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EDUCATION OF COLLABORATIVE LEARNING SKILLS FOR
STUDENTS IN GRADES 4 - 5 THROUGH SCIENTIFIC GAMES

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SUMMARY OF THE PEDAGOGICAL PHD THESIS

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INTRODUCTION

1. The reason for choosing the thesis topic

1.1. The requirement to form and develop basic skills for primary school students is defined in Article 27 of the Education Law, in which collaborative learning skills play an important role in the formation and development of the qualities and capabilities to help students achieve good results in their studies. The spirit of the Resolution No. 29-NQ/TW dated November 4, 2013 of the 8th Plenum of the 11th Party Central Committee on fundamental and comprehensive innovation of education and training has been strongly implemented to enhance the quality of the Education in Vietnam. The education of collaborative learning skills is extremely important and urgent to help students achieve good results in their studies and contribute to the successful implementation of the fundamental and comprehensive innovation of education and training.

1.2. Teaching today still focuses on knowledge without paying attention to the education of collaborative learning skills.

1.3. There are not many deep researches on teaching collaborative learning skills for primary school students, especially teaching collaborative learning skills through games.

1.4. The contents of Science subject in grades 4 - 5 are significantly attractive for the curiosity to discover of the students. The games are also suitable for and always expected by children of primary school age. If some contents of the Science subject are redesigned into games combining with teaching collaborative learning skills, this will be two advantages for the education of collaborative learning skills for students; however, this has not been paid attention for specialized researches.

Therefore, the topic “Education of collaborative learning skills for students in grades 4-5 through scientific games” is chosen for the study of the Pedagogical PhD Thesis (Primary Education).
2. The purpose of the study

Propose measures for the education of collaborative learning skills for students in grades 4-5 through scientific games, contributing to improve the quality of teaching Science subject in primary schools.

3. Object, subject and scope of the study

3.1. Object of the study
Teaching process of Science subject in primary schools.

3.2. Subject of the study
The relationship between the development of collaborative learning skills for students in grades 4-5 and teaching Science in primary schools through scientific games.

3.3. Scope of the study
- The topic conducted surveys and experiments in a number of primary schools in Long An and Hau Giang provinces.
- The topic focused on and proposed measures for the education of collaborative learning skills for students in grades 4-5 through scientific games in their Science subject.

4. Scientific hypotheses
If measures for the education of collaborative learning skills through scientific games are guaranteed by a scientific design and selection process of the games, teaching designing technique with scientific games, guiding progress of scientific games to comply with the rules, learning environment encouraging students to practice collaborative learning skills and appropriate assessment technique for the collaborative learning skills, these will affect positively on the collaborative learning skills of the students and contribute to improve the learning outcomes.

5. Tasks of the study

5.1. Determine the theoretical and practical basis of the education of collaborative learning skills through scientific games in primary education.

5.2. Propose measures for the education of collaborative learning skills for students in grades 4-5 through scientific games.
5.3. Evaluate the study results by scientific experiments.

6. Study methods

We use groups of theoretical research method, practical research method, expert method, and statistical data processing method.

7. New contributions of the topic

- Contribute to clarify the scientific concept of the collaborative learning skills in primary education and the education of collaborative learning skills through scientific games.
- Identify the system of collaborative learning skills for primary school students.
- Construct designing technique for scientific games and the system of scientific games in order to teach collaborative learning skills for students in grades 4-5.
- Propose measures for the education of collaborative learning skills for students through scientific games, thereby contributing to improve science learning outcomes for students in grades 4-5.

8. Arguments for the defence

- Collaborative learning skills are important learning and social skills which are needed to teach for primary school students. These skills can be taught for students in grades 4-5 through appropriate scientific games to improve the learning outcomes of students.
- Teaching collaborative learning skills for primary school students through scientific games is a big advantage because of the deeply social nature of the games. Each scientific game can teach a number of collaborative learning skills in line with the game itself.
- The effectiveness of teaching collaborative learning skills through scientific games depends on the game design, game process, the guidance of teachers, environment and evaluation methods suitable for games.

9. Structure of the thesis

Besides the introduction, conclusions and recommendations, the thesis has 3 chapters:

Chapter 1: Theoretical and practical basis of the education of collaborative
Chapter 1. THEORETICAL AND PRACTICAL BASIS OF THE EDUCATION OF COLLABORATIVE LEARNING SKILLS FOR STUDENTS IN GRADES 4-5 THROUGH SCIENTIFIC GAMES

1.1. Overview of the studied issues

1.1.1. Collaborative learning skills

1.1.1.1. Studies on skills

The general theoretical issues about skills have long been studied in the works of V.A. Krutrexki, A.G. Covaliop, K.K. Platonop, G.G. Golubev, N.D. Levitop, A.V. Petroxki, and many others. In Vietnam, there have been works of Dang Thanh Hung and many research projects on specific issues of skills also studied skills in different aspects depending on the studied directions.

1.1.1.2. Studies on collaborative learning skills

It can be taken into account the studies of the authors Johnson D. W, Johnson R. T (1999), Schmuck and Runkel (1985), Thousand J.S Villa R.A (1994), Romiszowski (1981), George Jacobs (1999), Dang Thanh Hung (2002), Nguyen Huu Chau (2005), Nguyen Ba Kim (2006), Thai Duy Tuyen (2008) and a number of PhD topics and theses on the teaching of collaborative learning and the development of collaborative learning skills have also studied to propose the collaborative learning skill groups needed to be trained or develop collaborative learning skills through a variety of measures suitable for each specific study branch, grade and age of learners. However, those issues in the primary schools are less discussed.

1.1.2. Science teaching in primary schools

1.1.2.1. Abroad studies

All over the world, there are numerous studies on the science teaching in general, but mainly the studies on the methods, models, and strategies of the science teaching
in order to make students acquire best the scientific knowledge and practice scientific skills. There are some popular teaching methods such as “Hands-on”, project-based teaching, case studies-based teaching, experiment-based science teaching, etc.

1.1.2.2. Domestic studies

In Vietnam, Science subject of grades 4-5 is taught based on both traditional and modern methods, such as: Tectonic theory, interactive pedagogical view, role-play method, problem-solving approach, project-based teaching, group discussion combined with some other methods, Hands-on, etc... but these methods mainly focus on helping students acquire knowledge in the best way, not the necessary learning skills. Up to now, there has not been any study that solves the problem of teaching collaborative learning skills through Science in primary schools.

1.1.3. Teaching collaborative learning skills through scientific games

1.1.3.1. Abroad studies

Using games to deliver learning contents and help develop some capabilities of the learners has been studied by scientists in the world in order to enhance learning activities and make the learning more effective.

1.1.3.2. Domestic studies

Studies on games and the use of games in the education process have been conducted by many people. Many theses discuss the games in kindergarten schools, studying the use of learning games to develop intelligence and cognition, practice physical activities, educate communication behaviors, teach sciences, teach mathematics, teach languages, develop intelligence, etc. However, there have not been many studies in secondary and high levels, and even less in primary schools.

1.2. Scientific games in primary schools

1.2.1. Concepts

1.2.1.1. Play and Game

- Play

The thesis approaches in the view of Dang Thanh Hung “Play is a kind of behavior or natural and voluntary activity, whose motivation is internal factors within the game, and the subjects are not necessary to pursue objectives of practical
benefits in the process voluntarily.”

- Trò chơi (Games, Plays)

Approaching to the views of previous researches, this thesis supposes that Game is a combination of different activities (communication, cognition, learning, playing, arts, sports...) and appropriate rules whose functions are combining them to make people play by the rules to achieve certain objectives and benefits.

1.2.1.2. Scientific Game

Depending on the intended use and approach view, games are classified and identified by specific names. Within the scope of the thesis, the concept of Scientific game is construed as a kind of educational game with the content and purpose of science education corresponding to the curriculum for Science subject in grades 4-5. It can be one of or contain all intellectual games, logic games, science quizzes.

1.2.2. Characteristics of scientific games in primary schools

Scientific games have a special function in physical practice, intellectual development and practice of social skills. The contents of basic components ensure the dual goals which are teaching collaborative learning skills and contributing to improve the learning outcomes of Science subject. Playing actions aimed at teaching collaborative learning skills are put into the rules; The play activities are designed for the students to get experience and students directly participate in these experiential activities; There is a harmony between the development of intelligence and collaborative learning skills; Friendly, suitable for students.

1.2.3. Design principles and selection criteria of scientific games

We propose 6 design principles: Selection combined with creativity; The principle of ensuring the development; Collaboration principles; Principles of focusing on experience and skills training; Friendly principles; System principles. 5 selection criteria of the games to meet the requirements of the education of collaborative learning skills through scientific games are criteria of: contents, objectives, playing actions, friendliness and results of the game.

1.2.4. Scientific games and Science subject in primary schools

We have clearly analyzed the applicability of the games in teaching Science
and proposed 6 criteria for selecting contents to design scientific games: Contents are the necessary matters, appropriate for playing methods; Consistent with the cognition and understanding of the students; Requiring the cooperation within groups; Performing specific tasks or actions; Suitable for playthings of student age; Requiring the use of collaborative skills and cooperative working skills in learning process.

1.3. Collaborative learning skills

1.3.1. Concepts

Based on the views of previous researches, in the thesis we conceive as follows:

1.3.1.1. Collaborative learning

*Collaborative learning is understood as learning methods or strategies in collaborative environment and relationship, sharing learning interests, goals, outcomes, resources and tasks, in which the learners both take individual efforts and ensure their contribution to the common efforts of the group in learning with equal and interdependent status in a positive way.*

1.3.1.2. Skill

*Skill is a form of action which is implemented technically and flexibly in different conditions and environments based on the life experience and understanding of the work, motor capabilities and other biological, psychological and social conditions of individuals to solve problems to achieve the specified purposes or criteria, or the success according to the standard or regulation.*

1.3.1.3. Learning skills

*Learning skills are the actions performing learning tasks of the learners which are conducted self-consciously and flexibly in different learning conditions and environments based on the life experience and understanding of learning, motor capabilities and other biological, psychological and social conditions of individuals to solve problems to achieve the specified purposes or criteria. In other words, learning skills are skills used in learning by individuals.*

1.3.1.4. Collaborative learning skills

*Collaborative learning skills are the actions performing learning tasks which are conducted flexibly in different learning conditions and environments based on the life*
experience and understanding of learning, motor capabilities and other biological, psychological and social conditions of individuals and groups to implement learning tasks by learning together to achieve results according to the specified purposes or criteria. In other words, collaborative learning skills are learning skills used by individuals and groups in collaborative learning environments and conditions.

1.3.2. Principles and characteristics of collaborative learning

In the thesis, we identify five principles and a number of basic characteristics of collaborative learning in primary schools: Teachers design and organize collaborative learning activities, give advices and support while students performing learning tasks, review and evaluate the process of performing tasks of individuals and groups and the results, encourage students to put more effort into learning. Students are proactive in learning, actively carry out tasks in collaborative relationship with interpersonal interaction, know how to use collaborative skills to share documents, materials and help each other to complete personal tasks with the highest results, contributing to the general success of the group.

1.3.3. Collaborative learning skills system in primary schools

From the characteristics of collaborative learning methods, psychological, physiological and social characteristics of primary school students and the structure of learning tasks, inheriting the studies of domestic and foreign authors, we propose 4 basic groups of collaborative learning skills in primary schools with 18 skills, including: 1/ Group of Team set up skills, 2/ Group of Interpersonal interaction skills, 3/ Group of learning tasks performance skills, 4/ Group of Review and feedback skills.
Because of the characteristics of the subject's content and characters of the game, the collaborative learning skills that can be taught through scientific games include: Moving and coordinating skill; individual tasks assigning skill; listening skill; opinion expression skill; collaborative attitude expression skill; friend support skill; learning tool manipulation skill; assessment and self-assessment skill. Different collaborative learning skills are taught depending on the each specific game.

1.4. The education of collaborative learning skills through scientific games in primary schools

1.4.1. Concepts

1.4.1.1. Education

According to Mr. Dang Thanh Hung, with the most common sense, education is the process and result of receiving social experience from outside into individuals to
process and develop to make personal values and when these values are used by individuals, this will be the new contribution to the social experience.

1.4.1.2. The education of collaborative learning skills

Inheriting previous concepts, the thesis uses the concept of the education of collaborative learning skills as follow:

The education of collaborative learning skills is the process to help students acquire social experience in collaborative learning, process and develop it with their basic experience and practice and apply it through their participation in educational activities specially organized by the schools. The education of collaborative learning skills through scientific games is a process to help students acquire social experience in collaborative learning based on the function of education and development of the scientific games for those who play the games.

1.4.2. Characteristics of students in grades 4-5

Through the study of biological, psychological and social characteristics of students in grades 4-5, we have drawn some relevant pedagogic conclusions to be the foundation to propose measures for the education of collaborative learning skills through scientific games.

1.4.3. Principles of the education of collaborative learning skills through scientific games

We have identified six principles needed to ensure for the effective education of collaborative learning skills through scientific games, including: Suitable for the educational content of the Science subject; Suitable for the characteristics of school age children; The participation and cooperation of all students; The humanity of the games and educational methods; The scientificity of the games and educational methods; The development of the games and educational methods.

1.4.4. Methods of the education of collaborative learning skills through scientific games

To educate collaborative learning skills for students through scientific games, it is necessary to implement such methods as: Persuasion, modeling, guiding, encouraging the exploration and using pedagogical situations.
1.4.5. Forms of the education of collaborative learning skills through scientific games

The main forms used to educate collaborative learning skills for students through scientific games are: Educate through games in the classroom and educate through the game in environments outside the classroom. Scientific games are held in the teaching process of teachers, most of the contents of Science curriculum are taught in the classroom. Therefore, the education of collaborative learning skills through scientific games are conducted mainly in the classroom and ensure the teaching process based on the games. Some contents can be taught outside the classroom, they are designed into scientific games to play outside the classroom. Games conducted outside the classroom will be more interesting for students because they mostly study in the classroom. Educating collaborative learning skills for students through scientific games in the environments outside the classroom will have the advantages to educate moving skill, team management skill, observation skill, support skill,...

1.5. Actual situation of the education of collaborative learning skills through scientific games in some primary schools

1.5.1. An overview of the survey of actual situation

1.5.1.1. Purpose of the survey

To assess the actual situation of the education of collaborative learning skills through scientific games in some primary schools in Long An and Hau Giang provinces.

1.5.1.2. Objects of the survey

Teachers and students in grades 4-5 at some primary schools in Long An and Hau Giang provinces. Quantity: 205 teachers and 250 students.

1.5.1.3. Contents of the survey

- The capability to educate collaborative learning skills through scientific games.
- The actual situation of the education of collaborative learning skills through scientific games in the surveyed schools.
- The actual situation of collaborative learning skills of students in grades 4-5 in the surveyed schools.
1.5.1.4. Methods of the survey

The survey is conducted by questionnaires, interviews, observation, study of the teaching records of teachers and the Science subject’s learning outcomes of students, and survey data processing.

1.5.2. Results of the actual situation survey

Regarding the content structure of the curriculum: The Science subject integrates knowledge of many areas, divided into appropriate topics. Each lesson is able to educate basic learning skills. Simultaneously, the content of Science subject is potentially applicable with the games very well, several collaborative learning skills can be educated for students through these games.

1.5.3. Actual situation of the education of Science subject in some primary schools

The result of the survey shows that teachers have been using multiple teaching methods suitable for the characteristics of Science subject, especially the methods that promote the activeness of students such as group discussions, games,... The teachers highly appreciate the benefits for students when using games in teaching Science, especially the games help students practice some skills, including collaborative learning skills, so they use games in teaching Science quite often.

1.5.4. Actual situation of the education of collaborative learning skills through scientific games

Through the analysis of the actual situation, we conclude as the followings:

- Characteristics, content structure of Science subject in grades 4-5 are very familiar, attracting students’ curiosity about the Science to help them enjoy learning Science.

- In teaching Science, teachers have combined the use of many methods suitable for the characteristics of the subject, including positive teaching methods such as group discussion, game-based teaching method,....

- Teachers have not designed the science games in order to teach collaborative learning skills for students, so the education of collaborative learning skills for students through scientific games have not been taken into account for the
Students still lack basic collaborative learning skills or have not voluntarily practised collaborative learning skills regularly.

1.5.5. Findings about practices of the teaching and education of collaborative learning skills for primary school students through scientific games

Through the survey and analysis of the actual situation, we have also found a number of practical issues as the basis to propose measures, concretely: collaborative learning teaching, collaborative learning skills, the design and use of scientific games, education of collaborative learning skills through games.

Conclusions of Chapter 1

1. Collaborative learning skills are basic skills that primary school students need to practice. Science subject and scientific games are suitable for the task to develop collaborative learning skills. Studies in Science and facts through the survey of the actual situation in some primary schools have proved this.

2. Studies show different views on skills, learning skills, collaborative learning skills, playing, games and playing activities, which mean that still there are some ideological issues that need to be further clarified. However, such studies’ results help the thesis identify the theoretical foundation for this study taking into account the facts of primary schools in Vietnam.

3. We propose 4 basic groups of collaborative learning skills consisting of 18 specific skills for primary school students: Group of Team set up skills; Group of Interpersonal interaction skills; Group of Tasks performance skills; Group of Review and feedback skills. These are basically suitable for scientific games.

4. The result of the survey shows that the Science subject is potentially applicable with the scientific games, teachers use game-based teaching methods quite often, this is a favorable precondition for the education of collaborative learning skills for students through scientific games. Besides, it also shows the fact that the education of collaborative learning skills through scientific games is not cared enough by teachers, the design of the games is mainly based on the teachers’ personal experience. Students lack necessary collaborative learning skills.
Chapter 2. MEASURES TO EDUCATE COOPERATIVE LEARNING SKILLS FOR STUDENTS OF GRADES 4, 5 THROUGH SCIENCE GAMES

We have identified some basic principles and processes to design and select science games, and measures to educate collaborative learning skills through such science games as follows:

2.1. The basic principles of science games
   2.1.1. Purposeful
   2.1.2. Appropriate
   2.1.3. Experiential and collaborative
   2.1.4. Effective

2.2. Measures to educate collaborative learning skills through science games
   We propose measures to educate cooperative learning skills through science games as follows:
   2.2.1 The process to design and select science games
      2.2.1.1. The general process to design science games
      The process consists of 5 steps: Determine lesson objectives; Select content design; Select toys; Estimate group's size and playground location; Design games.
      When designing the games, we must meet specifically technical requirements.
      2.2.1.2. The general process to select science games
      Consists of 2 steps: Review and evaluate the basic components of the games; Supplement and adjust the games. The basic components of the games include: Content, objectives, technical design, game tasks and instructions, laws/rules of the games, tools/utensils and game results.

      2.2.2. Developing techniques to design teaching methods with science games
      2.2.2.1. Techniques to design teaching methods with science games whose content is part of the lesson
      2.2.2.2. Techniques to design teaching methods with science games whose content belongs to one lesson or lessons
      The techniques to design teaching methods with science games consists of 4 steps: Design the lesson objectives; Design teacher's and students' preparation; Design specific learning activities; Design the lesson summarization. Every step must meet the specific requirements.

      2.2.3. Organize and instruct how to play science games in classroom
      Phase 1: Design teaching preparing conditions in consistency with science games at class. Consists of 3 steps: Determine the lesson objectives; Design or select games; Prepare teaching plans/design teaching methods with the games
Phase 2: Teach with science games at class. Consists of 5 steps: keep the class in order, introduce lessons/games; Devide the class into and organize groups; Introduce game tasks and instructions and rules of the games; Conduct the games; Summarize the games. In each step, there are specific requirements for teachers and students, ensuring educational process for collaborative learning skills through science games and the smooth coordination between the teacher and the students and between the students.

2.2.4. Organize and instruct how to play science games outside classroom

Phase 1: Design conditions for the preparation of teaching with science games outside class.

Phase 2: Teach with science games outside class.

The steps in two phases are similar to organizing and instructing how to play science games in class. However, the requirements for each step must be relevant to the conditions outside classroom.

2.2.5. Design and organize an environment encouraging cooperative learning skills practice

- Build good psychological environment between teacher-student, student-student and appropriate, safe infrastructure.
- Combine active teaching techniques to encourage students to participate and cooperate actively when participating in science games.

2.2.6. Design and apply assessment techniques for cooperative learning skills through science games

Design steps to assess collaborative learning skills through science games. Consists of 3 steps: Specify cooperative learning skills which should essentially be educated through games; Specify criteria and rating scale for collaborative learning skills; Assess those. Evaluate cooperative learning skills based on five criteria: The completeness of the content and structure of the skills; The rationality of the skills; The skill proficiency level; The flexibility of the skills; The effectiveness of the skills. When conducting the evaluation, we used observation sheets to assess the collaborative learning skills and the level of active cooperation of the students.

2.3. The relation between the measures

The measures' role and effectiveness vary but they are related and affected by each other in the educational process of developing collaborative learning skills for students through the science games. Therefore, it is necessary to coordinate the implementation of measures together to achieve the best results.
2.4. Conditions for the implementation of the educational measures for developing collaborative learning skills through the science games

The conditions for the implementation of the measures include: profession management condition; Personnel and professional activities condition; Facility condition; Learning condition.

Conclusion of chapter 2

1. Based on the theoretical and practical studies of science games and cooperative learning skills education through science games for students, we have identified some basic principles of the science games and developed science general processes to design and select science games. Based on these process, we have designed a number of science games, with 1-2 game(s) for each topic, and teachers can keep developing them themselves. The science games must ensure two goals which are cooperative learning skills education and knowledge of lessons. The difference from other games is the requirement for cooperative actions in the games included in the rules of the games.

2. We have proposed several measures to develop cooperative learning skills and build the educational process for developing cooperative learning skills through science games, consisting of: developing a process to design and the select science games; Developing techniques to teach with science games; Organizing and instructing how to play science games in classroom; Organizing and instructing how to play science games outside classroom; Designing and organizing environment to encourage cooperative learning skills practice; Designing and applying techniques to assess cooperative learning skills developed through science games. The measures has their own roles and are related, support and complement each other in developing collaborative learning skills for students. For the measures, we have overcomed the limitations when organizing games, as well as developed the process to design science games with specific criteria to help organize students to implement science c games successfully according to its objectives. The measures and process proposed are based on the fundamental principles of collaborative learning skills and the procedure for teaching collaborative skills to students with clear and easy-to-apply instructions.

3. Depending on the content of the science lesson, each science game will appropriately be designed or selected for the mission to develop certain cooperative learning skills. There is no one-fit-all science game for all cooperative learning skills; instead, each science game will be directed to developing certain skills which are well defined and set out as the objectives of the lesson.
3.1. Design experiments

3.1.1. The purpose, scope and location of experiments
In order to verify the science of the hypotheses and the feasibility of the educational measures which are used to develop collaborative learning skills for students in grades 4, 5 through science games.

The experiment was conducted within the Science subject in grades 4 and 5. Each grade chose one class for the experiment (30 students) and a referential class (30 students). The experiment was conducted at Mai Thi Non primary school, Ben Luc district, Long An province.

3.1.2. The content of the experiment
Select content for lesson in Science subject in grades 4 and 5 which is relevant to playing activities to design science games. Conduct the lesson according to educational measures which are used to develop cooperative learning skills for students through proposed science games.

3.1.2.1. Object for experiment
The students in grade 4 and grade 5 of Mai Thi Non primary school, Ben Luc district, Long An province.

3.1.2.2. Methods of measurement and evaluation
- We used observation method to observe and assess cooperation activeness level and cooperative learning skills of 4 groups. Knowledge was acquired through post-experiment tests.
- Criteria for evaluating collaborative learning skills: In this study, we assess the skills according to 3 levels: highly skilled, skilled, and unskilled. The test is graded out of 10.
- Processing the experimental results: using Excel.

3.1.3. Experiment procedure and method
3.1.3.1. Experiment procedure
Follow these steps: 1/ Select a experimental class and a referential class, 2/ Train the collaborators, 3/ Make plans for the lessons 4/ Conduct the experiment

3.1.3.2. Conduct a survey in advance about the learn results and cooperative learning skills of the students

3.1.3.3. Experiment method
Conduct the experiment with reference, the program conditions, the content, the teaching conditions, the class sizes and the entry capability levels are equivalent. The experimental class was applied the teaching method with the science games and the
designed teaching plan. The referential class was applied the normal teaching method.

3.1.3.4. The end of the experiment

At the end of the experiment, we summarized the results of the experimental class and the referential class to assess the degree of active cooperation, the progress of the students with collaborative learning skills and the knowledge acquired through the lessons with the games.

3.2. Experimental results analysis

3.2.1. Compare the degree of pre-experimental cooperation activeness between the experimental class and the referential class

The results of the analysis of pre-experimental cooperation activeness levels of the 2 groups were equivalent, the majority of the students do not have the mind to perform the tasks of learning and cooperating..

3.2.2. Compare the post-experimental cooperation activeness levels between the experimental class and the referential class

Through the educational process, the students in the experimental class became readier for learning activities as well as learning cooperation than before the experiment. The students in the referential class got an insignificant change therein..

3.2.3. Analyze the progress of the students in cooperative learning skills made through the science games

![Figure 3.5. The development of the cooperative learning skills of the students in grade 4](image)
Figure 3.6. The development of the cooperative learning skills of the students in grade 5

Figure 3.9. The progress in cooperative learning skills shown in each time of measurement

Figure 3.10. Compare the average scores of cooperative learning skills between the experiential class and the referential class before and after the experiment
The students in the experimental class made a progress in with the progress in collaborative learning skills compared to previous experimental and were more progressive than the students of the referential class. The change in the average score and in standard deviation over the observations, as well as in p-value of t-test over the observations confirmed the results.

3.2.4. Analyze the case of improving collaborative learning skills

In the course of the experiment, we chose some students for studying the case. Analyzing the results observed during the impact showed that their cooperative learning skills has improved dramatically, their level of activeness and confidence has also improved remarkably.

3.2.5. Analyze the results of the students' learning

![Figure 3.11](image1.png)  
Figure 3.11 The frequency illustration for the learning results of the students of grade 4 through science games

![Figure 3.12](image2.png)  
Figure 3.12 The frequency illustration for the learning results of the students of grade 4 through science games
Through the experiment, the learning results of the student of the experimental class was better than the referential class’. This confirms that, through science games, educational not only cooperative learning skills is developed, but the quality of science learning is also ensured.

3.3. General evaluation for the experiment results

3.3.1. About the effect of the games

The experiment results show that the science games are very suitable for the physiological characteristics of students in grade 4 and 5 and can develop some cooperative learning skills for students who are suitable with those games.

3.3.2. About the improvement of the collaborative learning skills

Through the science games, the students' cooperative learning skills were significantly improved, the level of "unskilled" barely existed, the level of "skilled" and "good skills" has increased much more so than before the experiment.

3.3.3. About the science learning results

The testing results after the experiment showed that the learning results of the experimental class were better than what of the referential class, the students of the experimental class acquired knowledge well. This confirms, if students have good cooperative learning skills, the learning results will be good.

The conclusion of chapter 3

1. The initial experimental results showed that educational measures to develop cooperative learning skills through science games for students in grades 4 and 5 have a positive impact on improving cooperation learning skills and the results of students' learning in grades 4 and 5. After the experiment, the students' cooperative learning skills have improved significantly in all 4 groups of skills. The degree of cooperation activeness of the students have also been significantly improved. The quantitative and qualitative analysis, and the scientific measurements and testing has confirmed the effectiveness of the educational measures to develop cooperative learning skills through science games.

2. The scientific experiment results also showed that educational measures to develop cooperative learning skills through science games also positively affect the science learning results of students. It is the process of cooperative learning skills training that helped students become more active in learning, having good cooperative learning skills facilitates students' learning process to achieve better results.

3. The experimental results confirm that the scientific hypothesis of this study is correct and proven, the educational measures to develop cooperative learning skills
for students through science games in grades 4 and 5 have an impact on the development of students’ cooperative learning skills.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusions

1.1. Cooperative learning skills are basic skills for elementary school students to be trained. Science and science games are very suitable for the development of collaborative learning skills. Scientific studies and practical events via surveys about the current situation of some primary schools have proven it. The studies reflect different perspectives on skills, learning skills, cooperative learning skills, playing, games and playing activities, which means that there are still some theoretical issues that need to be further unraveled.

1.2. Though there have been many studies and practices for skills, there are not so many for learning skills and cooperative learning skills. However, that is also the reason for further studies on developing cooperative learning skills in elementary school. The thesis proposes 4 groups of cooperative learning skills in elementary school with 18 specific skills fitted with the science games. The division of the cooperative learning skills into the groups are only approximate because there are some fundamental skills, which are the foundation to develop other skills, so that they can match with other cooperative learning skills groups, depending on the timing and content of work. These fundamental skills play the role of connecting members, maintain team work and promote cooperation to perform work efficiently, such as cooperation attitude showing skill, communication skill, feedback giving skill, etc. Based on the educational function of the games and the direction of the study, we have identified some basic principles of science game and developed general processes to design and select science games. In the study, the science games are designed to ensure not only the basic characteristics of educational games but also the two core objectives of education which are to develop cooperative learning skills and acquire knowledge (help students acquire knowledge and basic skills from lessons as much as possible). In science game, experience and cooperation are clearly expressed; the requirements for developing cooperative learning skills are specified though the actions consistent with the content and audience participating in the games, especially implementation the requirement to include the cooperative actions in the rules of the games. When students follow the rules, which also means performing cooperative actions when playing, students are practicing cooperative learning skills through the games. Each science game will help educate students
certain cooperative learning skills included in such game, but cannot teach all the cooperative learning skills through a science game.

1.3. Based on the theoretical and practical study, we have proposed a number of measures to develop cooperative learning skills and build educational process to develop cooperative learning skills through science games: Develop the process to design and select science games; develop techniques to design teaching with science games; organize and instruct how to play science games in classroom; organize and instruct how to play science games outside classroom; design and organize an environment to encourage cooperative learning skills practices; design and apply assessment techniques for cooperative learning skills through science games. The measures are linked closely together as a whole and support each other to develop cooperative learning skills for students through science games to achieve the best results. Creating an environment that encourages students to practice the cooperative learning skills is the measure that is implemented throughout the educational process to develop cooperative learning skills through organizing and instructing how to play the games in and outside classroom as well as other measures, to help students actively engage in the activities in the games to practice cooperative learning skills. The experiment shows that the educational measures to develop cooperative learning skills for students in grade 4 and 5 through science games have had a positive impact on improving cooperative learning skills and learning results of students in grade 4 and 5. After the experiment, cooperative learning skills of the students have been significantly improved in all 4 groups of skills. The degree of the cooperation activeness of the students have also been significantly improved. It is the process of experiencing the science games to practice cooperative learning skills that helps the students become more active in learning, having good learning skills facilitate students achieve better results.

1.4. The experimental results confirm that the scientific hypothesis of this study is correct and proven, the educational measures to develop cooperative learning skills for students through science games in grades 4 and 5 have an impact on the development of students’ cooperative learning skills.

2. Recommendations

2.1. For the Ministry of Education and Training

Conduct researches and look for innovative solutions to synchronize programs, contents, teaching methods and forms of examination and assessment for Science subject. The content of the science subject should be added more practice and experience. Ensure the balance between knowledge and science practice. Compile more documents instructing how to develop cooperative learning skills through
games and science games to provide teachers with references. Developing more samples of science games to develop learning skills in general and cooperative learning skills in particular.

2.2. For Department of Education and Training

Give consultancy to the local leaders to develop the network of school in line with the socioeconomic conditions of the local society, ensure sufficient number of classrooms, functional rooms, proper furnitures, and playground in accordance with the regulation for elementary schools in order to create favorable conditions for the teachers to apply the active teaching methods, including teaching through games. There are measures to encourage teachers to explore and design appropriate games for use in elementary schools to teach the students.

2.3. For school

Create plans to properly develop the school, do not let the ratio of students/class exceed regulations. Facilitate the teachers to raise their own teaching level, to access and to boldly apply more effective teaching methods such as teaching through science games. Develop internal policies to encourage the teachers to actively design and use games in teaching and education on a scientific basis and the specific conditions of the local.

2.4. For elementary school teacher

Never stop learning and studying about the physiology of elementary school students and pay attention to developing cooperative learning skills for the students, learning necessary skills to design and organize teaching through science games. The most important thing is training professional skills related to the design and use of science games in particular and educational games in general at elementary school.

2.5. For researcher

Extend the study for developing general learning skills and developing cooperative learning skills through game in other subjects in elementary school. However, these studies about games need to be updated with new achievements in science and technology in order to create theoretical and technical basis to help the school and teachers be able to design and use educational games effectively.
LIST OF SCIENTIFIC WORKS RELATING TO THE THESIS


