MINISTRY OF EDUCATION AND TRAINING
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TEACHING TECHNOLOGY SUBJECTS AT SECONDARY SCHOOLS AIMING AT DEVELOPING THE CREATIVELY PROBLEM SOLVING COMPETENCE

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INTRODUCTION

I. Rationale

First, developing the creatively problem solving competence helps the labors not to be eliminated in the 4.0 Technology Revolution (or the fourth Technology Revolution).

The 4.0 Technology Revolution will be where "Robots replace labors". Man makes robots, man may not process data as quickly and precisely as robots, however, man is better at solving creative problems than them. The creatively problem solving competence will help them integrate with the 4.0 Technology Revolution more easily; To support and accelerate the development of the 4.0 Technology Revolution.

Second, improving the students' competence is assimilated in the main goals of Vietnam Communist Party and in the government fulfillment.

This thinking is presented in the 29 Revolution – (Revolution/Central Committee) (signed on September 4th, 2013) about reforming mainly and completely in all aspects of training and education to meet the demands of modernization and industrialization in the condition of marketing economy towards socialism and international participation. The clause 27 – No 1, the goals of school general education in education law 38/2005/ Parliament1- signed on June 14th, 2005; Revolution No 88/2014/Parliament13 about reforming curriculum, textbooks – signed on November 28th, 2014.

Third, teaching Technology subjects at secondary schools aiming at developing the creatively problem solving competence is suitable and feasible.

The main goals of curriculum of our general education tend to forming and improving the following competences for the students: Self-study; Solving problem and creative; Artistic competence; Physical competence; Communicative competence; Co-operate competence; Calculative competence and informative technology competence.

Technology subjects is taught at secondary schools, therefore, it will also tend to aim at improving necessary capabilities for students.

Teachers teaching and students studying this subjects will be received the basic knowledge of mechanic - motive power, electricity, electronics. They will also find no difficulty in doing scientific research (especially in theme manufactured proposal, upgrading the new products to serve directing in people's daily life).

From the above reasons, the author choose to study ***"Teaching Technology subjects at secondary schools aiming at developing the creatively problem solving competence".***

II. Aims of the study

The main purpose of this study is to develop theoretical basis; Propose to organize teaching Technology subjects at secondary school aiming at developing the creatively problem solving competence.

III. Subject, object and scope of the study

1. Subject of the study: Teaching Technology subjects at secondary school; Teaching aiming at competence development.

2. Object of the study: The object of the study is the creatively problem solving competence; Solutions for teaching Technology subjects aiming at developing the creatively problem solving competence.

3. Scope of the study: The study focuses on the reality of teaching and learning Technology subjects at grades 11, 12 towards developing the creatively problem solving competence.

IV. Scientific hypothesis

If the solutions for teaching Technology subjects at grades 11 and 12 aiming at development of the creatively problem solving competence are found, students will develop the creatively problem solving competence, have positive attitude towards the subject and contribute to increase the teaching quality of this subject.

V. Duty of the study

- The study aims at developing the theoretical basis of teaching Technology subjects towards improving the creatively problem solving competence.
- Survey status teaching Technology subjects at grades 11, 12 towards improving the creatively problem solving competence.
- Promote the solutions for teaching Technology subjects at grades 11 and 12 aiming at development of the creatively problem solving competence.
- Both experiment and educational experiment are conducted to evaluate the accuracy and feasibility of the theme.

VI. Methods of the study

1. Theoretical study methods:

Analyzing, compositing, generalizing, systematic data relating to teaching Technology subjects towards developing the creatively problem solving competence is theoretical basis for the study.

2. Practical study methods:

- Survey method with questionnaires: The questionnaires are delivered to the teachers and students in order to find out the current reality in teaching and learning Technology subjects grades 11, 12 aiming at developing the creatively problem solving competence.

- Observe method: Observing the teachers' teaching and the students' learning activities in classes in order to give qualitative analysis of educational effect to students.

- Experimental and educational experiment methods: In order to determine the accuracy and feasibility of the study, the author carries out the experiment and gives experimental approaches in teaching Technology subjects grades 11,12 towards developing the creatively problem solving competence.

- Asking for Expert Method: Asking for the experts' ideas about the proposals teaching Technology subjects aiming at developing the creatively problem solving competence.

3. Mathematics statistic methods: In this method, the author uses the statistic Math to analyze and deduct the figures through the survey and experiments with the Excel software in order to find the suitable conclusions.

VII. The new contributions of the treatise

- The study focuses on developing the theoretical basis of teaching Technology subjects aiming at improving the creatively problem solving competence.

- Conducting survey, analyzing current reality of teaching Technology subjects grades 11, 12 towards developing the creatively problem solving competence.

- Proposing methods to teach Technology subjects aiming at improving the creatively problem solving competence.

- It is used to determining the feasibility of the mentioned proposals.

VIII. Defending points

- The view on the creatively problem solving competence: The study mentions the definitions, levels, evaluation of the creatively problem solving competence.

- The teaching organized measures are proposed towards developing the creatively problem solving competence.

IX. Structures

Besides the introduction and conclusion, the study consists of three chapters:

Chapter 1: The theoretical and practical hypothesis of teaching Technology subjects aiming at improving the creatively problem solving competence.

Chapter 2: Proposing teaching solutions for Technology subjects aiming at improving the creatively problem solving competence.

Chapter 3: Experiment and evaluation

DEVELOPMENT

CHAPTER 1: THE THEORETICAL AND PRACTICAL HYPOTHESIS OF TEACHING TECHNOLOGY SUBJECTS AIMING AT IMPROVING THE CREATIVE PROBLEM SOLVING COMPETENCE

1.1. An overall view of teaching Technology subjects aiming at improving the creatively problem solving competence.

This section will present briefly about the current situation of the study: Problem solving competence and teaching aiming at developing the problem solving competence; Creative competence and teaching to improve the creative competence; Creative problem solving and teaching to develop the creatively problem solving; Solving problem creatively competence and teaching in order to develop the creatively problem solving competence. The findings shows that there has never had any studies before mentioning detail about teaching Technology subjects aiming at improving the creatively problem solving competence. Therefore, the aims of the study are necessary and feasible.

1.2. The creatively problem solving competence

1.2.1. Definition:

In this part, the study is going to show briefly about the results of the study, definition of the creatively problem solving competence. *The creatively problem solving competence is the ability to use innovative methods to solve problems that help shape and create new solution, new products.*

1.2.2. Stages of the creatively problem solving and levels of the creatively problem solving competence:

Through finding out some models/ stages of creation, problem solving, creative problem solving, the author proposes the stages of solving problem creatively and levels of the creatively problem solving competence are showed in the figure 1.2 and table 1.1

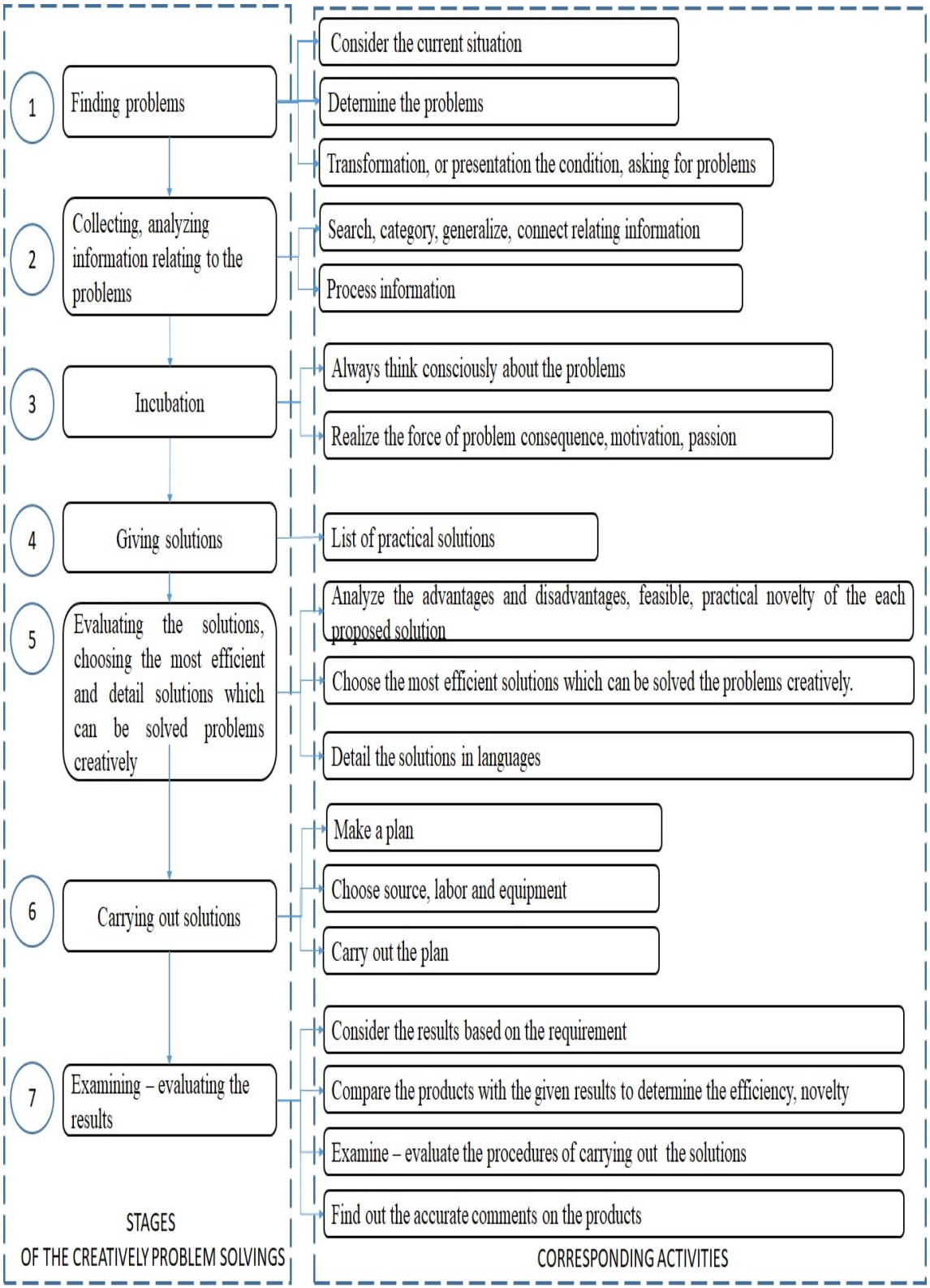


Figure 1.2. The stages of the creatively problem solving and corresponding activities

Table 1.1: Levels of the creatively problem solving competence for students

No	*Stages*	*Activities*	*Levels*
1.	Finding the problems	Considering the current situations	Not subjectively consider the current situations
			Consider the current situations under the teacher's guidance
			Self- considering the current situations
		Determine/assess problems (creativity)	Not determine/assess problems
			Consider/assess the problems under teachers' guidance
			Find the novelty of the problems
		Rewriting or conditional presentation, asking for problems	Underline and give condition, ask for problems
			Write what they understand and give conditional problem requirements showing the creativity
2.	Collecting/ analyzing information relating to the problems	Search for, category, sum up, connect relating information	Search for, category, sum up, connect relating information
			Self – search for, category, sum up, connect relating information adequately
			Self- search for category, sum up, connect relating information adequately in a short time
			Creativity in search for category, sum up, connect relating information
		Process the information	Process information under teachers' guidance
			Self - Process information under teachers' guidance in a short time
			Creativity in processing information
3.	Incubation	Always think consciously about the problems	Not thinking consciously about the problems
			Always think consciously about the problems

			Always think consciously about the problems in a short time
		Realize the force of problems, consequences, motivation, passion	Not realize the force of problems
			Realize the force of problems
			Motivate – have passion on the problems
			Motivate – have passion, realize the force of problem consequences
4.	Giving solutions	List of practical solutions	List the feasible solutions under teachers' guidance
			The number of given solutions ≤ 2
			The number of given solutions > 2
			List the solutions in a short time
5.	Evaluating the solutions, choosing the most efficient and detail solutions which can be solved problems creatively	Analyze the advantages and disadvantages, feasible, practical novelty of the each proposed solution	Analyze the solutions under the teacher's guidance
			Analyze the advantages and disadvantages, feasibility of each proposed solution
			Analyze the advantages and disadvantages, feasibility, novelty of each proposed solution
			Using short time in analyzing
		Choose the most efficient solutions which can be solved the problems creatively.	Can choose the solutions under teachers' guidance
			Choosing the solutions by themselves
			Using short time for choosing solutions
		Detail the solutions in languages	Write/present solutions under teachers' guidance
			Write/present solutions by themselves
6.	Carrying out solutions	Make a plan	Make a plan under teachers' guidance
			Make a plan by themselves
			Using short time for making a plan
			There is creativity in making a plan

		Choose source, labor and equipment	Choose sources under teachers' guidance
			Choose sources by themselves
			Choose sources in a short time
			There is creativity in choosing sources
		Carry out the plan	Carry out the plan under teachers' guidance
			Carry out the plan by themselves
			Carry out the plan in a short time
			Creativity in making plan
7.	Examining – evaluating the results	Consider the results based on the requirement	Giving inefficient comment on the products/results
			Giving efficient comment on the products
		Compare the products with the given results to determine the efficiency, novelty	Can compare the products under teachers' guidance
			Can compare the products by themselves
		Examine – evaluate the procedures of carrying out the solutions	Can examine – evaluate the procedures under teachers' guidance
			Can examine – evaluate the procedures by themselves
		Find out the accurate comments on the products	Find out the accurate comments on the products
			Find out the accurate comments on the products/creativity, expression, invention, transformation

1.2.3. Evaluating the creatively problem solving competence

Basing on the studies of assessing problem solving competence, creative competence evaluation, competence evaluation, assessment of problem solving ability and creativity … are declared, the author proposes the procedures of ability evaluation in figure 1.3. It is also used to evaluate the creatively problem solving competence.

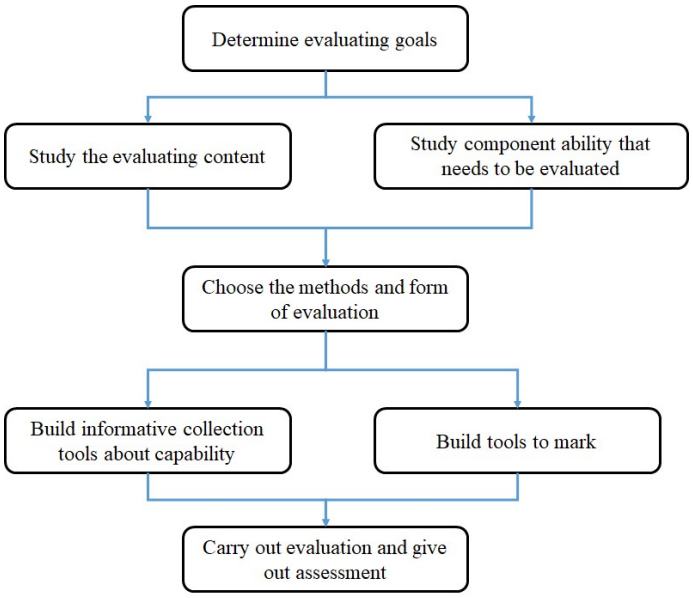


Figure 1.3: The procedures evaluate learners' capability

1.3. The findings for teaching Technology subjects aiming at developing the creatively problem solving competence

The author has proposed two methods in teaching Technology subjects aiming at developing the creatively problem solving competence:

- Teaching students creative methods. The procedures are shown in figure 1.4

- Giving students Tasks in order that they can solve the problems creatively. The procedures are shown in figure 1.5

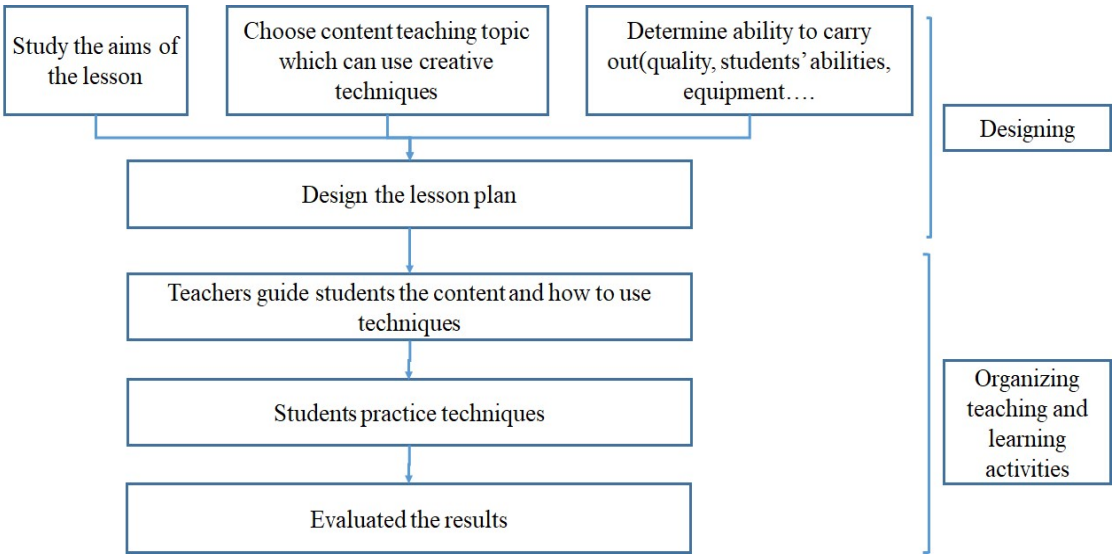


Figure 1.4: The procedures of teaching Technology subjects aiming at developing the creativity problem solving competence by teaching students creative methods/techniques

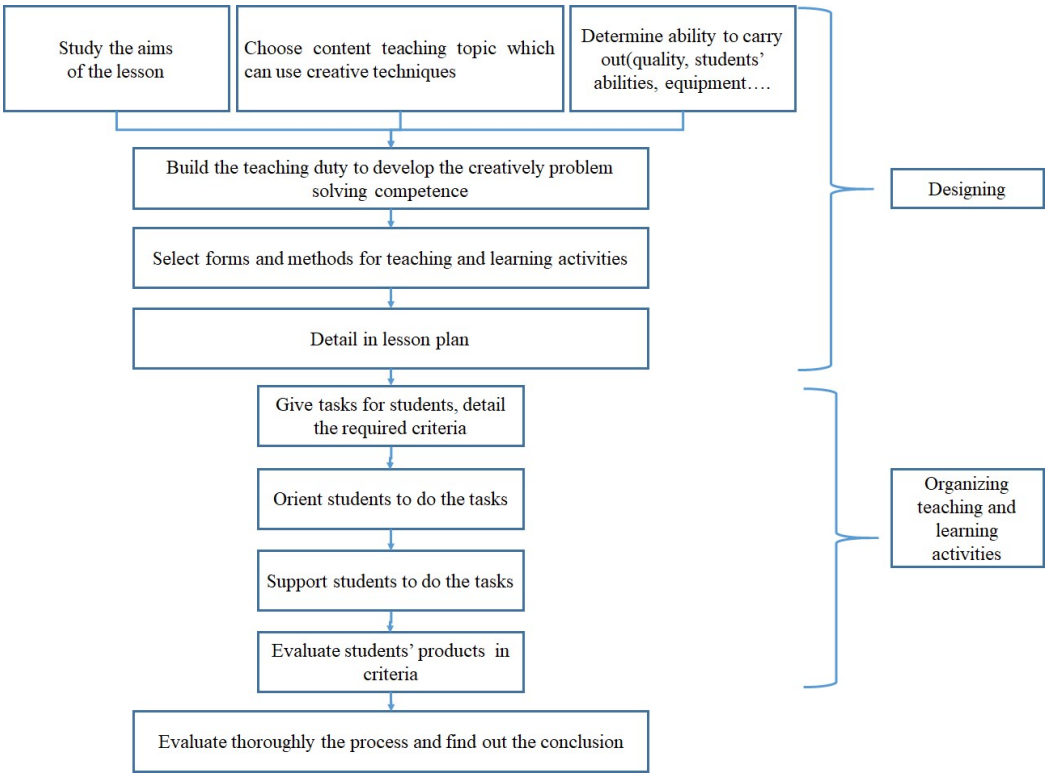


Figure 1.5: The procedures of teaching Technology subjects aiming at developing the creativity problem solving competence by giving students Tasks in order that they can solve the problems creatively

1.5 .The real situation in teaching Technology subjects at secondary school aiming at developing the creatively problem solving competence.

The survey was conducted by delivering questionnaires to 32 teachers teaching at secondary schools in the North and 387 students at three schools: Hanoi Experiment secondary school (137 students); Yen The secondary school in Bac Giang (123 students); Que Vo secondary school in Bac Ninh (127 students), the author concludes the following findings.

** The findings from the students*

1. The students are not good at finding the problems; Process the information; Analyzing the advantages, disadvantages, feasibility, efficiency of each solution in order to choose those which can be solved problems in a new way.

2. The problems/situations that students solve in learning only follow teachers' requirement contributing to receive more knowledge for them, not create new products for themselves and others.

3. The problems/situations that students are received in the learning process haven't been compound, students haven't been asked to find out the new.

4. The learning Technology subjects only depends much on the textbooks.

** The findings from the teachers*

1. The teachers themselves recognize the beginning factors affecting on developing the students' creativity problem solving competence.

2. Developing the creatively problem solving competence for students by designing-organizing; However, it is not often, the teachers meet have had many difficulties from the content, the curriculum, the teaching equipment, their qualities; The use of teaching methods, examining and evaluating nowadays has not encouraged the students in the creatively problem solving competence.

CONCLUSION OF CHAPTER 1

1. In reality, there hasn't had any research studying deeply about the creatively problem solving competence, the treatise studying about this is limited, focusing mainly since 2012; The recent studies have only mentioned the creatively problem solving and the problem solving competence and creativity. Teaching to develop the creatively problem solving which meet the students' demand not only help students find solutions for the problems but also find the solutions in the new ways. Because of the distinctive features of Technology subjects, it is used much in real life, attaching to daily life. Therefore, it is suitable to teach aiming at the creatively problem solving competence in manufacturing, up-grade, innovative, inventing new products. Developing the creatively problem solving competence through Technology subjects will help to improve the quality of teaching and learning, increase the role and effect of the subjects to students, schools and society.

2. The creatively problem solving competence is the ability to use innovative methods to solve problems that help shape and create new solution, new products. The main difference between the creatively problem solving competence and the problem solving competence is that the final results/products of the creatively problem solving competence is to find the new. The final results of the creatively problem solving competence is to find out the novelty of the problem. While the creatively problem solving competence focuses both on the process of solving problems and on the novelty but the creative competence only aims at the new of the products.

3. There are two measures for teaching Technology subjects aiming at developing the creatively problem solving competence: Teaching students creative methods/techniques; Setting students into the creatively problem solving tasks.

CHAPTER 2: PROPOSING TEACHING SOLUTIONS FOR TECHNOLOGY SUBJECTS AIMING AT DEVELOPING THE CREATIVELY PROBLEM SOLVING COMPETENCE

2.1. The rules of teaching and learning Technology subjects aiming at developing the creatively problem solving competence.

- First, it is said to follow the curriculum, content of the subject at secondary schools.
- Second, it must be suitable to the culture of each region, equipment is used in teaching at schools and the students' knowledge.
- Third, it is necessary for students' ability to enable students to be proactive, self-reliant on problem solving and develop the creatively problem solving competence
- Fourth, synchronous inheritance and development are also considered.

2.2. The suitability of teaching Technology subjects aiming at developing the creatively problem solving competence.

Teaching this subjects will improve the creatively problem solving competence as the following reasons:

- First, it should be started from the objects of the study and content of the subject.
- Second, the teachers find the advantages in designing activities for students.
- Third, the subject itself is the basic knowledge and the sources for other technique researches in designing, manufacturing and improving.

2.3. The proposal of using the creative methods in teaching and learning Technology subjects.

In this part, the study presents seven creative methods which are chosen to use in teaching: The six-question (5W and an H); Brainstorming; Fish-skeleton graph; Mind-map; Focal point object method; Morphology analyze method; The navigation question set. The study also presents fourteen ideas for organizing the creative methods in teaching Technology subjects grade 11.

2.4. The proposal of the subject's learning tasks aiming at developing the creatively problem solving competence.

In this section, the author has conducted the survey in order to find out 23 topics lying in 10 units (technique design, building draw, hand-made methods, definition of burning motor, fuel system, choosing and using motorbikes, control opened circuit, daily circuit equipment, national power system, three phase motor) in the curriculum of Technology textbooks grades 11,12.

2.5. Illustrating the detail content according to the procedures of teaching Technology subjects aiming at developing the creatively problem solving competence.

2.5.1. The illustration of teaching students with the creative methods.

The author has presented seven examples of teaching this subjects which are chosen from the proposal ideas in section 2.3. Seven examples correspond to seven creative methods. The procedures of teaching and learning are followed the stages which are already proposed in figure 1.4 of chapter 1.

2.5.2. The illustration of teaching Technology subjects aiming at developing the creatively problem solving competence by giving students into learning tasks.

The author has used the procedures of teaching Technology subjects aiming at developing the creativity problem solving competence by giving students Tasks in order that they can solve the problems creatively are mentioned in chapter 1. For example Unit 8: Designing and technique draw (Technology textbook – Grade 11 – Page 42) and Unit 12: Practice building draw (Technology textbook – Grade 11 – Page 62).

CONCLUSION OF CHAPTER 2

There are two solutions used in teaching Technology subjects at secondary schools in order to develop the creatively problem solving competence: Teaching students the creative methods; Setting students into the creatively problem solving tasks. Each method has its own advantages and disadvantages:

- Teach students creative methods to help students form creative ideas in the process of solving problems. The final result / product will be creative. However, this method requires teachers to choose teaching content that is suitable to both teach students the content of the new lesson. Each student lesson is known and practiced to practice creative methods, the result for the whole process is that students can know the system of creative methods and apply them in the process of solving problems.

- Putting students into creative tasks to solve creative problems will force students to implement creative problem solving process. The final result/product is definitely new. However, building a task to solve creative problems is not easy for teachers. This measure partly helps students to practice methods to teach students creative methods.

In teaching technology subject towards developing creative problem solving capacity using two proposed methods, teachers need to abide by some principles: It is said to follow the curriculum, content of the subject at secondary schools; It must be suitable to the culture of each region, equipment is used in teaching at schools and the students' knowledge; it is necessary for students' ability to enable students to be proactive, self-reliant on problem solving and develop the creatively problem solving competence; Synchronous inheritance and development are also considered.

In terms of technology subjects taught in grades 11 and 12, grade 11 is the optimal time to apply both measures because grade 12 students often focus on high school graduation exam, so only need to build some learning tasks so that students can apply the methods learned in 11th grade. There are many creative methods but the topic stops choosing seven basic creative methods: The six-question; Brainstorming; Fish-skeleton graph; Mind-map; Focal point object method; Morphology analyze method; The navigation question set was taught in 11 technology lessons11. The thesis also proposed 23 tasks to solve creative problems of technology 11 and technology 12.

CHAPTER 3: EXPERIMENT AND EVALUATION

3.1. Aims of the study

The detail aims of this part are the assessment of the feasibility and efficiency of teaching Technology subjects at secondary schools aiming at developing the creatively problem solving compentency through lesson plans of educational experiment teaching and asking for expert method.

3.2. Objects of the study

- With the experimental survey, the author conducted with 136 students at Hanoi Experiment secondary school.
- With educational experiment survey, it was conducted with 124 students at experiment classes comparing to 123 students at three schools in Hanoi, Bac Ninh and Bac Giang.
- The objects of asking for expert method are 20 Technology teachers who have taught Technology subjects for 3 years at some provinces in the North.

3.3. The content of the study

These methods are conducted at 2 Units

- Unit 8: Design and technique draw (Technology textbook – Grade 11- Page 42), teaching time: 45 minutes
- Unit 11: Build draw and Unit 12: Practice building draw (Technology textbook – Grade 11 – page 56), teaching time 90 minutes.

The content of the asking for expert method is section 2.3. Proposing to use the creative methods and giving the sample teaching with the creative methods in section 2.5.1.

3.4. The procedures

** The procedures of carrying out experiment*

The author makes assessing forms to evaluate the creatively problem solving competence before and after doing research. Each form corresponds with the effect of lesson plan. Lesson plans are built for experimental teaching. The results are revealed from the forms and marks after lessons.

** The procedures of carrying out educational experiment*

The author makes assessing forms to evaluate the creatively problem solving competence before and after doing research. Each form corresponds with the effect of lesson plan. Lesson plans are built for experimental and control teaching. The results are revealed from the forms and marks after lessons.

** The procedures of asking for expert method*

It is choosing the content, making the forms, delivering the forms to the teachers. Then collecting them and assessing the results.

3.5. Results – Evaluation

3.5.1. The Experiment

** The results – evaluation from the questionnaires are used to evaluate the creatively problem solving competence of the students before and after educational effect.*

- The important cognition of the developing the creatively problem solving competence: Before teaching, there are over 60% of the students who find the development of the creatively problem solving competence is very necessary. After teaching, the percentage of students increase 9.56% (13 students). This is the evidence for the importance of developing the creatively problem solving competence. It also shows that teaching plays an important in improving students' attitude to the development of the creatively problem solving competence.

- The students' problem solving levels:

+ Realizing the problems: 30.15 % of the students haven't had any difficulties in considering current situations. 11.76% of them find it less difficult than before learning. This shows that teaching contributes largely to students' cognition of developing the creatively problem solving competence to develop the students' finding problem ability. However, rewriting skill/realizing problems of the students, problem requirement tend to increase in the level of difficulty (1.4%) and normal (increasing 11.03 %) for students. The reasons are that they are unfamiliar with rewrite/conditional presentation, asking for problems in studying Technology subjects and it is different from Math, Physics and Chemistry.

+ Collecting and processing information: after teaching, collecting and processing information, skills are not much improved (illustrated in decreasing in the percent of difficult level and increasing in normal level, it is a bit difficult and is around 5%).

+ The problem solving motivation: This is the important part in helping students to find the new solutions. After teaching, students are more conscious in thinking. The rate of students finds it less difficult in realizing the force of consequence, passion, motivation. The percentage increases a lot (17.64%). This brings good signal for the students who are interested in the subjects and take the

ability to find new solution. However, there may be the teachers' force to make students finish the tasks in the experiment time.

+ Finding solutions and choosing solutions: the students don't find any difficulties in listing and choosing solutions. However, there are over 25% of the students find it difficult to analyze the solutions. There are many factors leading to this. For example, the information processing factor. In fact, there are over 22% of them find it difficult to process information. This factor should be known in the development of the creatively problem solving competence for students.

+ Making – carrying out the plan: before and after teaching, students find no difficulties in making and carrying out the plan. Especially the ability to follow the plan increases considerably (the percentage of students find it be a bit difficult level increases 14.87%).

+ The product assessment: students find difficulty in two steps: comparing the products to the given ones in order to assess the novelty (difficult level accounts for 19.12%) and giving the precise comment on the products (> 35%). This is not easy in assessing product steps, problem solving procedures in general and of course to students because the information given to them is not plentiful, various and perfect. The students' object assessment skills do not complete. The assessment activity needs continuing to build students' skills.

- Self-problem solving ability: after teaching, students can find solutions by themselves increasing about 10%.

- The results after solving problems: the majority of the students meet the teachers' requirement. The problem solving mainly helps students to widen more knowledge, consolidates, creates new products only for them but not for the public. The result of the survey is higher, taking around from 3% to 11%.

- The forms of problem given by teachers: There are 82.35% of problems which the teachers raise in the forms of questions basing mainly on the contradiction between the knowledge that the students already know and the knowledge they haven't seen. This is a barrier to motivate students' creatively problem solving. After teaching, the given problem forms increase basing on the contradiction between practical knowledge and theory, asking students for finding the new, however, the rate is not high, covering maximum 11.03 %.

- The index also shows the students' activities illustrate that the development of the creatively problem solving competence in Unit 11 is a bit higher than that in Unit 8.

** The findings from the students' learning activities*

Table 3.1: The students' results with experiment

Units	***Classes***	***Frequency of marks***					
		5 points	*6 points*	*7 points*	*8 points*	*9 points*	*10 points*
TOTAL (UNIT 8)		11	1	22	24	34	44
TOTAL (UNIT 11)		5	0	30	25	61	15
TOTAL (UNIT8 + UNIT 11)		**16**	**1**	**52**	**49**	**95**	**59**
%		**5.88%**	**0.37%**	**19.12%**	**18.01%**	**34.93%**	**21.69%**

+ The students' product results: from the table 3.1, it can be found that the students get good points from the products accounting for 74.63% which means the answer the teachers' questions.

+ The results of each criteria of the problem solving ability after each unit are shown in table 3.6.

The weak points of the students in solving problems to meet the criteria are:

- Category, synthesize, connect relating information cover 90% of the students making mistakes in these), summary, comparison, selecting information (nearly 90% of them make mistakes). As it is not an easy skill requiring learners practice regularly, having good thinking skill. Maybe the results from the students' shame and they have not do much about these.
- The students do not spend enough time thinking deeply on the requirement (the frequency accounts for 6.62% and 14.71%, they are not motivated- interested in doing the tasks, they finish the tasks only by their teachers' asking (account for over 90%). The main reason is that the students are more concentrate on the subjects they have to take in the national examination or entrance university examination. Second, the teachers do not bring interesting lessons enough for them. Spending time on thinking, passion, motivation is the ground of creativity. This explains the reason why the students' products are not new to the public.
- Analyzing precisely the advantages and disadvantages, the feasibility, the effect, the novelty of each solution should be under 10%. However, the capability of choosing the most efficient solution that can solve the problems and be new accounts for over 70%. This contradiction of the results may be for the students' subjects in doing the tasks.

- Assessing the product results: they can compare their products with the given ones to determine how effective and new it is. The results show that the mistakes account for 50%. This illustrates the real situation of reference, the ability to exploit, process information and assessment of students.

3.5.2. The results of educational experiment

** The results gain from the questionnaires before and after teaching.*

The results showed, it can be seen that before teaching the creatively problem solving competence between the confrontational and experimental classes is the same. After teaching, the results of experimental classes are higher than those of confrontational ones (about 5%). The solution for this is that the teachers should intensively give situations/problems under topics and bring them relating to the real life and encourage students to find the new for themselves and others; They should also improve students' ability and processing information, assessment, giving ideas, variety in reference of Technology subjects.

** The results gain from student' activity*

- Qualitative assessment:

From summarizing the results by observing at experimental and confrontational classes, exchanging with the teachers and finding out problems, observing the students' attitude, it comes to conclude that:

+ Teaching lessons at the confrontational classes are supported with the available equipment, however, the students' products are not as new as those at experiment classes. The students here are more active, self-conscious in debating more eager in presentation and assessment their work.

+ The students are more motivated when studying with what relating more to real life. They have space to create things for themselves. They find out the problems in an eager attitude, search for useful information to process, category and use; propose and choose suitable options to solve the problems; make a plan actively and follow the schedule, determining the products and find out the novelty of the products.

+ The results from the experimental and confrontational classes are the same, however, the number of marks 9 and 10 at experimental classes is higher because the products are more creative.

- Quantitative assessment:

The results of the students' products through educational experiment are processed by Mathematics statistics methods and analyzed by Excel tool with the following steps:

+ Step 1: Make the frequency distribution table, the rate of occurrence, draw the frequency distribution table 3.2.

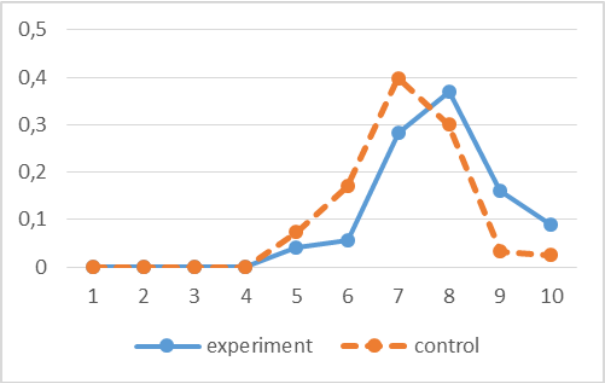
Table 3.2: The number and the frequency of distribution from the educational experiment results.

x	**n**				**f**			
	E	***C***	***E***	***C***	***E***	***C***	***E***	***C***
	Unit 8		*Unit 11*		*Unit 8*		*Unit 11*	
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	5	9	0	3	0,04	0,07	0	0,02
6	7	21	12	26	0,06	0,17	0,09	0,21
7	35	49	24	46	0,28	0,39	0,19	0,37
8	46	37	43	33	0,37	0,30	0,35	0,27
9	20	4	31	10	0,16	0,03	0,25	0,08
10	11	3	14	5	0,09	0,02	0,11	0,04

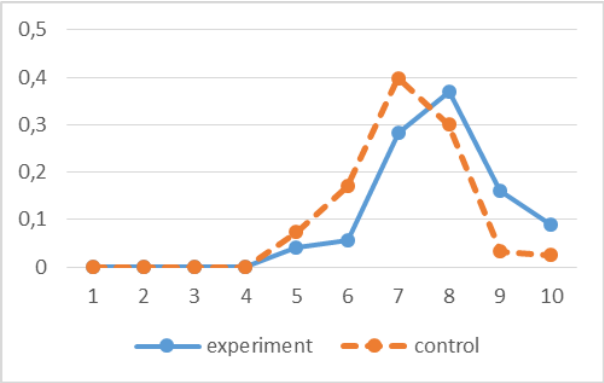
x: Mark value; n: Number; f: Frequency; E: Experiment; C: Confrontation

It can be seen from the table that it illustrates the value of frequency in experimental classes moves towards the right comparing to the confrontational ones. This shows that the students' marks at experimental classes are higher the confrontational ones.

Graph 3.1: Experiment results – Unit 8



Graph 3.2: Experiment results – Unit 11



+ Step 2: Determining the sample pattern. Table 3.3.

The sample pattern value between experiment and confrontation shows that the main figures as: average value, standard dellection and the precision of the experimental classes are higher than the confrontation ones. Sample errors of the two classes are the same. Besides, it can be estimated that the reality of the experimental classes comparing to the latter one.

+ Step 3: Theoretical analysis

It is the theory that: H0: The average value of the experimental class is higher than the average of the reference class is random. H1: The average value of the experimental class is higher than the mean value of the reference class is statistically significant. Processing the Excel data by T-test and using Anova on Excel and both give the results: Rejecting Ho and accepting H_1.

3.5.2. The results of carrying out expert method

It can be seen from the results of the questionnaires, the author finds that:

- The results of using seven creative methods in teaching students. 80% of the teachers said that it was suitable while the rest considered it was normal.

- The ability to make sure about the aims, content, time, students' motivation, the creatively problem solving competence: 100% of the teachers told that the mentioned techniques met the teachers' requirement, encouraged students to study actively and developed students' new ideas. 10% of the teachers told that it was not easy for students to study when combining the content of Technology subjects with the creative methods.

- The feasibility of teaching and learning by the proposed ideas and the teachers' teaching ability. 100% of them agreed that they are feasible, 60% of them can teach well and the rest can teach normally.

In conclusion, it can be seen from the questionnaires of asking for expert method that the content of Technology subjects grade 11 aiming at developing the creatively problem solving competence by teaching the creative methods is feasible; Meets the requirement of the subject; The teachers succeed in teaching their students.

CONCLUSION OF CHAPTER 3

The survey of the study has been conducted educational experiment, asking for expert method to test the feasibility of the Technology subjects at secondary schools aiming at the creatively problem solving competence through the questionnaires used before and after educational activities, the students' marks, the form of the assessing criteria in the creatively problem solving competence shown at experimental classes, the form of asking for experts. The results are mentioned clearly in experimental and confrontational classes. However, there has not been clearly different between them as the author gives only two topics in a long process. The beginning findings make the solutions be continual used in other schools.

With the findings from experiment and educational experiment, teachers should concern about:

- The way to organize teaching and learning: giving more problems/situations in real life in order to find the new for themselves and for the public.

- The source of reference should be varied.

- Teachers should focus on improving the ability of collecting, processing information, finding out solution, evaluation, especially the necessary brainchild stage in order to solve problems in the new way to make creative products.

CONCLUSION AND SUGGESTIONS

1. Conclusion

The creatively problem solving competence is the ability to use innovative methods to solve problems that help shape and create new solution, new products.

The creatively problem solving consists of seven stages: Detect problems; Collect and analyze information related to the problem; Incubation; Provide solutions; Evaluate solutions, optimum solutions and concretize solutions to problems with creativity; Implement solutions; Check - evaluate results. Each stage will present from the low to the high levels in which the novelty is the most important.

There are two main measures for developing the capacity to solve a creative problem for students: Teaching creative methods; Setting students into the creatively problem solving tasks. Innovative methods are tools that help students form new ideas. When students perform learning tasks that create new products, students will apply creative problem-solving processes. This is the way to form and develop the creatively problem solving competence

The developing in the creatively problem solving competence in teaching Technology subjects is completely feasible. It can be seen from the educational experiment in two topics of the two lesson plans: Technique design and home draw. We also can see from the results of the asking for expert method that the creatively problem solving competence of students can be improved and carried out at secondary schools.

2. Suggestions

2.1. For the managements and people making curriculum

Renewing the curriculum of our general education and the curriculum of the technology subjects with fostering knowledge and skills for learners who also need teaching to develop their competence.

They should combine the content in learning topics and encourage students to find further knowledge about these.

They also should reform the students' evaluation by assessing their abilities and the process of learning.

They need to give clear plans, especially hold training courses for teachers to improve their competence of designing lesson plans in teaching Technology subjects. The science research should be introduced to students in order to develop their creatively problem solving competence.

2.2. For the teachers

Should understand deeply about theoretical basis of capability in general and know how to organize activities aiming at solving the problems in particular.

Besides developing the creatively problem solving competence for students through teaching the creative methods and setting students into the creatively problem solving tasks, teachers can also develop this competence for students through creative engineering calculation exercises, small scientific research of technology subject... This is the development direction of the study.

Should realize the requirements of the subject, do accurately the procedures of assessing students' levels.

LIST OF PUBLICATIONS

[1]. Nhu Thi Viet Hoa (2015), "*Developing problem solving competency by scientific research for student in high school"*, Journal of science of hnue, Educational Sci., 2016, Vol.60, No.8D, pp 159 – 164.

[2]. Nhu Thi Viet Hoa (2016), "*Assessing student's problem – solving compentency"*, Journal of science of hnue, Educational Sci., 2016, Vol.61, No.6B, pp 43 – 50.

[3]. Nhu Thi Viet Hoa (2017), *"Realities of capacity development in addressing creativity issues emerged in general technology teaching based on survey forms collected from students",* Science journal of vocational training education , 43 – 44 (April - May/2017), pp 31 -34.

[4]. Nhu Thi Viet Hoa (2018), *"The opinion of developing creative problem solving competency in teaching techonology subjects through pedagogical testing method",* Science journal of vocational training education, 57 – 58 (June - July/2018), pp 52 – 61.

[5]. Nhu Thi Viet Hoa (2018), *"Assessing the creatively problem solving competence in teaching techonology subjects",* Educational Equipment Magazine, Vol 179 (October /2018), pp 109 - 111.

[6]. Nhu Thi Viet Hoa (2018), *"Teaching Technology 11 aiming at developing the creatively problem solving competence by focal the point object method",* Educational Equipment Magazine, Vol 183 (December /2018), pp 35 - 37.