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Organizing Project Based Teaching in the Training of Math Teachers in Vietnam

Tran Viet CUONG¹

Abstract. Project based teaching has already been used in many countries around the world, including Vietnam. After overview research about project based teaching of some domestic and foreign authors, we suggest that the process of organizing project based teaching in the training of math teachers in Vietnam include 4 stages: Preparation; Planning the way to perform teaching projects; Performance of the project; Reporting the products and assessing the projects. In the final part of the article, we will mention the use of this form of teaching in the process of showing the methods of teaching to students of Math Education in Vietnam. The results of this experiment have shown the effectiveness of this form of teaching in the training of math teachers in pedagogical universities in Vietnam.

Keywords: Project based teaching, math teachers, Vietnam.

1. Introduction

According to Michel Knoll (1997), the concept of “project” in teaching was first used in vocational schools in Italy starting at the end of the 16th century. After that, this concept was used in France. Later, the idea of project based-learning (PBL) traveled to a number other European countries and to the U.S. At the beginning, PBL was mainly used in technical fields and in architecture. Later, during the rush of the development of information and communication technology (ICT), PBL was used in many other study domains and many different subjects. PBL received special attention in the educational system in the U.S. from the beginning of the 20th century and from the 6th decade of the 20th century in Europe. Today, PBL is used in many countries, in many different domains and is applied in many different subjects, at every level. PBL was called one of the ways that is especially important and that aim at the reform of teaching methods by many schools around the world. During all these years, there were many researches about PBL, belonging to some authors such as: David Moursund (2003), Joseph L. Polman (2002), John W. Thomas (2000), Peter D. Hiscocks (2004), Bell S. (2010), Des Matejka (2010)...

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In Vietnam, according to Nguyen Van Cuong and Nguyen Thi Dieu Thao (2004), the form of writing papers, such as studies or essays is closely related to PBL. The teacher introduces an issue or a topic to the students, and they have to figure it out within a given amount of time. In this given time, students perform a series of assignments with research characteristics independently, but with the support and following the instructions of the teacher. Since Nguyen Van Cuong's research work about PBL (1997), today there some education researchers who approached this issue and published their results such as: Do Huong Tra (2009), Nguyen Thi Hoang Yen (2012), Dinh Huu Sy (2014). In recent years, because of the increased collaboration between Vietnam and other countries and international organizations, and because of the development of ICT, the use of PBL in Vietnam is increasing day by day. Programs promoting the application of ICT amongst high-school teachers belonging to some international companies or organizations such as Intel and Microsoft also played an important role in spreading and using PBL in Vietnam. Intel's "*Teaching for the future*" program from 2003 stated that the main purpose is to help high-school teachers to know how to use and exploit the computer in order to contribute to the constitution and development of students' imagination and finally teach students to more effective methods and forms based on the foundation of PBL. A number of training programs from the framework of the Ministry of Education and Training have started to present the use of PBL to some teachers and education administers.

After some domestic and foreign authors' reasoning for using PBL and from the research and the practical training of math teachers in Vietnam our article presents the options for organizing PBL in the training of math teachers that are appropriate for the Vietnamese education.

2. Purpose of the study

The main objective of this study is to propose a process and to use that process to organize project-based teaching in the training of math teachers in Vietnam.

3. Research questions

This study to answer the following questions

1. What are project-based teaching?
2. What is the process of project-based teaching in teacher of maths education in Vietnam?

3. What are the results of using project-based teaching in teacher of maths education in Vietnam?

4. Research method

This study use following methods: theoretical studies (analysis, synthesis, systematized, generalized, ...); Practical observation; Interviewing experts, education management, teachers and pupils.

Based on the results and numbers of student learning specific contents teaching methodology from the Math faculty of the Thai Nguyen University of Education, Thai Nguyen city, Vietnam, we chose class N02 to be the experiment and class N01 to be the control experiment. The control experiment class was taught in the form of memorizing information and the experiment class was taught in the form of PBL. The time of the experiment was August 2016 – April 2017.

Then we conducted the orientation assessment (The knowledge assessment, The student's pedagogical duties practice assessment) and the quality assessment. Since then, we have come to the conclusion of organizing project based teaching in the training of math teachers in Vietnam.

5. The content of the research

5.1. Project based teaching

The term “project” means *a scheme, a draft or a plan*. Today, the concept of project is frequently used in production, business, and scientific research and also in social administration... Therefore, *a project is the process of an activity of one or more persons to perform a plan that they made themselves in order to create products that were defined as goals*.

At the beginning, the concept of project was popular in almost all of the socio-economic domains. After that, this concept spread into the education and training field not only as a way of developing the education but also as a way for teachers to teach their students. Therefore, project based learning is *a project in which the student performs a complex assessment combining theory and practice, knowledge, skills and practical experience in many different domains*.

Nowadays, education researchers in Vietnam and around the world have many ways to define BPT, but authors agree a few points:

- PBL is a form of learner-centered teaching. In PBL the learner has to do research and to perform a complex assessment that the teacher gives to achieve knowledge and skills and to gain necessary strengths on their own.

- In PBL, all learning activities are designed carefully, with regard to the syllabus, with interdisciplinary knowledge and the learner is in the center.

- In PBL, the result of the learning process is to create realistic yields.

In our opinion, *PBL is the way to teach PBL under the instruction and control of the teacher.*

Therefore, in PBL, learners must perform complex assessments combining theory and practice; combining knowledge, skills and practical experience of many different fields. Learners must create a plan themselves, perform according to that plan, assess the results, and finally create the products to match the goals. The final product of all groups of students of all PBL may be a lecture session, a report or a webpage. PBL leads the learner to perceiving the knowledge and create the skills and strengths that are necessary in the process of solving complex problems. This PBL allows the creation of more opportunities for the learner to study. PBL gives the learner a positive role, similar to problem solvers, investigators, or people who write reports. All these duties are met by the learner with high self-reliance throughout the process of learning.

5.2. The use of PBL in the training of math teachers in Vietnam

In order to organize PBL for students of Math Education effectively, to promote the strengths of PBL and to respond all the requirements in teaching, to help the student not only to have basic knowledge but the form and cultivate the skills, strengths that pedagogy requires, the teacher and the student need to perform the following activities: (diagram 1):

Diagram 1. *The process of organizing PBL for students.*

a) Preparation. During this stage, the teacher and students need to perform the following activities:

- *Form the PBL:* The teacher and students research the goal, the requirement and the content of the syllabus of this discipline in order to be prepared for the possible topic that will deploy the PBL. From there, the teacher and students define the target, the activities that must be perform in PBL (theoretical research, research realistically, at school, practice in class), define the products that must be achieved after completing the PBL (The group's PBL performance detailed plan, each member's research content, the group's theoretical research content, the group's theoretical research product report content, the sample teaching hours evaluation notes of all the members in the group, the group's high school field research product report, the groups' lesson plans, the teaching periods evaluation notes of all the members of the group), the expected time to perform PBL, define some

timelines in the process of PBL (report the PBL performance detailed plan, the field research at high schools, sample teaching observations, the theoretical research product report, the approval of the lesson plan, the actual teaching).

- *Divide the students into groups*: On the basis of the target, the amount of knowledge of PBL, the strength of each student, the teacher, together with the whole class, decides the number of students of each study group. The whole class organizes the division of the class into groups so that each group has very good students, good students, and average students... to proceed with performing PBL. Each group elects one student to be the leader of the group and supervise the activities of that group.

- *Inform the students about the reference documents*: the teacher will show the students the sources of the main reference material to serve the completion of the PBL research products, such as: refer to which documents? Which webpage?

b) Planning the way to perform PBL. During this stage, the teacher and students need to perform the following activities:

- *Planning the way to perform PBL*: All study groups proceed with group meetings to build the PBL performance detailed plan, define each activity that is necessary to deploy for each part of the work such as: theoretical research (define the title of the written assignment, define the contents that need to be researched, divide the assignment amongst students, such as: research a specific content, write the group's research product, design the group's research product report content), field research at high schools (the group meetings prepare all necessary details when going high schools, the assignment of the person who writes the high school field research harvest report), create a lesson plan and teach in class.

- *Check whether the PBL performance plan is possible*: After each group completes the PBL performance detailed plan, the teacher inspects the PBL performance plan of the group makes suggestions for the PBL performance detailed plan of each group so that it is possible, effective and time-saving.

c) Performance of PBL. During this stage, the teacher and students need to perform the following activities:

- *Theoretical research*: In order to complete their research product, each study group needs to do the following tasks: Each member or small group within the study group must work to proceed with collecting and researching the documents, searching and managing the information... complete the research product; write the research product of the group (the student

generalizes the content of individual written assignments in order to complete the research product of the whole group); have group discussions so that the members perceive the content that the group is researching and complete the group's research product; design the group's research product report content (the student will design this based on the group's research product content); have group discussions to complete the report content and to practice reporting before in front of the group.

- *High school field research*: In order to succeed in with this activity, the groups need to perform the following tasks: discuss all the activities when going to high schools (define the amount of knowledge, the knowledge to be taught during the observed teaching period, define the exact activities to be done when going to high schools...); observe the sample teaching of the high school teachers; discuss the construction and deployment of the planned teaching content that the group is researching at the high school with the high school teachers; have group discussions to exchange ideas, assess and comment the high school teacher sample teaching content and exchange ideas for the information paper; write the information paper and present it to the teacher.

- *Teaching practice in small groups*: In order to succeed in with this activity, the groups need to perform the following tasks: Each group is divided into smaller groups, each of these smaller groups chooses a teaching content that belongs to the topic that is researched, in the high school syllabus in order to make a lesson plan, have a group meeting to make the lesson plan, present it to the teacher, make corrections according to the teacher's requirements and practice teaching within the smaller groups.

- *Check PBL performance progress*: During the process of the groups performing PBL, on the basis of the PBL performance detailed plan that the groups build, the teacher checks the progress of each student in performing their work as well as the general PBL performance progress of the whole group. If necessary, the teacher helps students perform seriously, correctly and complete the requirements. Also, during this process, the teacher must also check whether the PBL products of each group are appropriate with the content and the target of PBL as required or not.

d) Reporting the products and assessing the PBL of a group:
During this stage, the teacher and the students need to perform the following activities:

Report the theoretical research products in class: In order to complete this activity, the teacher and the students need to perform the following tasks:

the teacher, together with the students prepare all the basic material for each group to be able to present their theoretical research products report in front of the class and teacher. The delegate of each group presents the theoretical research products report content in front of the class. The whole class and the teacher make suggestions and ask questions with the purpose of discussing the group's research content. The delegate student of the reporting group asks all the questions that the teacher and the class ask. Based on the suggestions and assessments of the teacher and the class, the study groups make corrections in order to improve their research product and submit it to the teacher.

- *Teaching practice in class*: In order to complete this content, teacher and the student need to perform the following duties: the teacher, together with the students prepares all necessary basic material so that each small group proceeds with the teaching the content of the lesson prepared in advance. The delegate of each small group comes and presents the content of the lesson to the class. The class and the teacher observe, comment, assess and make suggestions about the content of the lesson. All the groups submit their lesson plans to the teacher.

- *The teacher and the students assess and comment the PBL performance results of each group*: Based on the results of the activities to deploy the PBL performance such as: theoretical research, field research in high schools, create a lesson plan the teaching practice of each group... the teacher and the students comment and assess the PBL performance process as well as the PBL performance result of each group.

For example:

Organizing PBL with the content “Teaching equations” for students

Equations are one of the knowledge circuits that go all the way through the high school math syllabus. Regarding its position and its role in high schools and its teaching practice we realize that the content of equations is appropriate to organize PBL for pedagogy students. Therefore, we choose this topic to organize PBL for pedagogy students of math.

The plan to organize PBL with the content “Teaching equations to students”:

1) The title of the PBL: Teaching equations to high school students.

2). The time to perform: 3 weeks.

3). The target of the PBL: The target is defined below:

About the knowledge

- Students generally and systematically understand the syllabus of the topic “Equations” as they are presented in high school syllabus.
- Students understand the way to organize and what to pay attention to when teaching the concept “Equations” and other related concepts.
- Students understand the way to organize and what to pay attention to when teaching the solutions for “Equations”; understand the methodology knowledge; figure out some difficulties and mistakes that are common amongst students when solving the main forms of “Equations” and figure out solutions for the students...
- Students understand the way to organize and what to pay attention to when teaching how to solve math problems with the use equations; the realistic uses of equations in science and life.

About the pedagogical major practice

Through PBL, there are some skills and strengths that form in the student: the establishment of a studying plan; the deployment of a teaching plan; the cultivation and improvement of their disciplinary level; the solving of problems that may appear during teaching practice; the ability to anticipate tasks in advance; the ability to research a syllabus or a textbook; the ability to choose and research documents; the ability to organize activities to increase the knowledge while teaching math in high schools; the strength of having a grasp of the knowledge of orientation, adjust the students’ knowledge activities; the strength of understanding math and using the math knowledge to explain different situations spontaneously, the solving of practical math problems; the strength of cooperation... All these skills and strengths be formed and trained through activities such as: the process of building and deploying the PBL performance, through the research activities, finding the material, the syllabus and the textbooks, through discussions with high school teachers, with their own teacher, during group discussions, during observing other classes...

4) The duty of the PBL: Each study group must proceed with the following tasks:

- *The theoretical research:* Each member of the group, according to their duty, proceed to find out information and research the problems in the theoretical research content (the content, the topic “Equations” as exposed in high schools, according to the syllabus; understand certain points to pay attention to while teaching “Equations”; the “Equations” methodology knowledge; figure out some of the high school students’ common difficulties

and mistakes when solving equations; systemize the formulas and the methods for solving equations...); Discuss within the group so that all members understand the research content; complete the research product and the group's research product report content and report the research product in class.

- *High school field research*: students find out about the organization of teaching equations in high schools, proceed with observing a lesson about equations taught by a high school teacher and complete the group's harvesting information report after coming back.

- *Teaching practice in class*: each group is divided into 3 smaller groups and each of these smaller groups chooses a lesson about equations from the syllabuses of grades 10, 11 and 12 to make the lesson plan, submit it to the teacher and practice teaching.

5) *The reference material*

1) Nguyen Ba Kim (chief author) (1994), *The methodology of teaching math part 2 – Teaching the basic content*, The Education Publishing House.

2) Hoang Ky, Nguyen Van Bang, Nguyen Duc Thuan (1979), *Primary algebra*, The Education Publishing House.

3) Bui Van Nghi (2008), *Methodology of teaching specific math contents textbook*, The Pedagogical University Publishing House.

4) Textbooks, Exercise books and Teacher's books of grades 10, 11 and 12.

6) *The PBL performance plan*

• *The preparation*

The teacher's duties	The students duties
<p>- Together with the students, prepare the content and the topic that may be deployed to organize the PBL. From there, the teacher and the students define the target of the PBL, define the tasks that need to be performed during PBL, define the products that need to be after completing the PBL, set the deadline for performing the PBL, define several important key moments in the process of the PBL performance.</p>	<p>- Together with the teacher, prepare the content and the topic that may be deployed to organize the PBL. From there, the students and the teacher define the target of the PBL, define the tasks that need to be performed during PBL, define the products that need to be after completing the PBL, set the deadline for performing the PBL, define several important key moments in the process of the PBL performance.</p> <p>- Together with the teacher, divide</p>

<ul style="list-style-type: none"> - Together with the students, divide the class into groups. - Present the reference material to the students. 	<ul style="list-style-type: none"> the class into groups. - Listen and note the problems.
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• **Planning the way to perform PBL**

The teacher's duties	The students duties
<ul style="list-style-type: none"> - Monitor the working process and help the groups. - <i>Check whether the PBL performance plan is possible:</i> after each group submits their detailed plan, the teacher checks the PBL performance plan of all groups and then makes suggestions about the PBL performance plan of each group so that it is possible, effective and time saving. 	<ul style="list-style-type: none"> - <i>Building the PBL performance plan:</i> Organize a group meeting to build the PBL performance plan, define the tasks that have to be done: the theoretical research (define the title of the written paper, define the content that have to be explored.), the field research in high schools, the making of the lesson plan, the teaching practice in class, each of the group's members' task (who collects information about the theoretical research specific contents, writes the group's theoretical research product, designs the theoretical research report, writes the field research in high schools report.) - Report the PBL performance plan to the teacher, make corrections according to the teacher's suggestions.

• ***The performance of the PBL***

The teacher's duties	The students duties
<ul style="list-style-type: none"> - Monitor the working process and help the groups. - <i>Check the PBL performance progress:</i> during the PBL performance process, on the basis of the PBL performance plan and the task sharing within the groups, the teacher check the performance progress of each member. If 	<ul style="list-style-type: none"> - <i>The theoretical research:</i> follow their tasks of collecting the information, research the material, find and work with the information to complete their product; write the group's research product (the student who was given the task synthetizes the written paper of all the members to complete the group's product); have

<p>necessary, the teacher makes corrections, helps the students so that they perform seriously and have the right progress in the task they were given. In the completion of the PBL, the teacher also needs to check the groups' PBL products to see whether they fit match with the discipline, the target of the PBL as required or not so that the teacher can correct, consult, assist.</p>	<p>group discussions so that all the members can understand the content that the group researches and to complete the group's research product; design the theoretical research product report; have group discussions to complete the report content and proceed with reporting practice within the group.</p> <p>- <i>High school field research</i>: have group meetings and discuss the necessary tasks when doing field research in high schools; observe the high school teacher's sample teaching; share ideas about the deployment of the "Equations" teaching content in high schools; have discussions to assess, comment the lesson taught by the high school teacher and write the collecting information paper of the field research; have a group meeting about the high school field research paper content; submit the paper to the teacher.</p> <p>- <i>Teaching practice in small groups</i>: the small groups choose the lesson content; have a group meeting to make a lesson plan; pass the lesson plan to the teacher; make corrections according to the teacher's requirement; practice teaching in small groups.</p>
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• **Reporting the products and assessing the PBL**

The teacher's duties	The students duties
- <i>Report the theoretical research product in class</i> : together with the students, prepare the basic resources for the groups to present their product report in front of the class; call the	- <i>Report the theoretical research product in class</i> : together with the students, prepare the basic resources for the groups to present their product report in front of the class; the group

<p>students to report; ask questions aim at sharing ideas about the report paper content with the group; comment, make suggestions and assess each group's product.</p> <p>- <i>Teaching practice in class</i>: together with the students, prepare the necessary resources for the small groups to practice teaching in class; call the students to come and teach; comment, make suggestions assess each small group's teaching.</p> <p>- <i>Assess and comment the PBL performance results of each group</i>: after the theoretical research product performance results, the process of high school field research, the making of the lesson plan, the teaching practice... the teacher comments, assesses the performance process and also the PBL performance result of each group.</p>	<p>delegates (called randomly by the teacher) present the theoretical research product report to the class; the whole class comments, make suggestions and ask questions aimed sharing ideas about the report's content; the reporting student answers the questions asked by the teacher and by other students; on the basis of the suggestions made by the teacher and the the groups make corrections on the theoretical research product and submit it to the teacher.</p> <p>- <i>Teaching practice in class</i>: together with the teacher, prepare the necessary resources for the small groups to practice teaching in class; the group delegates (called randomly by the teacher) come and present their lesson the class; the whole class listens, comments, assessesand make suggestions about the lesson; submit the lesson plan to the teacher.</p>
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In the organization of "Teaching equations" for students, if we organize the teaching in an appropriate way, make sure the content of each task such as the PBL performance plan is correct, this will help students perceive all the necessary knowledge and form necessary pedagogical skills and strengths, specifically:

- With the duty of creating the PBL: students have the conditions to form and develop necessary pedagogical abilities and strengths such as: the ability to research the material, the ability to prepare a task in advance, the ability to communicate...

- With the duty of PBL performance plan construction: the product each group needs to realize is: the PBL performance detailed plan "Teaching equations to high school students". Students have the conditions to form and develop skills and strengths, such as: the ability to prepare a task in

advance, the ability to create a plan, to organize, to cooperate, to communicate...

- With the duty of theoretical research: the product each group has to realize is: each student's content of the theoretical research with the topic "Equations", the group's theoretical research product "Teaching equations to high school students" and the group's theoretical research product report content for "Teaching equations to high school students". Students have the conditions to perceive the necessary knowledge about "Equations" (the syllabus for equations in high schools; the similarities and differences between the ways of exposing the concepts and characteristics of equations in secondary schools and high schools; the general purpose and requirement when teaching equations to students; what to pay attention to when teaching the concept of equations and other connected concepts; what to pay attention to when teaching the solutions for equations; the methodology of teaching equations to students; to figure out the students' common mistakes when solving equations; systemize the main formulas and methods to solve equations for the students...) and form skills and strengths for themselves (the abilities to research the syllabus, the coursebook; the ability to choose and research the material; the skill to comprehend the math knowledge and the math teaching reasoning and methodology; self-improve their level and major; creativity; communication; organization; math problem solving; check and assess; use ICT and use the math knowledge to solve math problems practically...).

- With the duty of field research at high schools: the product the groups need to realize is: each member's evaluation ballot of the high school teacher's sample teaching class with the topic "Equations", the group's field research information harvesting report. Students have the conditions to understand the organization of teaching equations at high schools, form and develop the following pedagogical skills and strengths: the ability to research the syllabus and coursebook; the ability to improve their major; the ability to communicate; the ability to cope with pedagogical situations; the ability to use the board; the ability to organize; the ability to assess a class...

- With the duty of teaching practice: the product the group needs to realize is: each group's "Equations" lesson plan, each member's "Equations" teaching practice evaluation ballot. Students have the conditions to form and develop pedagogical skills and strengths such as: the ability to research the syllabus and coursebook; the ability to cope with pedagogical situations; the ability to use the board; the ability to create a lesson plan; the ability to

improve their major; communication; organization; creativity; cooperation; the ability to create a plan; the ability to deploy a plan; the ability to use ICT in teaching; the ability to organize cognitive activities in teaching math in high schools; the ability to perceive the methodology knowledge and to adjust the student's cognitive activities...

6. Findings

6.1. Some results of pedagogical experiments

Based on the content and the syllabus of the specific contents teaching methodology to pedagogy students' and on the general purpose and requirement when teaching this to pedagogy students, we constructed the following PBL (Table 1):

Table 1. PBLs for organizing PBL for math pedagogy students.

Order	PBL
1	Teaching Number systems to students
2	Teaching Equations to students
3	Teaching Inequations to students
4	Teaching Functions to students
5	Teaching Derivatives and their application to students
6	Teaching Antiderivatives – integrals to students
7	Teaching Algebraic combinatorics to students
8	Teaching Spatial geometry to students
9	Teaching Vectors and coordinates to students

With each of these products, the main activities to perform the PBL are:

- With the duty of *theoretical research*, students need to research content such as: finding out more about the content and the syllabus of this topic at high schools; the purpose and the requirement when teaching this topic to students; what to pay attention to when teaching this topics; the methodology knowledge for teaching this topic; figure out some students' common difficulties and mistakes when solving math problems of this topic; systemizing the main math formulas and the main methods of solving the math formulas that belong to this topic.

- With the duty of *field research at high schools*, the student needs to observe one hour of sample teaching of the high school teacher and research the organization of teaching this topic at high schools.

- With the duty of *teaching practice*, the student needs to create a lesson on this topic from the high school syllabus and practice teaching a class about with chosen content.

Based on the results and numbers of student learning specific contents teaching methodology from the Math faculty of the Thai Nguyen University of Education, Thai Nguyen city, Vietnam, we chose class N02 to be the experiment and class N01 to be the control experiment. The control experiment class was taught in the form of memorizing information and the experiment class was taught in the form of PBL. The time of the experiment was August 2016 – April 2017.

a. The orientation assessment: about the orientation assessment of the experiment's results, we consider that it has two aspects: the student's knowledge assessment and the student's pedagogical duties practice assessment.

- **The knowledge assessment:** After proceeding with the pedagogical experiment, the students from N01 and N02 took their exams for the specific contents teaching methodology. The results were as it follows:

Chart 1. *The proportion of results of classes N01 and N02 - the specific contents teaching methodology*

From the results above we can notice: the average results for the specific contents teaching methodology of class N02 are higher than those of class N01. The percentage of students who received good results is higher

in class N02 than in class N01. The percentage of students who received average results is higher in class N01 than in class N02. This is proof that the quality of learning in the experiment class is higher than in the control experiment class.

- The student's pedagogical duties practice assessment:

According to the educational plan of the Thai Nguyen University of Education, Thai Nguyen city, Vietnam, in the 7th semester, students are divided into small groups; each group has from 10 to 15 students. Each group is instructed to create a lesson plan, practice teaching and grade. From the 8th semester, the students that have a mark higher than 5 for pedagogical duties practice are allowed to proceed with the field practice at high schools. The time of this practice is 7 weeks. Each student that attends this pedagogical practice must teach 7 lessons to receive a mark. Each student's mark for this teaching practice is the average mark of the marks received for these classes, and it is given by the high school teacher.

The results for the pedagogical duties practice of students from classes N01 and N02:

Chart 2. The proportion of results of classes N01 and N02 - pedagogical duties practice

From Chart 2 we can notice: The average results of the students from class N02 are higher than those from class N01. The percentage of students who received excellent and good results is higher in class N02 than in class N01. The percentage of students who received fair or above average results is higher in class N01 than in class N02. This is proof that makes us conclude about that students from the experiment class have a better ability to do their pedagogical duty comparing to students from the control experiment class.

The results for the teaching practice of students from classes N01 and N02 are:

Chart 3. *The proportion of results of classes N01 and N02 - teaching practice*

From Chart 3 we can notice: the average results of students from class N02 are higher than of students from N01. This helps us conclude once again about the ability of the experiment class in comparison with the control experiment class.

From all the analysis above, we can see that students from the experiment class have a better ability to do their pedagogical duty compared to students from the control experiment class. And this proves again that organizing PBL for specific contents teaching methodology has been effective.

Therefore, we can state that: students who have access to PBL not only have a better scientific knowledge, but their pedagogical skills and strengths are also better comparing to students who do not have access to PBL.

b. The quality assessment: In parallel with the orientation assessment, we proceed with the quality assessment of the students' pedagogical experiment results by basing on the results of the process assessment; by collecting information directly from the students, the high school teachers and through student check forms and by teacher interview forms.

By observing all groups' deployment of each task in order to complete the PBL, we notice that the organization of the PBL has brought interest and motivation to students; students expressed their opinions and helped each other positively in order to complete the tasks; the atmosphere within groups and in class was relaxed; most of the students have perceived the knowledge after learning the specific contents teaching methodology; the students' ability to present a report improved day by day, their ability to create a lesson plan moved forward; they became more mature in organizing teaching activities, in using the teaching methodology, the positive forms of teaching; their abilities to use the board, to communicate, to organize have improved...

In order to have more accurate information to assess the positive effects of PBL on the student's process of learning, we moved on to collecting the information directly from the students and from the high school teachers, through forms. The exact results were as follows:

- To affirm that organizing PBL for specific content teaching methodology brings interest and effectiveness to the process of learning and to the students' ability collaborate, we proceeded to ask, through forms, the experiment class students. The content and the results of the probe were as follows:

Table 2. *The evaluation of motivation, effectiveness and ability of cooperation of students who learned specific contents teaching methodology through PBL*

Probe content	Number of students who answered			
	Level A	Level B	Level C	Level D
Do you think that working on your own to control the knowledge brought interest in your learning?	27	24	9	0
What was the level of participation of the members of the group when giving opinions?	22	34	4	0
What do you think about dividing responsibilities within a group?	19	36	4	1
What was the level of satisfaction when working in a group?	30	25	5	0
How do you evaluate the	30	25	4	1

atmosphere of the group work?				
How do you evaluate the cooperation in the group work?	31	26	2	1
How do you evaluate the results of your group?	30	27	2	1
How do you evaluate the atmosphere in your class?	34	21	3	2

(Level A is the highest level and level D is the lowest)

By observing and monitoring the students' work process, by asking the students directly and based on the results of the survey above, we notice that most of the students agree that:

+ Working on their own to control the knowledge brought more interest in their learning process, and stimulated their abilities to learn.

+ The group members positively gave their opinions, helped each other; the studying environment within groups and in class was relaxed, fun, and was not affected or lumbering.

+ The effectiveness in all the groups' work was high. All students perceived the knowledge in a profound way.

+ To affirm that organizing PBL for specific content teaching methodology helps students to form necessary pedagogical strengths, we moved on with asking the experiment class directly and giving them forms to complete. The content and the results were:

Table 3. *The evaluation of the formation of necessary pedagogical competences through organizing PBL for the specific content teaching methodology.*

Content	Evaluation				
	Level A	Level B	Level C	Level D	Level E
The competence to hold the math knowledge, the reasoning and the math methodology	20	21	15	4	0
The competence to figure out a problem	23	21	12	4	0
The competence to make an educational and teaching plan	17	22	16	5	0
The competence to deploy an educational and teaching plan					
<i>The ability to hold all the teaching methods, all the teaching techniques and use them effectively in teaching</i>	16	27	12	5	0
<i>The ability to cope with pedagogical situations</i>	23	19	15	3	0

<i>The ability to use the teaching equipment and technical means</i>	20	25	9	6	0
<i>The ability to understand the students</i>	20	18	18	4	0
<i>The ability to transmit the teaching content</i>	21	21	16	2	0
<i>The ability to process the material</i>	16	26	13	5	0
<i>The ability to distribute the attention</i>	21	17	19	3	0
<i>The ability to explain</i>	19	21	18	2	0
<i>The ability to use the language</i>	19	25	11	5	0
<i>The ability of pedagogical observation</i>	21	20	17	2	0
The competence to check and evaluate	17	29	10	4	0
The competence to cooperate	22	20	17	1	0
The competence to create	20	21	16	3	0
The competence to communicate	20	25	11	4	0
The competence to organize	25	19	13	3	0
The competence to solve problems that may appear while teaching	20	19	16	5	0
The competence to develop, to improve the techniques and major	21	22	13	4	0
The competence of solving math problems	25	22	10	3	0
The competence of using ICT in teaching	17	24	14	5	0

(Level A – Very good, Level B – Good, Level C – Fair, Level D – Average, Level E – Poor)

By asking the students directly and based on the results of the survey above, we notice that most of the students agree that: Organizing PBL for the specific content teaching methodology helps the students not only form, but regularly practice the necessary pedagogical skills and competences. Because of that, the students will have certain pedagogical skills and competences that they will need when they become teachers.

- In order to have more information to affirm that organizing PBL for the specific content teaching methodology will aid to forming and developing the students' pedagogical skills and competences, we asked the high school teachers of the classes where students from N01 and N02 did their pedagogical practice. The content and the results are shown in Table 4.

Table 4. *The high school teachers practice delivery evaluation results*

Order	Content	Teachers' answers results							
		Level A		Level B		Level C		Level D	
		N02 (%)	N01 (%)	N02 (%)	N01 (%)	N02 (%)	N01 (%)	N02 (%)	N01 (%)
1.	Evaluation of the student's ability to define the goal of the lesson.	63.33	57.89	35.00	35.09	1.67	7.02	0.00	0.00
2.	Evaluation of the ability to define the basic knowledge and the main knowledge of the lesson.	60.00	57.89	38.33	31.58	1.67	8.77	0.00	1.75
3.	Evaluation of the ability to exploit the information from the coursebook, the teacher's book, the reference book. to serve to the lesson's content.	38.33	33.33	48.33	49.12	13.33	17.54	0.00	0.00
4.	Evaluation of the preparation for the organization, methodology and means of teaching the lesson.	18.33	17.54	75.00	71.93	6.67	10.53	0.00	0.00
5.	Evaluation of the anticipation of the distribution of time during the lesson.	19.33	19.30	73.33	66.67	7.33	14.04	0.00	0.00
6.	General evaluation about the student's way to design the lesson (the lesson plan).	57.67	57.89	38.33	35.09	4.00	5.26	0.00	1.75
7.	Evaluation of the competence to understand the pupils in the educational and teaching process.	38.67	38.60	56.67	47.37	4.67	14.04	0.00	0.00

8.	Evaluation of the competence to sense the pupils in educational and teaching process.	46.67	36.84	46.67	52.63	5.00	8.77	1.67	1.75
9.	Evaluation of the ability to use the teaching methodology in a positive, active and creative way.	23.33	19.30	61.67	52.63	13.33	26.32	1.67	1.75
10.	Evaluation of the ability to use the teaching means and equipment (at the right moment and place and effectively) in the teaching process.	33.33	29.82	46.67	38.60	18.33	24.56	1.67	7.02
11.	Evaluation of the competence to make the pupils notice and solve the problems.	26.67	22.81	60.00	47.37	13.33	28.07	0.00	1.75
12.	Evaluation of the student's ability to teach concepts.	51.67	45.61	38.33	40.35	10.00	12.28	0.00	1.75
13.	Evaluation of the student's ability to teach theorems.	36.67	35.09	55.00	50.88	8.33	10.53	0.00	3.51
14.	Evaluation of the student's ability to teach solutions.	36.33	36.84	56.67	40.35	7.00	21.05	0.00	1.75
15.	Evaluation of the student's ability to use ICT and communication technology (competently and effectively) in the teaching process.	28.00	28.07	46.67	40.35	20.67	15.79	4.67	15.79
16.	Evaluation of the student's ability to absorb the lesson.	38.33	29.82	45.00	47.37	16.67	17.54	0.00	5.26
17.	Evaluation of the board organization (the way	44.33	43.86	46.67	40.35	9.00	12.28	0.00	3.51

	of writing, organizing, erasing, combine speaking and writing.) in the teaching process.								
18.	Evaluate the ability to organize and control the class so that the pupils study in a positive and active way.	30.33	29.82	58.33	52.63	11.33	15.79	0.00	1.75
19.	Evaluation of the ability to deal with pedagogical situations.	35.00	29.82	50.00	50.88	15.00	17.54	0.00	1.75
20.	Evaluation of the ability to observe and understand the pupils and deal with all wrong information during the teaching process.	30.00	29.82	53.33	42.11	15.00	24.56	1.67	3.51
21.	Evaluation of the ability to create a learning environment (be friendly, cooperative, beneficial, safe and healthy) while teaching.	58.33	49.12	41.67	35.09	0.00	15.79	0.00	0.00
22.	Evaluation of the ability to check and assess the pupils' results (make sure that they are exact, full, fair, objective, open and that they develop the pupils's own ability to evaluate.).	45.00	38.60	46.67	43.86	8.33	17.54	0.00	0.00
23.	Evaluation of the communication and cooperation skills with other students and with the teachers at that high school. while cultivating their major (ask questions, share, cooperate regularly, exchange information	65.00	57.89	33.33	26.32	1.67	14.04	0.00	1.75

	with friends and teachers. during the pedagogical practice).								
24.	Evaluate the student's posture and manners in class.	75.00	68.42	25.00	22.81	0.00	8.77	0.00	0.00

After talking to some high school teachers directly, and based on the results of the survey shown in Table 4, we notice: Most of the students from class N02, when doing their pedagogical practice in high schools, received better pedagogical major evaluation from their instructors, comparing to students from class N01. This was shown in several aspects:

- + Having the ability to define the purpose of the lesson, the basic knowledge, the center of the lesson, and exploit information from different sources.

- + Having the ability to use several teaching methods, several positive, active and creative teaching forms, throughout the teaching process.

- + Having the ability to make the high school students remember the content of the lesson and the ability to communicate.

- + Having the ability to exploit and use the teaching means, equipment and objects while teaching.

- + Having the ability to exploit and apply ICT while teaching.

- + Having the ability to deal with pedagogical situations while teaching.

- + Having the ability to create a relaxed and friendly learning environment.

- + Having the ability to sense the pupils during the educational and teaching process.

After collecting the results above, we can again affirm: 'Through organizing PBL, the students' necessary pedagogical skills and competences are step by step formed and are often practiced during the learning process. This way, organizing PBL will help students not only receive the necessary knowledge, but also the pedagogical skills and competences that they need before becoming teachers, responding to the requirements of the society.

7. Conclusion

The results of teaching the PBL following the procedure of organizing PBL as proposed showed the effectiveness of PBL in the teaching practice, generally, and in the training of math teachers in Vietnam. Through PBL, pedagogical math students not only accumulate the necessary knowledge but they also have the conditions to form and practice the pedagogical skills and competences that a teacher needs to have.

Acknowledgment

I declare on my own responsibility that the subjects in this research were informed of their voluntary participation, they understood the information received and the possibility to withdraw from the research at any time without any negative consequences on them. Research complies with the ethical standards, and the research participants gave their consent to participate in this project.

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