh Hoa. From 2/2013 to 5/2013.

We carry out experiment under built-in method of topics into the teaching process of contents. Affine and Euclidean geometry. Incessantly, we combine to give the building exercise system by orientation of teaching ability preparing high school geometry in measure 2 for practicing in teaching process of students.

Contents 2 is carried out for the students of math faculty, Hai Phong University. We carry out seminar with 82 fourth year students in the classes: Bachelors grade math teacher K11 and Bachelors grade math K11 in seminar contents: Distribution is carried out from 8/2013 to 11/2013. Seminar Content is directly compiled and instructed by the author. Contents 3 is developed by the author for 4 students

3.4. Experiment result and some first comments

The pedagogical experiment process was carried out many times with many different periods in Hai Phong University since take shape idea of graduation thesis. Through experiment process, we draw conclusion: the teaching measures that we give in chapter 2 can accept. The measures is effective methods in order to develop teaching ability high school geometry, a basis part of professional capacity for the math students of education university through teaching advanced geometry in particular, advanced mathematics in general.

Conclusion

The graduation thesis makes it clear in teaching advanced geometry subject in University in the direction of preparing for math teaching students some teaching qualifications through the following:

-After systematization in terms of theory and fact, the thesis gave a system that include 7 facts of teaching qualification high school geometry of the math teaching students and then they can take shape it through teaching subject advanced geometry

-Giving ability of advanced geometry subject in practicing of teaching qualification high school geometry for students. Through the detail example, the graduation thesis gives method for exploiting the abilities in process of teaching advanced geometry content.

-The graduation thesis gives viewpoint, regulation and 5 measures of teaching advanced geometry with purpose to take shape, develop facts of teaching qualification of high school geometry mentioned above for math teaching students of university level.

-The first testing feasibility of measure by pedagogical experiment

The research results followed, complemented results of precedents in training of math teaching university in order to contribute to form necessary abilities in professional capacity for students through basic scientific subjects. The graduation thesis can used as a reference for coworkers, students from universities of education and math teachers in high schools.