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TEACHING PROBABILITY - STATISTICS AT HIGH SCHOOL BASING ON CONNECTIVISM WITH THE SUPPORT OF INFORMATION TECHNOLOGY

DISSERTATION SUMMARY

THAI NGUYEN - 2020

THE AUTHOR'S PUBLICATIONS
RELATED TO THE DISSERTATION TOPIC

1. Bui Van Nghi, Vu Hong Linh (2015), "Applying connectivist learning theory in teaching the chapter "Vector" at high school", Journal of Education, No. 361 (Period 1-July 2015) pages 41-43.

2. Bui Van Nghi, Vu Hong Linh (2018), "Orientations of applying connectivism in teaching Probability - Statistics at high school", Journal of Educational Management, No. 6 (June 2016), p.82-86.

3. Vu Hong Linh (2018), "Connectivism and some suggestions for applying connectivism in teaching", Journal of Education, special issue (September 2018), pp.112-114 .

4. Vu Hong Linh (2019), "Connectivist teaching methods with the support of information technology", Journal of Education Management, No. 1 (January 2019), p.48- 57.

INTRODUCTION

1. Reasons for choosing the research topic

+ Teaching in the direction of developing learners' competencies is receiving attention from countries around the world in general and in Vietnam in particular.

Research works on educational program development are interested in two types of programs, namely income based curriculum (IBC), which focus on what contents to teach to learners, and outcome based curriculum (OBC), which cares about what contents learners need. Teaching in the orientation of developing learners' competencies falls into OBC.

Competence-based education aims to ensure the outcome quality of teaching, realize the goal of comprehensive development of personality qualities, focus on the competence to apply knowledge in practical situations to develop competencies to solve situations in life and career. OBC emphasizes the role of the learner as the subject of the cognitive process. Competency-based teaching aims to promote students' activeness, proactiveness and creativity.

+ The rapid development of information and communication technology (ICT) has been increasingly supporting teaching in the orientation of individualizing learners and promoting their competency development.

Besides foreign research works, in Vietnam there are also many research works on IT application in teaching. The most common is the research direction of exploiting and using application software in teaching subjects. Besides, there are research works on designing software to support testing and assessment and virtual experiments, etc. Theoretical research works also mainly discuss general issues and IT application in teaching innovation as tools, including research works by Nguyen Tich Lang (2000), Dao Thai Lai (2006), Trinh Thanh Hai (2006), Tran Trung (2009), Nguyen Van Hong (2012), etc; and the use of IT to support teaching, including research works by Hoang Ngoc Anh (2011), Le Tuan Anh (2016), Bui Minh Duc (2018) , etc.

+ The theory of connectivism was initiated by Siemens in 2004 and officially published in 2005. Siemens has pointed out that:

connectivist learning can be considered a learning theory in the digital age and in a society with rapid changes. In connectivism, learning occurs through connections across a network, with a network of nodes and connections helping the learning process. Connectivism theory is the integration of continuously updated and supplemented information sources.

There have been a number of foreign researchers studying Siemens's theory of connectivism and applying it in teaching, including Siemens (2005); Downs (2009), AlDahdouh, Alaa A ., Osório, António J. & Caires, Susana (2015); Ann Hill Duin and Joseph Moses (2015); Barnett, J., McPherson, V., & Sandieson, RM (2013), etc. Accordingly, lessons can be designed about some contents for a number of students to meet the learning and scientific research needs of individuals. However, in Vietnam, there are few studies on applying connectivism in teaching Mathematics in high schools.

+ Along with the rapid development of science and technology industries, Probability - Statistics has become an independent science, a powerful service tool in many different fields of the socio-economic life. Recognizing that importance, over the recent years, Probability - Statistics has been taught at high school. In the innovation process, the education system has achieved many remarkable achievements, however, teaching and learning in general and teaching Probability - Statistics in particular still have many shortcomings and challenges.

In foreign countries, there are many articles on the topic of teaching Probability – Statistics, for example, Brousseau G, Brousseau N. & Warfield G (2002); Hayter A.J. (2007); Stigler S.M. (1978); Yule G. U. (1900), etc.

In Vietnam, there are many research works discussing the topic of teaching Probability - Statistics in high schools, such as Tran Kieu (1988), Do Manh Hung (1993), Tran Duc Chien (2007), Ngo Tat Hoat (2012), etc.

Research works on teaching Probability - Statistics mainly focus on career support in universities. Research works on teaching Probability - Statistics at high schools are mainly master's theses on applying teaching methods to contribute to improving teaching efficiency.

For the above reasons, we have chosen the research topic: ***"Teaching Probability - Statistics at high school basing on connectivism with the support of information technology".***

2. Research aim

The aim of the research is to propose a method of designing and organizing the teaching of Probability - Statistics in high schools according to the theory of connectivism with the support of information technology in order to create connections between teaching contents with supporting materials, the interaction between teachers and students, and between students in the teaching process, contributing to innovating teaching methods and improving the effectiveness of teaching Mathematics in high schools.

3. Research tasks

(1) Summarize domestic and foreign studies on the teaching of Probability - Statistics in high schools and connectivist teaching with the support of IT.

(2) Study connectivist teaching: the concept of connectivist teaching, the origin and development of connectivism in teaching, and how to apply connectivism in teaching?

(3) Investigate the current situation of teaching Probability - Statistics at high school related to connectivism and IT.

(4) Propose methods of designing and organizing the teaching of Probability - Statistics at high school basing on connectivism with the support of IT.

(5) Carry out pedagogical experiment to evaluate the feasibility and effectiveness of the proposed methods of designing and organizing the teaching of Probability - Statistics at high school basing on connectivism with the support of IT.

4. Scientific hypothesis

If the teaching of Probability - Statistics in high school is designed and organized based on connectivism as proposed in the thesis, it will create a teaching and learning environment which can connect knowledge and skills of the learners themselves with the knowledge and experiences of others, between individual work and teamwork through interaction, contributing to improving the effectiveness of teaching Probability - Statistics in high schools.

5. Research object and scope

- The object of the study is the method of designing and organizing the teaching of Probability - Statistics at high school basing on connectivism with the support of IT.

- The subject of the study is the process of teaching Probability - Statistics in high schools.

- Scope of the study: Applying connectivism in teaching the content of Probability - Statistics at high schools with the support of IT.

6. Research methods

- Theoretical research method: Studying documents and works related to connectivism and information technology application in teaching, and then propose the method of designing and organizing the teaching of Probability - Statistics at high school basing on connectivism with the support of IT.

- Methods of investigation and survey: Using questionnaires to investigate the current situation of teaching Probability - Statistics at high school, applying IT in teaching Mathematics, and some problems of teaching methods related to connectivism.

- Pedagogical experiment: Teaching some lessons of Probability - Statistics in high schools basing on connectivism with the support of IT to evaluate the feasibility and effectiveness of the proposed methods.

- Case study: Monitor and observe the self-study competence of a group of students under the guidance of teachers during the designed lessons in Chapter 3 to have grounds to adjust and change proposals and evaluate students' guided self-study abilities.

7. Contributions of the thesis

7.1. Theoretical contributions

- Propose the concept of connectivist teaching, the significance and effects of connectivist teaching methods with the support of IT, the similarities and support between connectivist teaching methods and some other teaching methods.

- Propose the method of designing and organizing the teaching of Probability - Statistics at high school basing on connectivism with the support of IT.

7.2. Practical contributions

- Help teachers know how to design and organize the teaching of Probability - Statistics at high schools basing on connectivism.

- Applying the method of designing and organizing the teaching of Probability - Statistics as proposed in the thesis will contribute to innovating teaching methods and improving the effectiveness of teaching Probability - Statistics at high schools.

8. Points to be protected

- Teaching Probability - Statistics at high schools basing on connectivism with the support of IT can be done and is based on scientific and practical grounds.

- Methods of designing and organizing teaching Probability - Statistics at high schools basing on connectivism with the support of IT as proposed in the thesis contribute to innovating teaching methods and improving the effectiveness of teaching Mathematics at high school.

9. Structure of the thesis

In addition to the Introduction and Conclusion, the thesis includes 04 chapters:

Chapter 1: Theoretical basis

Chapter 2: Practical basis of teaching Probability - Statistics at high school basing on connectivism

Chapter 3: Methods of designing and organizing teaching Probability - Statistics in high school basing on connectivism with the support of IT

Chapter 4: Pedagogical experiment

Chapter 1
THEORETICAL BASIS

1.1. Overview of works related to the thesis topic

1.1.1. Research works on connectivism

1.1.1.1. Foreign Research works

Summaries of foreign research works related to connectivism:

(i) After connectivism was proposed by Siemens in 2005, almost every year there is research on this theory.

(ii) The published works related to connectivism falls into the following research directions:

Direction 1: Discussing terms related to connectivism.

Direction 2: Discussing the views, principles, roles and importance of connectivism.

Direction 3: Studying the advantages and disadvantages of connectivism, and applying connectivism in teaching.

(iii) There is no research on applying connectivism in teaching Mathematics in high schools.

1.1.1.2. In Vietnam

There are not many studies in Vietnam on connectivist teaching. The term of connectivism is only officially used in the work of Nguyen Manh Hung (2014) and Do The Hung, Nguyen Thi Kim Hoa (2015). In addition, the dissertation and some scientific articles of this thesis author can be counted. In recent years, there are a number of works related to the term of connectivism, connecting knowledge, connecting schools. These works can also be considered to be related to connectivism.

1.1.2. Research works on teaching Probability - Statistics

1.1.2.1. Foreign Research works

It can be seen that foreign published works related to teaching and learning Probability - Statistics focus on the following directions: Research on difficulties and challenges in teaching Probability - Statistics; Research on theories and methods of teaching Probability - Statistics; Research on training and retraining teachers of Probability - Statistics; Research on modeling and simulation in Probability - Statistics teaching; Using IT in teaching Probability - Statistics; Developing the curriculum of Probability - Statistics. However, there has not been any research on Probability - Statistics teaching in high schools basing on connectivism.

1.1.2.2. In Vietnam

The research works related to the teaching of Probability - Statistics in Vietnam can be divided into five groups. Specifically, there are quite a lot of researches on Probability - Statistics teaching at the university, college and high school levels. Meanwhile, foreign researches on Probability-Statistics teaching as mentioned in section *1.1.2.1 mainly focus Primary and Lower secondary levels.*

1.2. Connectivism theory in teaching and learning
1.2.1. Scientific basis of connectivism in teaching and learning

Among the studies of teaching theory, some authors mention the relationships between the elements and components of the teaching process:

Vygotsky (1978) mentioned the relationship between the existing knowledge area and the new knowledge to be acquired by students in his theory of Zone of Proximal Development.

Nguyen Ba Kim (2005, 2017) discussed the relationships between teaching, learning and teaching contents.

Jean-Marc Denomme '& Madeleine Roy (2000) mentioned the Learner-Teacher-Environment interaction (The E trilogy in French stands for Étudiant - Enseignant - Environnement).

The above mentioned relationships and interactions create the connection between the subjects and components in the teaching process. These relationships can take place directly in the classroom, but they can also take place outside the classroom in many different ways, for example through the internet or telecommunication networks, etc.

Siemens (2005), introduced a teaching and learning theory based on the connection of many related learning resources known as connectivism. According to Siemens: "*Connectivism is a teaching and learning theory based on connection of many related learning resources that takes place in the rapidly developing digital age*"; "*Teaching and learning basing on connectivism are based on the diversity and complexity in the learning process of each individual*".

Siemens (2005) identified 8 core principles of connectivism.

1.2.2. Concepts of connectivism in teaching and learning

Based on Siemens's concept of connectivism presented on page 27, in this thesis, the concepts of connectivism, connectivist teaching and connectivist learning are defined as follows:

Connectivism in teaching is a teaching theory based on the integration of the following connections: connections between the lesson contents with related learning resources; connections between each individual learner with other learners or with the teacher; connections between existing knowledge, experience with the

knowledge to be achieved in the lesson. These connections can be in different forms, through direct or indirect interaction.

Connectivism theory is learning that uses connections: Connecting the lesson content with related materials; connect existing experiences and knowledge with information provided to form new knowledge; connects your own understanding of the lesson with that of others, through interaction with classmates and teachers. Learners can self-study, self-test and assessment with the support of IT.

Connectivist teaching is a teaching method in which there is a connection between teaching contents and different resources (textbooks, exercise books, reference books), lectures, related issues (history and formation, development, mathematicians ...), discussing opinions, testing and assesssment; a connection between each individual learner with other learners or with teachers about knowledge, experiences in various forms, through direct or indirect interaction.

1.2.3. Some concepts related to connectivism

First of all, related to connectivism is the concept of connection and connection node. In the lexicographical sense: connection is to make separate, discrete objects join together into a block or system.

In connectivism, each connected subject (or content) is denoted by a connection node. Connection nodes are indicated by an icon, a figure, a character. When the connection node is acted upon, the connection will be made; Then, users can exploit information resources, materials and many applications on the internet. (AlDahdouh Alaa A., Osório António J. and Susana C., 2015) [46]

Other related concepts include *Learning Ecosystem, Learning Environment, Learning Community.*

1.2.4. Types of connections in teaching and learning

From the scientific basis of connectivism and the concept of connectivism in teaching as mentioned above, we can see that connectivist teaching is based on the following connection forms:

(1) Connecting knowledge
(2) Connecting learning resources
(3) Connecting teaching tools and facilities

(4) Connecting with methods of testing and assessing learning results of students

(5) Connection between teachers, learners and others

1.3. Relationship between connectivism and some teaching theories and new requirements of education

1.3.1. Relationship between connectivism and some teaching theories

a) Behaviorialism

Connectivism will support behaviorist teaching in selecting input information and puts it in a connection node, assisting the student's learning process, after removing sources of information that are either confusing or inaccurate.

b) Cognitivism

If behaviorist teaching is mainly concerned with providing information to learners, cognitivist teaching is mainly concerned with the organization of cognitive activities for learners. In connectivist teaching with IT support, organizing cognitive activities for learners is aided by the connection nodes and the connections between those connection nodes.

c) Constructivism

Constructivism both pays attention to learning of each individual (each individual must construct and create his own knowledge in accordance with his existing knowledge and cognitive competence), and pay attention to cooperative learning, learning community (mutual share and help). Still following this spirit, in connectivist teaching, through knowledge connection and the interaction of each student with other students and with the teacher, each individual will find a suitable learning path for themselves.

Thus, connectivism has inherited and developed some previous teaching theories.

1.3.2. Education requirements in the current period

a) The four pillars of education in the twenty-first century

b) The development of information technology

c) The need to develop self-study competencies for students

d) The roles of the teacher, learner and environment

e) The appropriateness between connectivist teaching with the goal of developing students' competencies in the General Education Program 2018

1.4. The similarity and support between connectivist teaching methods and some other active teaching methods

1.4.1. The similarity and support between connectivist teaching methods with problem-based teaching methods

When designing connectivist teaching, it is necessary to create connection nodes corresponding to the steps in problem-based teaching. There must be activities to support each step of the teaching process; there must be nodes to assist in approaching the problem, nodes to assist in solving problems, nodes to help students look into, improve, and expand problems, nodes to assist with testing and assessment.

1.4.2. The similarity and support between connectivist teaching methods with discovery teaching methods

Connectivist teaching can also organize for students to explore knowledge and skills through a system of questions that orient their learning activities based on the node "Approach the problem" and stimulate students to be self-reliant in solving problematic situations; students do their own research and discover knowledge through the node "Solve the problem"; After studying, students can self-test and evaluate their results with the help of the node "Test and assess".

1.4.3. The similarity and support between connectivist teaching methods with cooperative teaching method

Connectivist teaching also has similarities and supports with cooperative teaching methods where students learn together, think together, share knowledge and experiences in a learning community; create conditions for learners to practice communication skills and social interaction.

1.4.4. The similarity and support between connectivist teaching methods with self-study method

Connectivist learning will create a favorable opportunity for students to self-study. Students can study by chapter, lesson or practice for each topic and each math problem in accordance with their own circumstances, anywhere, anytime. Learners are allowed to use selected materials with; connect lesson content (presented in the textbook) with related materials; connect previous experiences with

other students' experiences and social interaction; and are able to interact, exchange, test and evaluate their own learning outcomes.

1.5. Conclusion for chapter 1

Connectivist teaching is a teaching method in which there is a connection between teaching contents and different resources (textbooks, exercise books, reference books); a connection between lectures, related issues (history and formation, development, mathematicians ...) and discussing opinions, testing and assesssment.

In his studies related to connectivism, Siemens et al have provided the scientific basis of applying connectivism in teaching. On that basis, we have given the concept of connectivist teaching, the relationship between this teaching method with some other types of connection in teaching and some positive teaching methods that have been used in recent years.

In connectivist teaching, students will use materials to connect the lesson contents (presented in the textbook) with related materials, connect previous experiences with experience of others and social interaction. This helps students have a better understanding of the lesson contents and teachers are able to interact, exchange, test, and evaluate students' learning outcomes. Learning in this way, students can study anywhere and anytime.

Connectivist teaching has similarities and mutual support with some other positive teaching methods: problem-based teaching methods, discovery teaching methods, cooperative teaching methods, and self-learning methods.

This chapter presents theoretical basis of connectivism; chapter 2 will clarify the practical basis of connectivist teaching.

Chapter 2
PRACTICAL FOUNDATION OF TEACHING PROBABILITY - STATISTICS AT HIGH SCHOOL BASING ON CONNECTIVISM

2.1. Purpose and requirements of teaching Probability - Statistics at high school

2.2. Investigate the current situation of teaching and learning Probability - Statistics in high schools

2.2.1. Issues to be investigated

2.2.2. Respondents

Respondents were 100 teachers and 400 students from 6 provinces: Thai Nguyen, Lang Son, Lao Cai, Hanoi, Bac Ninh, Da Nang.

2.2.3. Methods of data collection and analysis

* Methods of data collection

The data in the thesis was collected after the questionnaires were distributed to 100 teachers and 400 students. The questionnaire aims to collect information related to teaching Probability - Statistics basing on connectivism with the support of IT.

* Methods of data analysis

Microsoft Exel and SPSS 20 were used for describing statistics. There is a collection of methods for measuring, describing and presenting data with calculations and common statistical indicators such as Mean, Median, Variance, Standard deviation, and plotting the observed variables.

2.3. Survey results

2.3.1. Results of the teacher survey on the exploitation and use of learning resources and organizing experiential activities for students

2.3.2. Results of the teacher survey on the level and competence to use information technology in teaching Probability - Statistics in high schools

2.3.3. Results of the teacher survey on the competence to use information technology in teaching Probability - Statistics in high schools

2.3.4. Results of the teacher survey on teachers' activities in each step of the process of teaching Probability - Statistics in high schools

2.3.5. Results of the teacher survey on the use of relationships (connections) in the process of teaching Probability - Statistics in high schools

2.3.6. Results of the student survey on students' needs to learn Probability - Statistics in class

2.3.7. Results of the student survey on the need to self-study Probability - Statistics in high schools

2.3.8. Results of the student survey on the competence to use information technology

2.4. Conclusion for chapter 2

Teachers think that the need for exploiting and using learning resources related to Probability - Statistics in the lesson is relatively big, while the exploitation and use of materials related to Probability - Statistics in the lesson takes a lot of effort and time; therefore, it would be better if there is a resource available. It is necessary to organize students to make statistical tables during class time but it is difficult to implement and takes a lot of time.

Regarding the level of using IT in teaching: Teachers know how to use computers, projectors to support teaching, but only sometimes; they regularly use computers to draft Probability - Statistics lesson plans; they sometimes use software to support testing and assessment; they rarely use software for virtual experiments, trials and E-learning in teaching Probability - Statistics.

About the competence to use IT: Teachers and students are capable of proficiently using the online sharing, exchanging, discussing, and talking functions of social networks and proficiently using the software Microsoft Word, Microsoft Exel, Microsoft PowerPoint; Students know how to learn online; Teachers know how to use software (Violet, Adobe Presenter, ...) to create multiple choice questions and export flash documents.

Regarding the exploitation and use of the relationship (connection) in each step of the lesson, many teachers have made some connections: Connecting knowledge; Connecting resources; Connect teaching facilities and tools; Connecting methods of testing and evaluating learning results of students; Connecting teachers with students and with others. However, the teacher thinks that the implementation of the connections still faces difficulties. For example, it is difficult to connect the lesson contents with related knowledge because it takes a lot of time and effort to explore and choose; it is difficult to organize experimental activities and trials in class as it is time consuming; organizing students to work in groups and express their opinions on a problem has not yet brought into full play the capabilities of each individual due to the uneven learning competencies of students; it is difficult to check and evaluate the learning results of all students in the class after each class because there is not enough time and effort in preparing the questions and

marking the papers; it is difficult to connect the knowledge learned in the school and the reality because the prescribed study program has few practical contents; it is difficult to make direct connection between teachers, learners and others due to individual conditions, schedules and plans.

Regarding the need to learn Probability - Statistics in class, students have such needs as: to have more historical stories related to the lesson content; to participate in experiential activities, virtual games and experiments; to have more practical contents and problem solving activities; to have more activities to consolidate, apply knowledge learned, and at the same time check their comprehension level after each lesson.

Regarding the need of self-study, students want to have materials available for research without having to waste time searching, to practice more types of exercises to consolidate their learned knowledge; to be instructed to solve a number of practical exercises; to use internet tests to test their knowledge; to have lessons on topics selected for self-study; and to refer to the lectures of teachers on the internet.

Chapter 3
METHODS OF DESIGNING CONTENTS FOR CONNECTION NODES AND ORGANIZING THE TEACHING OF PROBABILITY - STATISTICS BASING ON CONNECTIVISM WITH IT SUPPORT

3.1. Methods of designing contents for connection nodes

Before presenting the methods of designing contents for connection nodes, in our opinion, teachers need to grasp some strategic ideas as follows:

- Information to be connected must be standardized contents in textbooks, exercise books, scientific articles, and books that have been evaluated and approved.

- The nodes must be designed in accordance with the teacher's activities and teaching process in class.

- The connection method and process must be suitable with the reality of teachers, students and the school.

As mentioned in section 1.2.1, pages 32 - 34 of the thesis, there are 5 types of connection nodes: Node 1 - connecting knowledge, Node 2 - connecting learning resources, Node 3 - connecting teaching facilities, Node 4 - connecting methods of testing and assessment, Node 5 - connecting teachers, students, and others.

Based on teaching objectives and teaching contents, the content of each connection node is proposed as follows:

3.1.1. Node 1 - connecting knowledge

3.1.1.1. Relevant knowledge in Mathematics or interdisciplinary subjects

Knowledge in Maths is often directly or indirectly related to each other and it is also related to some other subjects. Math is still considered an instrumental subject; therefore, connecting knowledge in Mathematics or interdisciplinary subjects can be considered as a natural connection.

Example 3.1. In the lesson "Probability of an event", relevant knowledge that should be mentioned is the rule of counting, union and combination; in the lesson "Newton's binomial", the relevant knowledge that should be mentioned is Important Mathematical Formulas, union, combination ...

Example 3.2. Connect knowledge of Probability with knowledge of genetics. Teachers can guide students to use a number of links such as http://upload.exam24h.com/9eOhcfbv89RitFW to get documents that connect Probability knowledge with genetic knowledge.

3.1.1.2. Math history problems

3.1.2. Node 2 - connecting learning resources

3.1.2.1. Electronic textbooks

3.1.2.2. Charts, tables, diagrams, graphs available to support the lesson

3.1.2.3. Materials are summarized theories, lectures and exercises on the internet

3.1.2.5. Practical situations

3.1.3. Node 3 - connecting teaching tools and means

3.1.3.1. Video clips of virtual models and experiments to support lessons.

Example 3.9. Virtual experiments of tossing coins in balance and homogeneity to form the concept of frequency and the definition of probability and statistics.

In the introductory example leading to the classical definition of Probability, the textbook presents the test of randomly tossing a

homogeneous, symmetrical die, and assuming that "the probability of each side appearing is the same".

Is that correct? This cannot be tested with a small number of times of rolling the dice (due to limited classroom time), and even the results are counterproductive. However, we can confidently test the validity of this result if we conduct the test of rolling the dice with a relatively large number of times thanks to the support of IT, for example, using Yenka software. The interface of this software is shown in Figure 3.4 below.
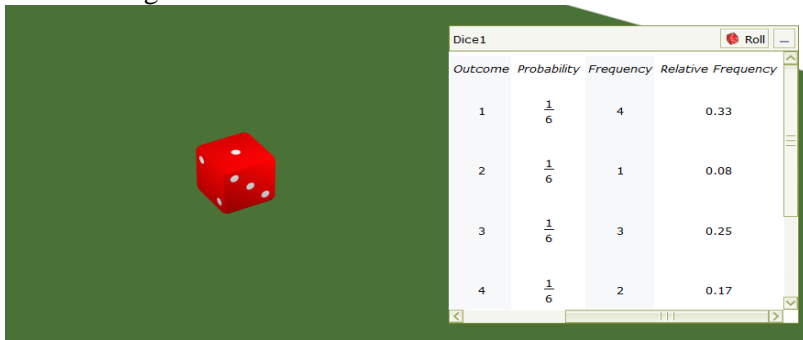

Figure 3.4. Roll the dice using Yenka software

Each time students left click on the "Roll" node, they get a roll of dice. On the screen, there is a result table with full information about the number of dots on the faces, the number of occurrences of each side, the possibility to appear of each side, the relative frequency in the total number of rolls. This software lists the sample space and count the occurrence frequency of each surface and the corresponding probability.

Or students can roll the dice through the website that has the link http://www.btwaters.com/probab/dice/dicemain3D.html. When they click on the link, the result is a web page (Figure 3.5), and students can choose to roll 01 dice in the "Number of dice" field, enter the number of times to roll the dice in the box below "Number of dice" (here they enter 1000), and then click on" Auto Roll". A table of statistical results will appear, showing the number of faces from 1 to 6 of the dice. This result is relatively close to the expectation that the probability of occurrence of each face is 1/6. Similar to the above method, we can choose how many times to roll

the dice, with just one click, the web page can describe the results of thousands and tens of thousands of times. This is a short time implementation, which can not work in the class.

3.1.3.2. Means and tools for calculating and charting

3.1.4. Node 4 - connect methods of testing and assessing students' learning results

3.1.4.1. Test questions are available for students to practice and compare their paper with the answers (if any) or send the papers for teacher evaluation.

3.1.4.2. Objective multiple choice test questions (multiple choice, gap fill, matching ...) are interactive and analyze the correctness and error of each selected answer.

3.1.4.4. Some free software to create test questions when the source is available

3.1.5. Node 5 – connect teachers, students and others

3.2. Method of orgamizing teaching

3.2.1. Method of using the contents of connection nodes

Contents in the connection nodes compiled by the teacher for the lesson can be used directly or posted on the website on the internet/intranet (LAN).

- To use directly during teaching, when needing to use any content, teachers will connect directly to the node containing that content.

- To use the website, the teacher needs to put the content of connection nodes on the website.

Figure 3.8. Interface of the website Teaching Probability - Statistics basing on connectivism

In each lesson there will be icons about the steps of the teaching process. Each step of the lesson can use one or several connection nodes depending on the intentions of the teacher and the conditions of the class (time, competencies, understanding of students ...). The organization of teaching will be detailed in section 3.2.

3.2.2. Teaching method according to Connectivism theory

In this thesis, we present teaching methods according to the 4-step process: Approach the problem; Solve the problem; Consolidate, apply and expand; Test and assess. Each step can use the connection nodes appropriately, as follows:

3.2.2.1. Step 1: Approach the problem

Method 1.1. Basing on the existing knowledge, through intellectual activities such as generalization, specialization, similarization, new knowledge is created. In this case, the knowledge connection node can be used to link existing knowledge and new knowledge.

Method 1.2. Starting from real situations (Using the node of connecting learning resources).

Method 1.3. Create motivation for students when entering new lessons through experiential activities (using the node of connecting teaching facilities).

Method 1.4. Use some active teaching methods such as conversation discovery, problem discovery and problem solving ... (Use the node of connecting learning resources).

3.2.2.2. Step 2: Solve the problem

Method 2.1. Organizing activities of exploring and discovering new knowledge

Method 2.2. Organizing activities of reasoning, explaining and solving problems.

Method 2.3. Organizing activities of reasoning, explaining and solving problems.

3.2.2.3. Step 3: Consolidate, apply, and expand

Method 3.1. Use the node of connecting teaching facilities to aid in computation when solving math problems.

Method 3.2. Refer to many different reviews, consolidation, application and expansion lessons.

Method 3.3. Refer to math problems and issues related to interdisciplinary or practical lessons.

3.2.4. Step 4: Testing and assessment

3.3. Meaning and effects of teaching based on connectivism and points to note

3.3.1. Meaning and effects

3.3.2. Notes

3.4. Conclusion for chapter 3

On the theoretical basis in Chapter 1 and the practical basis in Chapter 2, this chapter presents the methods of designing and organizing the teaching of Probability - Statistics in high schools basing on connectivism with the support of IT. The teaching design is represented by 5 connection nodes: Node 1 - connecting knowledge, Node 2 - connecting learning resources, Node 3 - connecting teaching facilities, Node 4 - connecting methods of testing and assessment, Node 5 - connecting teachers, students, and others.

The method of using the contents of connection nodes and organizing teaching activities is shown through 4 steps in class: Approach the problem; Solve the problem; Consolidate, apply and expand; Test and assess.

Specific examples taken from the Probability - Statistics lessons in high schools are presented in the chapter to clarify and illustrate the features, meaning, and contents of each node, and at the same time show the viewpoint of applying connectivism with the help of IT.

Chapter 4
PEDAGOGICAL EXPERIMENT

4.1. Purposes and organization of the pedagogical experiment

4.1.1. Purposes of the pedagogical experiment

The experiment was carried out to test the correctness of the scientific hypothesis stated in the thesis and evaluate the feasibility and effectiveness of the methods of designing and organizing the teaching of Probability - Statistics at high schools basing on connectivism with IT support discussed in chapter 3.

4.1.2. Organize the pedagogical experiment

The pedagogical experiment was conducted through 02 rounds:

- Round 1: Teaching in 02 classes, each class has 02 lesson plans (There are 2 corresponding control classes). The first class could not be taught in the computer lab, so the teacher use computers with internet connection; the second class was taught in a computer lab with an internet connection.

After round 1, ask teachers observing edagogical experiment lessons for their feedback on lesson plans, teaching practice and issues that need to be learned from experience.

- Round 2: The experiment is similar to that in round 1 but the implementation of the lesson plan has been adjusted accordingly, based on lessons learned in round 1.

Round 1: We carried out the pedagogical experiment with 02 lesson plans; each lesson is taught in 02 classes, specifically as follows:

- Lang Son Province: Class 11A2, Na Duong High School; the corresponding control class is 11A8.

- Thai Nguyen Province: Class 11A2, Gang Thep High School; the corresponding control class is 11A3.

Round 2: After learning from experience in the first round, we carried out the pedagogical experiment with 02 lesson plans; each lesson is taught in 02 classes, specifically as follows:

- Lang Son province: Class 11A1, Van Lang High School; the corresponding control class is 11A2;

- Hanoi City: Class 11B, Xuan Giang High School; the corresponding control class is 11M.

4.2. Experimental teaching lesson plans

4.2.1. Lesson plan 1: Probability of an event (period 30 - theory)

4.2.2. Lesson plan 2: Probability of an event (period 33 - exercise)

4.2.3. Self-study lesson plans

4.3. Evaluation of the pedagogical experiment results

4.3.1. Pedagogical experiment Round 1 (School year 2017 - 2018)

4.3.1.1. Qualitative evaluation of Round 1

a) Results of teachers' evaluation on Round 1 pedagogical experiment lesson plans

b) Results of teachers' evaluation on Round 1 pedagogical experiment lessons

c) Results of students' evaluation on Round 1 pedagogical experiment lessons

4.3.1.2. Quantitative evaluation of Round 1 pedagogical experiment results

a) Table of test results; Comparison bar chart.

b) Test the hypothesis of round 1 pedagogical experiment

c) Some issues that need to be learned from experience after the pedagogical experiment round 1

4.3.2. Pedagogical experiment Round 2 (Academic year 2018 - 2019)

On the basis of drawing experience from the first round pedagogical experiment lessons, we conducted experiment pedagogy round 2 according to the plan of organizing pedagogical experiment, specifically as follows:

- Lang Son province: Teaching 02 experimental lessons in Class 11A1, Van Lang High School; the corresponding control class is 11A2; Only teachers teaching experimental lessons used computers with internet connection.

- Hanoi City: Teaching 02 experimental lessons in class 11B, Xuan Giang High School; the corresponding control class is 11M; Both teachers and students used computers with internet connection.

4.3.2.1. Qualitative evaluation of Round 2

a) Results of teachers' evaluation on Round 2 pedagogical experiment lesson plans

b) Results of teachers' evaluation on Round 2 pedagogical experiment lessons

c) Results of students' evaluation on Round 2 pedagogical experiment lessons

4.3.2.2. Quantitative evaluation of Round 2 pedagogical experiment results

a) Table of test results; Comparison bar chart.

b) Test the hypothesis of round 1 pedagogical experiment

General evaluation of test results

Results of the 2 tests after 2 experimental teaching lessons for both classes show that:

+ The number of students with good and excellent scores in experimental classes is higher than that in the control classes. This result is acceptable through hypothesis testing.

+ The fact that the number of students with good and excellent scores in experimental classes is higher than the number of students

with good and excellent scores in the control classes can be explained as follows: In the experimental lessons, the experimental classes are supported with a lot of activities through connectivist teaching methods; it makes it easier to calculate the probability of an event in the problem of rolling dice and tossing a coin. During class time, students had more chances to consolidate and apply more, so they did better in the tests.

4.4. Case study results

4.4.1. Organize a case study

4.4.2. Results of observing the implementation of self-study lesson plans of the group of students

4.4.3. Results of the questionnaire survey on students' opinions about self-study

4.5. Conclusion for chapter 4

The results of the pedagogical experimental show that:

+ With pedagogical experiment lessons using connectivist teaching methods, students in the pedagogical experiment classes are more motivated, have conditions to better understand concepts and types of math problems during the lessons, and have conditions to perform learning personalization; therefore, the efficiency of learning Probability - Statistics is raised.

+ The learning results of pedagogical experimental classes show that students in experimental classed understand and do exercises better than the control classes. This is more evident in questions related to the application of knowledge of Probability - Statistics into practical problem solving. This confirms the feasibility and effectiveness of the proposed lesson plans. The results of the pedagogical experiment partly demonstrate the feasibility of the contents and methods of organizing connectivist teaching with the support of IT.

+ Although the case study was only performed on a small group of 05 students, the manifestations of the results obtained from this of students also help the researcher of the thesis make necessary adjustments to the proposed solutions in the thesis and have basis to reach conclusions about students' guided self-study competence according to connectivist teaching methods.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

The thesis has obtained the following main results:

1) The thesis has summarized, analyzed and synthesized theoretical and practical issues related to connectivist teaching methods with IT support including the concept of connectivism, the characteristics of connectivism, forms of connection in teaching and learning, the relationship between connectivism with some teaching theories and new requirements of education, the similarity and support between connectivist teaching methods and some other active teaching methods.

2) Through the investigation of the current situation, the thesis has clarified the current situation and limitations of teaching Probability – Statistics at high school; proposed connectivist teaching plans with the support of information technology to help overcome some difficulties when teaching this subject matter.

3) The thesis has proposed methods for designing and organizing the teaching of Probability – Statistics basing on connectivism with the support of IT through connection nodes based on the stages in the teaching process in the classroom and the process of expanding, deepening, assessing, and supporting students in their self-study. The thesis has also presented examples to illustrate and clarify the method of designing and organizing the teaching process.

4) The dissertation results have been partly tested through a two-round pedagogical experiment on grade 11 students in 04 schools and a case study on a group of 05 grade 11 students in periods of time alternating with regular lessons at school.

From the above results, it can be concluded that: The scientific hypothesis of the thesis is acceptable; the research tasks of the research have been completed, the contributions of the thesis can be deployed and applied in the practice of teaching

Probability - Statistics for high school students using connectivism with IT support.

Recommendations

- Continue to do research in the direction of this research topic for other teaching contents.

- The proposed teaching contents should be supplemented and updated regularly.