

MINISTRY OF EDUCATION AND TRAINING
VIET NAM INSTITUTE OF EDUCATIONAL SCIENCES

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**TEACHING PROBABILITY AND STATISTICS
FOR ACCOUNTING STUDENTS IN INDUSTRIAL
COLLEGES UNDER DEVELOPMENT OF STUDENTS'
PROFESSIONAL CAPACITY**

Speciality: Theory and Methodology of Teaching Mathematics

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ABSTRACT OF PhD THESIS

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INTRODUCTION

1. Rationale

Training and development of high quality human resources, especially at tertiary level to meet requirements of industrialization - modernization of the country, are taken much consideration by our Party and State. That policy was concretized in Vietnam Education law which states that: "The objective of higher education is to train learners political quality, morality, sense of serving the people, having professional practical knowledge and capacity equivalent with training level, having good health to build and protect the country". Training at college level provides students with specialized knowledge and basic practical skills to solve common problems of professional training"

To achieve this goal, Industrial Colleges training accountants has formulated students' learning outcomes and always focused on developing professional capacity for accounting students during training process to meet recruiting needs of labor market. However, current situation exposes that teaching still heavily focuses on academic theory and lacks professional practice. General and specialized subjects are not supported by each others. Teachers mainly teach knowledge to help students passing the final examination and do not pay attention to training interdisciplinary and professional skills. Therefore, students cannot meet the learning outcomes and adapt to job requirements which is more and more severe after graduation.

In curriculum of accounting major in most colleges and universities, Probability and Statistics subject belongs to general educational knowledge with 2 credits. This course aims to equip students with scientific knowledge, research methodology and other skills, so that provide students necessary skills to meet requirements of an accountant who is skillfull, dynamic, creative, adaptable with labor maket and all types of businesses. However, it is found that teaching Probability and Statistics for accounting students in current colleges and universities does not fully meet these above objectives. Therefore, we need to teach the students how to develop their professional capacity through the subject. In teaching process, teachers should have specific methods to promote applications of this module in formating and developing students' professional capacity in accounting field.

In general, studies on teaching under development of students' professional capacity is not new in Vietnam but its achievements have been listed very few and not in system. Especially, there is no research on teaching Probability and Statistics for accounting students under development of their professional capacity in industrial colleges. For that reason, the author decided to do a research on: **"Teaching Probability and Statistics for accounting students in Industrial Colleges under development of students' professional capacity"**

2. Overview of the Study

a. Some research on teaching under development of professional capacity in vocational education

b. An overview of teaching Probability and Statistics for accounting students under development of students' professional capacity

- *Some reasearch on teaching Probability and Statistics in foreign*

countries

- *Some reasearch on teaching Probability and Statistics in our country*
- *Some reasearch on Probability and Statistics related to this study*

3. Aims of the study

Recommending some methods in teaching Probability and Statistics for accounting students under development of students' professional capacity in Industrial Colleges in order to increase their ability in applying professtional knowledge to actual job and contribute to formulate and develop students' accounting skills.

4. Objects of the study

5. Scientific hypothesis

If we formulate and appropriately use these methods in teaching Probability and Statistics under development of students' professional capacity in Industrial Colleges for accounting students, it will contribute to develop students' professional capacity through their learning process .

6. Tasks and scope of the study

6.1. Research Tasks

Tasks of the research are presented by answering these scientific questions:

- What are elements of accounting students' professional capacity in Industrial Colleges developed through teaching Probability and Statistics? How are they represented?
- How do we think about teaching Probability and Statistics under development of students' accounting capacity? What are basic characteristics? What need to be supplemented to contribute to the formation and development of students' accounting capacity?
- What are current situations of teaching Probability and Statistics under development of students' accounting capacity? What are the reasons?
- What can we do with some pedagogical methods to change the situation?
- What are recommendations for teaching Probability and Statistics for accounting students in Industrial Colleges under development of their professional capacity?
- Are the proposed recommendations feasible and effective or not?

6.2. Scope of the study

7. Method of the study

Theoretical research; Investigation, Observation; Experience summary; Expert method; Pedagogical experiment

8. New points of the study

8.1. In terms of theory

- Formulating definition of professtional capacity and 11 elements of professtional capacity in accounting field that students are developed when they study the Probabilily and Statistics subject.
- Giving some other viewpoints in teaching under development of students' accounting capacity

8.2. In terms of practice

i) Basing on studies on cognitive characteristics and requirements of professional training of students in industrial colleges in the context of increasingly fierce competitiveness of labor market leading students' difficulties in finding jobs, the author has clarified "portrait" of an accountant that students need to work towards.

ii) Clarification of current situation of teaching Probability and Statistics for accounting students in industrial colleges under development of their accounting capacity; clarification of meaning and role of Probability and Statistics to actual accounting as an orientation for students in professional development.

iii) Basing on the views and rationales mentioned above, the author proposed five pedagogical measures and methods to implement them in teaching Probability and Statistics for accounting students in industrial colleges under development of their accounting capacity; Designing some lessons to illustrate the measures.

iv) The pedagogical measures and examples proven through actual teaching have demonstrated their feasibility that contributing to help students meet requirements of learning outcomes and creating students' confidence to enter to new labor market with new challenges.

9. Issues presented in the thesis defense

i) The concept of accounting capacity and 11 elements of accounting capacity associated with Probability and Statistics

ii) The views on teaching Probability and Statistics under development of students' accounting capacity and 4 groups of evaluation criteria of achieved level in teaching Probability and Statistics for accounting students in industrial colleges under development of their professional capacity.

iii) Clarification of differences in physiology, psychology, learning, job placement of accounting students in comparison with other students in other fields and other colleges.

iv) Some measures and techniques in teaching Probability and Statistics under development of accounting capacity.

10. Structure of the thesis

This thesis consists of 3 chapters apart from introduction, conclusion, appendices and references:

Chapter 1: Theoretical and practical background

Chapter 2: Methods in teaching Probability and Statistics for accounting students in Industrial Colleges under development of students' professional capacity

Chapter 3: Pedagogical experiments

Conclusion of the thesis

Some author's findings related to the thesis have been published

References; Appendix

Chapter 1

THEORETICAL AND PRACTICAL BACKGROUND

1.1. Professional capacity, accounting capacity

1.1.1. Accountants and their roles in labor market

1.1.1.1. Accounting

According to the Accounting Law: “Accounting is collecting, processing, testing, analyzing, and providing economic and financial information in the form of value, things and working time.”

Accounting includes: Business Accounting, public sector accounting, banking and financial accounting. Each position of accountants has special functions and tasks. For example:

In business: management accountants are responsible for

- + Calculating costs and prices of products, services and goods; analyzing information to find ways to save money or change business strategies to ensure profits for businesses.

- + Preparing budget estimates for enterprises; In fact, it is a complete financial plan from sales – cost, assets - liabilities to cash flows.

- + Establishing and maintaining evaluation system of each department’s performance, considering it as a basis for improving working efficiency as well as doing encouraging and rewarding policies in company.

- + Collecting and analyzing information to make short-term decisions (eg: produce or buy a part of a product) or strategic decisions (eg: arranging corporate structure or competition policy).

In Public Sector: Accountants in schools, hospitals and other national businesses are in charge of:

- + Recording and updating financial activities from national budget and other revenues such as tuition, hospital fees ... as well as donations from social and foreign associations.

- + Preparing reports for functional departments in which settle separate sources of revenues

- + Making tax reports for the field needed

- + Collecting and analyzing information to help managers/leaders evaluate working effectiveness

In summary, there are many different positions of accountants. However, *accountants’ tasks are generally regulated under Article 5 of the Accounting law as follows:*

- i. Collecting, processing information and accounting data under its subjects and working content; and under standards and regulations of accounting.

- ii. Inspecting and monitoring financial revenues and expenses, debt payment; supervising management and using of assets and resources to have assets; detecting and preventing actions against the law on finance and accounting.

- iii. Analyzing information and accounting data; proposing solutions to meet requirements of management and financial and economic decisions.

- iv. Providing information and accounting data under the law.

1.1.1.2. Accountants

According to accounting law, accountant is general term to refer to all workers who work in accounting field, including chief accountant and other accountants such as financial accountants, management accountants, general accountants, liability accountants, tax accountants, sales accountants...

1.1.1.3. Accountants' roles in today's labor market

1.1.2. Professional capacity

1.1.2.1. Capacity

In author's opinions, capacity is combination of personal attributes of human beings including knowledge, skills, attitudes that meet requirements of a certain work (tasks, jobs) and guarantee effectiveness of the work.

1.1.2.2. Professional capacity

1.1.3. Accounting capacity

In author's point of views, **accounting capacity** is combination of professional knowledge, skills and attitude to do tasks effectively and responsibly in different situations of accounting field and achieve good results.

Some necessary elements of accounting capacity: Doing some reviews on accounting capacity of some foreign and domestic authors, we suggest 15 necessary elements of accounting capacity: 1) expressing capacity; 2) capacity of working with others and teamwork; 3) capacity of using ideas and techniques in mathematics; 4) problem-solving capacity; 5) learning capacity; 6) plan-making capacity; 7) communication capacity; 8) personal capacity; 9) capacity of statistics and data analysis; 10) capacity making and presenting reports; 11) capacity of financial analysis; 12) capacity of choosing optimal solution in solving economic situations; 13) capacity of applying information technology to specialized major; 14) capacity of using English for specific purposes; 15) capacity of management and business.

Apart from 15 necessary elements of accounting capacity listed above, accounting capacity also has many other components, depending on position of accountants

1.2. Theory of Probability and Statistics in accounting major

1.2.1. Meaning of Probability and Statistics in formation and development of students' accounting capacity

Probability and Statistics has an important role in formation and development of students' accounting capacity. In fact, probability thinking and statistic models can help accountants to access their work systematically. From that, they would give their leaders suitable advice as they make important decisions.

1.2.2. Applying professional knowledge of Probability and Statistics subject into accounting field.

1.2.2.1. Real situations and practical problems in accounting field

a) **Real situations**

b) **Real situations and practical problems in accounting field**

A practical problem in accounting is problem in which contents of the assumptions or conclusions contain elements related to real activities of accounting.

Example 1.1. A manager of a factory stated that a worker's average salary is 2.760.000d per month. It is calculated basing on selecting randomly 36 workers in this enterprise; with standard deviation are 80. So, is the manager's statement reliable if level of significance is 5 %?

1.2.2.2. Applying mathematics to accounting

1.2.2.3. Applying professional knowledge of Probability and Statistics subject into accounting field, under development of accountants' capacity.

In the researcher's opinion, here are some steps for applying Probability and Statistics to practical accounting:

Step 1: Formulating problems from practical accounting situations; Step 2: From these problems, formulate mathematical models in Probability and Statistics; Step 3: Using mathematical tools in Probability and Statistics to solve problems in Probability and Statistics; Step 4: transferring results from mathematical model in Probability and Statistics to practical problems of accounting; in consequence of that, forming a number of accounting capacity.

1.3. Teaching Probability and Statistics for accounting students in industrial Colleges under development of professional capacity

1.3.1. System of nationwide industrial colleges

Decision No. 373 / QD - TTg , dated 01/3/2013 of the Prime Minister issued on public units of the Ministry of Industry and Trade (MOIT) includes 42 units, in which there are 10 industrial colleges out of 22 colleges in MOIT .

1.3.2. Characteristics and structure of curriculum of Probability and Statistics in some industrial colleges

1.3.2.1. Probability and Statistics in accounting curriculum at college level

1.3.2.2. Probability and Statistics curriculum in accounting curriculum in industrial Colleges

Chapter 1. Events and probability of occurrences

Chapter 2. Random variables and probability distributions

Chapter 3. Statistics

1.3.3. Learning outcomes of accounting students in some industrial colleges

a. Knowledge

b. Skills

- Checking, analyzing and evaluating financial and accounting activities of enterprises

- Being proficient in accounting from drawing up of documents, recording to making financial statements, tax reports.

- Analyzing financial situation, advising business leaders to improve accounting and financial management of enterprises effectively and legally.

- Being proficient in office softwares such as Word, Excel to edit documents, using Internet to look up information, using business accounting softwares in accounting management.

- Having communication skills, teamwork skills, using English related to the field of accounting.

C. Attitude

1.3.4. Some elements of accounting capacity formed and developed through teaching Probability and Statistics

According to the author, 11 elements of accounting capacity should be formed and developed through teaching Probability and Statistics including: **a) general capacity:** 1) expressing capacity; 2) capacity of working with others and in groups; 3) capacity of using ideas and techniques in mathematics; 4) problem-solving capacity; 5) learning capacity; 6) plan-making capacity. **b) professional capacity:** 7) capacity of statistics and data analysis; 8) capacity making and presenting reports; 9) capacity of financial analysis; 10) capacity of choosing optimal solution in solving economic situations; 11) capacity of applying information technology to specialized major

In teaching Probability and Statistics, these elements have some manifestations of development, for example :

Element 1: Expressing capacity

Expressing capacity (through verbal or written) refers to effectively use mathematical language in Probability and Statistics (letters, symbols, charts, graphs, logic links...) as well as accounting language which are manifested like: know how to present practical accounting situations using accurate tables and graphs to convey ideas and information; use language of Probability and Statistics to discuss when solving problems related to accounting profession.

Element 2: Capacity of working with others and in groups

Capacity of working effectively with others (with one or a group) is mutual understanding and working to meet job requirements and solve practical accounting situations effectively; and being a member of a group to achieve purpose of group. Some manifestations of this capacity in an assigned task are: positive interdependence; individual's sense of responsibility; mutual interaction; individual's understanding of society, accounting and Probability and Statistics. For Probability and Statistics, this capacity is needed to be shown clearly when teachers divide groups, assign tasks for students, and work in projects related to profession.

Element 7: Capacity of statistics and data analysis

Capacity of statistics and data analysis: Collecting knowledge, information related to activities of accounting profession; using Probability and Statistics to analyze and process data in order to make logical decisions which support effectively for enterprise accounting....Some manifestations of this capacity are: skills in selecting data; presenting data; comprehending statistical data in mathematical models; analyzing statistical information to draw conclusions; analyzing, interpreting data and conclusions ...

Element 9: Capacity of financial analysis

Some manifestations of this capacity are: making financial reports; analyzing information to have conclusion of data development and phenomenon in financial statements; estimating statistics in information processing from the financial statements. In teaching Probability and Statistics, teachers can give a financial statement, and then ask students to analyze and comment some aspects of the report to practice this capacity.

According to the author, teachers should put more attention to formation

and development of elements of students' accounting capacity when teaching Probability and Statistics.

1.3.5. Teaching Probability and Statistics under development of accounting capacity

1.3.5.1. Teaching under development of students' professional capacity

1.3.5.2. Teaching Probability and Statistics for accounting students in industrial Colleges under development of professional capacity

Teaching Probability and Statistics for accounting students in industrial Colleges under development of professional capacity is shown as follows:

- Aim of teaching is to help students fulfill their responsibilities and duties as an accountant of the enterprise in the future.

- Teaching content is concentrated on professional knowledge that students will use in their future job; appropriateness between theory and practice to develop necessary capacity for students; equipment of knowledge, methods and self-development for students.

- Teaching methods promote students' positive thinking and orientation; equip students' communication skills, help them in organization and management of practical accounting activities and solving practical problems...

- Assessment of students' learning outcomes: focusing on students' ability, application capacity of professional knowledge in solving practical situations in reality.

In short, ***Teaching Probability and Statistics under development of accounting capacity*** is arrangement and influence on the elements of teaching process (objectives, contents, methods and forms of teaching, ...) to establish and develop students' accounting capacity.

1.3.5.3. Viewpoints and assessment criteria of achievement level in teaching Probability and Statistics for accounting students in industrial Colleges under development of professional capacity

In the author's point of views, system, structure and assessment criteria of teaching Probability and Statistics for accounting students in industrial Colleges under development of professional capacity are considered on two aspects:

- *Firstly*, teaching organization in industrial colleges to meet the requirements of formation of professional capacity according to training objectives;

- *Secondly*, final products of the colleges are people who have accounting capacity adapting to all types of enterprises.

Assessment criteria of teaching Probability and Statistics for accounting students in industrial Colleges under development of professional capacity include 4 groups of following criteria:

- *Group 1*: Evaluation of identifying teaching goals under development of accounting capacity.

- *Group 2*: Assessment of content and curricula of teaching Probability and Statistics for accounting students under development of accounting capacity

- *Group 3*: Assessment methods and forms of teaching Probability and Statistics for accounting students under development of accounting capacity

- *Group 4*: Assessment of effectiveness of educational methods, training

personality qualities, abilities and behaviors for students; criteria for evaluating results of self-learning, self- study and self- cultivation of students to become accountants.

1.4. Characteristics of accounting students in Industrial colleges

1.4.1. Physiological and psychological characteristics

1.4.2. Characteristics of learning

1.4.3. Students' working position after graduation

1.5. Current situation in teaching Probability and Statistics subject for accounting students in industrial colleges under development of professional capacity

1.5.1. Goals of training accounting and objectives of Probability and Statistics subject

1.5.2. Current situation in teaching Probability and Statistics subject for accounting students in industrial colleges under development of professional capacity

1.5.2.1. Targets

1.5.2.2. Subjects

1.5.2.3. Survey time

1.5.2.4. Methodology

1.5.2.5. Surveying current situation and analyzing results

****) Current situation of accounting students' knowledge and skills after finishing the Probability and Statistics course***

****) Current situation of teaching Probability and Statistics for accounting students under development of professional capacity***

General assessment: It can generally be assessed that majority of teachers and students are aware of important role of Probability and Statistics in accounting profession. However, teaching Probability and Statistics for accounting students under development of professional capacity has not been paid much attention:

- Innovation in teaching methods is not really effective;

- Majority of teachers pays much attention to providing and training for students' skills and problem-solving process to pass the final examination only. Suitable pedagogical methods have not been identified for students when applying Probability and Statistics in accounting profession. Learning content is far from practice.

- Teachers lack oriented material in teaching Probability and Statistics under development of accounting capacity. Here are some limitations:

- + Teachers give students few chances to practice with examples, problems related to accounting profession, or practice with unsuitable problems.

- + It is not clear in relationship between professional knowledge with practical accounting profession. Therefore, students are not motivated and interested in learning; the role of Probability and Statistics subject with other specialized subjects in accounting curriculum is also not clear.

- + Teachers pay little attention to recognising, correcting, preventing common mistakes when applying Probability and Statistics in accounting.

- Students do not have passion on studying so they spend little time for the

subjects; students do not have skills in creating situations which link to accounting profession in reality; students also have difficulties in applying Probability and Statistics on accounting practices. Particularly, some accounting students think that they only need to study professional subjects without Probability and Statistics.

1.6. Current situations of lectures and textbooks of Probability and Statistics for accounting students in some industrial colleges under development of students' accounting capacity

Textbooks, lectures of Probability and statistics in some industrial colleges are used for all majors having the subject. There is no special material of the subject for accounting major, so numbers of examples and exercises related to accounting in the textbook are very few and not systematic.

CONCLUSIONS OF CHAPTER 1

In Chapter 1, the author has contributed the following new results:

Definitions of professional capacity, accounting capacity; practical accounting problems and application of mathematics were proposed to solve the problems, thereby, forming accountants' necessary capacity for students.

The meaning and roles of Probability and Statistics in formation and development of elements of for students has been made clear; fifteen elements of accountants' capacity and eleven elements of accounting capacity that are developed through teaching the subject have been listed.

The author has stated her point of views in teaching Probability and Statistics under development of accounting capacity and four assessment criteria of achievement level in teaching Probability and Statistics for accounting students in industrial Colleges under development of professional capacity; distinguished physiological and psychological characteristics and working position of accounting students in comparison with others after graduation

The author has analyzed current situations of teaching Probability and Statistics for accounting students under development of professional capacity in four colleges: Phuc Yen College of Industry, Quang Ninh University of Industry (college level), Bac Giang College of Industry, Vinh Phuc College of Economics and Technology, in order to determine some basic views on teaching Probability and Statistics for accounting students under development of professional capacity. The situations revealed that most teachers and students still teach and learn with traditional method; there is no clarification of interdisciplinary subjects; assessments are concentrated mainly on academic theory; numbers of textbooks and lectures related to accounting are very few; there are a few exercises in the textbook related to accounting profession.

The above findings play as theoretical and practical background to propose some methods of teaching Probability and Statistics for accounting students under development of students' professional capacity in industrial colleges in chapter II.

Chapter 2

METHODS IN TEACHING PROBABILITY AND STATISTICS FOR ACCOUNTING STUDENTS IN INDUSTRIAL COLLEGES UNDER DEVELOPMENT OF PROFESSIONAL CAPACITY

2.1. Directions for measures development

Direction 1: The measure to contribute to providing students with basic knowledge of probability and statistics under training standard and be suitable with specialized knowledge of accounting required.

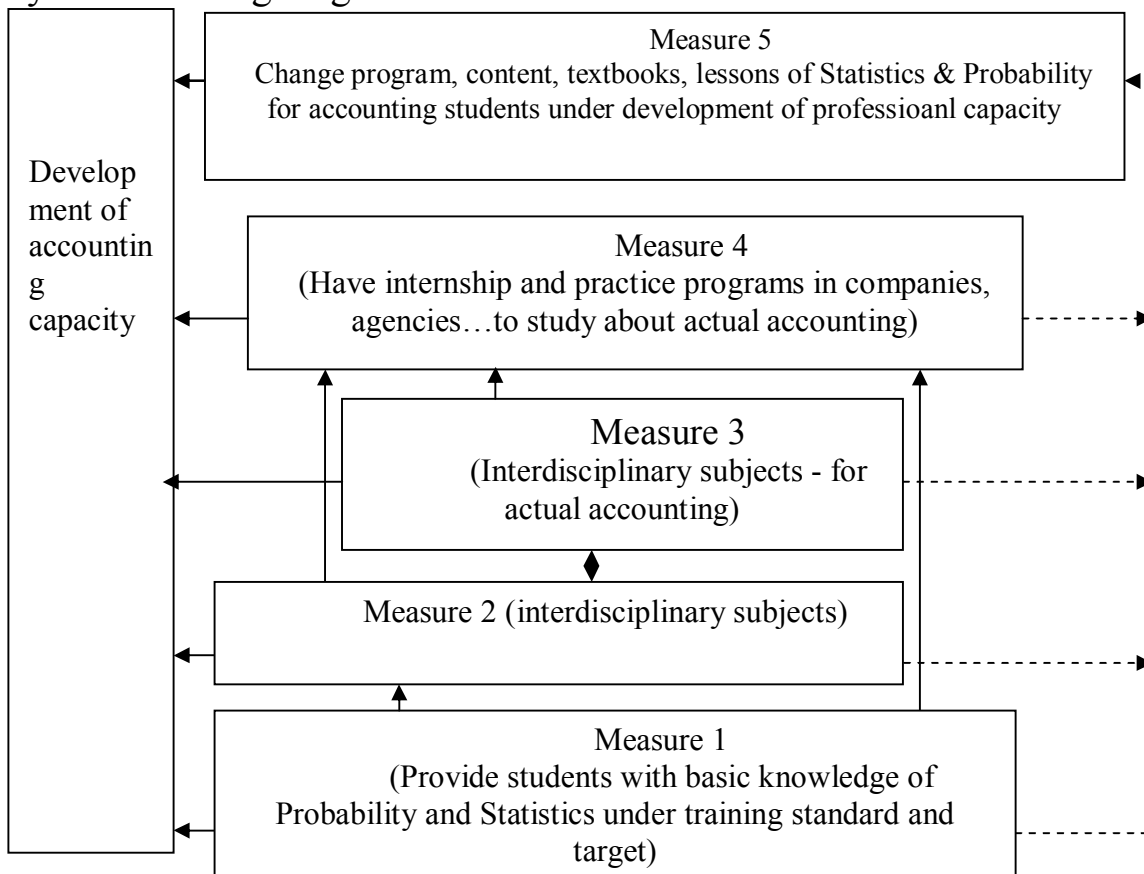
Direction 2: The measure to contribute to adjusting teaching objectives, improving program and renewing content, teaching methods towards strengthening links between probability and statistics and accounting in order to establish and develop professional capacity for students.

Direction 3: The measure to contribute to helping students increase adaptability to reality and resolving some problems arising in actual accounting.

Direction 4: The measure must be feasible and suitable with training program for accountants and facility conditions of industrial colleges.

2.2. Pedagogical measures

Measures to teach probability and statistics under development of professional capacity of accounting students in industrial colleges are illustrated by the following diagram:



2.2.1. Measure 1: Providing students with basic knowledge of Probability and Statistics under training standard and target of Accounting curriculum in Industrial Colleges under development of professional capacity.

2.2.1.1. Scientific basis of the measure

2.2.1.2. *The purpose and meaning of the measure*

Purpose: The measure helps teaching affairs to meet standard requirements and skills needed for probability and statistics in training program of accounting sector.

Meaning: The measure contributes to the formation and development of capacity components 1, 2, 4, 5, 6 (in Section 1.3.4) for students.

2.2.1.3. *Implementation methods*

In order to implement the measure, three following techniques are presented:

a) **Technique 1: Adding and finishing high school mathematics knowledge which helps accounting students understand the basic knowledge of probability and statistics program for accounting students in Industrial Colleges**

Adding knowledge in teaching probability and statistics means specifying what knowledge needs to add for students, why we should add, not newly teach or re-teach the whole program. For example:

- *Classical probability:* Students learnt concept of classical probability at high school. As a result, at college level, teachers only give examples for application of probability formula to company activities and social life.

- *Statistics:* According to high school math program of grade 10, time duration for statistics is not much, so teachers do not have time to work out how to read charts, from which they can draw conclusions for students. Thus, at college level, for the first lesson of Statistics, teachers should add some statistical examples of accounting in order to create interest in learning for students. At the same time, this is the way to focus them on reading charts, finding information via available data on the charts. Sometimes, some concepts related to accounting should be asked.

Example 2.7. (*Apple becomes the most profitable company in history*)

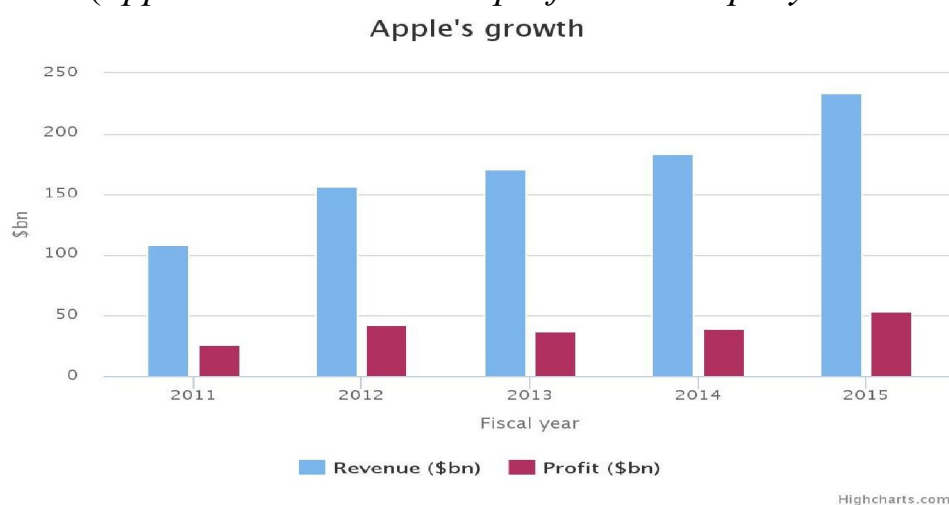


Chart 2.1. Apple's growth rate from 2011 to present

(Source: <http://news.zing.vn/Apple-tro-thanh-cong-ty-co-loi-nhuan-cao-nhat-trong-lich-su-post594555.html>, reported at: 14h39 ' dated 28.10.2015).

Question 1: What is investigating signal and unit?

Question 2: What are the meanings of the words revenue and profit?

After that, teachers should further provide some information: With

recorded high revenue and profit in the last fiscal years, Apple has become the most profitable company. The financial report in 2015 of Apple showed that it had revenue of \$ 233 billion and net profit at 53.4 billion dollars (*see the last column of chart 2.1*), equivalent to \$ 1 billion of profit per week.

Contents of probability and statistics in industrial colleges have some knowledge of high school, including dispersion formula vs center region: variance, standard deviation. Thus, when teaching this section, teachers should recall knowledge of grade 10 and add some examples related to accounting to avoid boredom from students.

Example 2.9. The daily wages of 65 employees at a private enterprise are as follows (Unit: thousand dong):

Levels of wages	Number of employee
[50; 60)	8
[60; 70)	10
[70; 80)	16
[80; 90)	14
[90; 100)	10
[100; 110)	5
[110; 120)	2
Total	65

Calculate the variance and standard deviation of daily wages?

In short, there is much knowledge in accounting training program in Industrial Colleges that students learned at high school, so teachers should focus on old knowledge and add examples of economic sector in general and accounting sector in particular. This makes efforts for students to study and gradually perfect their knowledge of probability and statistics under probability and statistics standard at colleges.

b) Technique 2: Using some positive teaching methods to help students actively acquire knowledge of Probability and statistics.

The author uses a number of active teaching methods teach probability and statistics for accounting students in order to improve their knowledge of probability and statistics required by the college's curriculum.

b1) Technique 2.1: *Applying Mind Map to organize a number of activities in teaching probability and statistics.*

b2) Technique 2.2: *Strengthening the application of information technology to enhance learning efficiency of probability and statistics under development of professional capacity.*

In the framework of the thesis, the author illustrates this technique by using virtual experiments on the Internet and use drawing software to teach definitions, theorems, and properties; and guide students using Excel in solving probability and statistics.

Example 2.11. Teachers can illustrate virtual experiment on balanced coin toss to help students understand concepts of frequency and statistics on probability:

Example 2.12. Teachers use drawing software to teach the definition of normal distribution rule.

c) Technique 3: Guiding students self-studying to meet standard knowledge and skills of probability and statistics in accounting training program.

In self-studying training for accounting students in Industrial Colleges, teachers need to consider the three following basic issues:

o **Issue 1:** *Formation of proper awareness of self-studying activities in students*

o **Issue 2:** *Formation of positive attitudes toward self-studying activities in students*

o **Issue 3:** *Teaching self-studying skills of propability and statistics for students*

2.2.1.4. *Notes the implementation of the measure*

2.2.2. Measure 2: Designing situations and problems that represent interdisciplinary relationship between probability and statistics and some accounting subjects (specified in the accountant training program in Industrial Colleges) under development of professional capacity.

2.2.2.1. *Scientific basis for implementing the measure*

2.2.2.2. *The purpose and meaning of the measure*

Purpose: The measure helps to achieve the goal of subject teaching, and ensure probability and statistics knowledge, which is the basis of some specialized subjects and ensure the interdisciplinary of the subject associated with professional practice.

Meaning: The measure contributes to training capacities 1, 2, 3, 4, 5, 6, 7, 10 (in Section 1.3.4) for students.

2.2.2.3. *Implementation method*

a) Technique 1: Selecting examples of probability and statistics related to some specialized subjects of accounting training program in industrial colleges.

The formulation of interdisciplinary knowledge for students' understanding the knowledge of probability and statistics for the next subject is essential. It helps students be better prepared in their studying plan. To accomplish that, teachers need to use interdisciplinary knowledge in making lesson plans, internal textbooks or classroom teaching. For example, *when preparing chapter II, lesson 3: "The specific parameters of random variables", in the nature and meaning sections of expectation and variance, teachers can involve knowledge of the subjects: business finance, business analysis, administrative accounting, investment accounting into each other for students to know applications of probability and statistics with specialized subjects.*

Example 2.22. An investor is considering his investment in two projects A and B in two different areas. The ability to recover capital after 2 years (%) of the two projects is the random variables with the same probability distribution as follows:

Project A

X_A	65	67	68	69	70	71	73
P	0,04	0,12	0,16	0,28	0,24	0,08	0,08

Project B

X_B	66	68	69	70	71
P	0,12	0,28	0,32	0,20	0,08

From the table above, we have:

$E(X_A) = 69.16\%$; $D(X_A) = 3.0944$; $E(X_B) = 68.72\%$; $D(X_B) = 1.8016$.

Thus, if we need to choose project A for its higher ratio of investment expectation payback, and choose project B for its lower risk of payback ratio, that is, the ability to recover investment capital is more stable. This example helps students toward some subjects like business finance business analysis, administrative accounting, investment accounting, etc.

At higher levels of learning levels: A class can be divided into four groups for doing homework (Duration: 2 weeks)

Group 1: Present the basic structure of investment economics subject, its significance for economic sector; give 5 examples (with detailed explanation) related to relationship between probability and statistics and the subject of business finance.

Group 2: Present the basic structure of business finance subject and its significance to economic sector; give 5 examples (with detailed explanation) related to relationship between probability and statistics and business analysis.

Group 3: Present the basic structure of business analysis and its significance to economic sector; give 5 examples (with detailed explanation) related to relationship between probability and statistics and business analysis.

Group 4: Present the basic structure of administrative accounting and its significance to economic sector; give 5 examples (with detailed explanation) related to relationship between probability and statistics and administrative accounting.

Then, depending on the duration of the curriculum that students will have presentations and discussion in class. Thereby, students will understand the relationship between probability and statistics and other specialized subjects, and know their meanings for economic sectors as well.

2.2.2.4. *Notes the implementation of the measure*

2.2.3. Measure 3: Formulating a "bridge" between probability and statistics and actual accounting sector (in the socio - economic development) to establish and develop accountant capacity in the future.

2.2.3.1. *Scientific basis of the measure*

2.2.3.2. *The purpose and meaning of the measure*

Purpose: The measure helps students understand the necessity of probability and statistics in actual accounting; meet more probability and

statistics models formulated on the basis of actual accounting; enhancing using ability of probability and statistics in actual accounting; training the ability to set a "bridge" between knowledge of probability and statistics learnt at colleges and actual accounting through formulation of actual accounting problems and use tools of probability and statistics to solve the problems.

Meaning: On the basis of probability and statistics models and tools of probability and statistics to solve problems, students will understand the significance of probability and statistics to accounting; the measure contributes to the formation and development of capacity components 1, 3, 4, 5, 7, 8, 9,10,11 (in Section 1.3.4) for students.

2.2.3.3. Implementation method

a) Technique 1: Formulating a "bridge" between probability and statistics and actual knowledge of accounting in Industrial Colleges under development of professional capacity.

Teaching under the standpoint of formulating a "bridge" between probability and statistics and accounting, teachers should note that the *determination of the teaching content* (of probability and statistics or another subject), teachers need to answer these questions: (1) which knowledge of probability and statistics should be equipped to be able to perform well any aspect of accounting? (2) Is it possible to formulate some actual situations of accounting use probability and statistics to solve, aiming at helping students understand clearly whether or not the need to learn probability and statistics?

In order to point out the relationship between probability and statistics in industrial colleges and actual accounting, teachers should note some following points in teaching:

- + Adding the knowledge of "skills training" to each lesson: Applying knowledge to actual accounting; compiling new probability and statistics lessons with accounting components.

- + Exploiting and linking knowledge of probability and statistics with some fields of current accounting.

- + Strengthening learning activities related to practical activities for accounting students to help students understand the relationship and effect of knowledge in probability and statistic with works of an accountant in future.

Example 2.29. When entering new markets, a company cannot confirm how much monthly profit will be achieved, but only estimate the minimum profit of 20 million/per month and the maximum profit of 40 million/per month. Find the probability for the company to achieve the minimum of at least 35 million/per month.

Example 2.30. Two factories make two plans of processing the same component. To assess whether the average cost of raw materials of the two plans is the same or not, the component is produced and given the following results:

Plan 1: 2.5 3.2 3.5 3.8 3.5 0

Plan 2: 2.0 2.7 2.5 2.9 2.3 2.6

With the level of 0.05, please draw conclusion for the above issue. It is known that the costs of raw materials for the two plans are random variables with normal distribution $\sigma_1^2 = \sigma_2^2 = 0,16$

Comment: Administrative accounting in a company often has the task of assessing the potential of a product prior to the market, balancing finance of the company and giving advice to its leaders. So, through the above examples, students clearly understand the role of probability and statistics with business accounting and formation of capacities 3, 4, 5, 6, 10 in Section 1.3.4.

- In addition, teachers also require students to carry out processes and do exercises by themselves:

Lesson 1 [58, p.56]; Lesson 2 [58, p.56]; Lesson 3 [58, p.56].

b) Technique 2: Formulating a "bridge" between situations in practice of accounting with the knowledge of probability and statistics in accountant training program at industrial colleges.

*** Technique 2.1: Training language changing ability for accounting students in teaching Probability and Statistics.**

Firstly, teachers should pay attention to students in both ordinary language of accounting and practical language of probability and statistics.

Secondly, students are given chance to practice ordinary language changing ability into the language of probability and statistics and vice versa.

For this measure, we use problems from actual situations and ask students to solve problems by means of probability and statistics under the process: Step 1: From actual situations in accounting, giving probability and statistics problem; Step 2: Solving the probability and statistics problem; Step 3: Transferring results of probability and statistics solution to the answer of actual accounting. Example 2.33. Situation ; Example 2.34. Situation 2:

- **Technique 2.2: Teachers provide data and suggest knowledge for students to give problems – create actual situations of accounting when knowing assumptions in advance.**

Example 2.35. Based on the range of data 39, 41, 40, 43, 41, 40, 44, 42, 41, 43, 41, 42, 39, 40, 42, 43, 41, 41, 42, 39, 42, 42, 41, 42, 40, 41, 43, 41, 39, 40, 39, 41, 40, 43, 41, please set out the problems in practice related to accounting and use knowledge of estimated math problems and statistical hypothesis test to solve them.

2.2.3.4. Notes the implementation of the measure

2.2.4. Measure 4: Enhancing activities for students: having internship and practice programs for students in companies, administrative agencies...via assigning a "project".

2.2.4.1. The scientific basis of the measure

2.2.4.2. Purpose and meaning of the measure

Purpose: This measure optimizes the use of probability and statistics in actual life by requiring students to do academic projects and asking them to enter into real accounting.

Meaning: The measure contributes to the formation and development of capacities 1, 2, 3, 4, 5, 6, 7, 9, 10,11 (in Section 1.3.4) for students.

2.2.4.3. Implementation method

- Creating good conditions for students to practice: Field tours to companies; giving students chances to practise in actual accounting, asking them to study about accounting and finding relationship with probability and statistics.

- Creating good conditions for students to practise accounting via probability and statistics assignments in order to solve the problem of a production company, or an administrative agency.

- Asking students to participate in a probability and statistics learning project in order to establish accounting capacity for students.

Example 2.36. In this thesis, project-based-learning method is chosen for "statistical hypothesis test" part, namely: using project-based-learning method for the theme "Hypothesis test on the average value of a random variable with normal distribution"

Via the above mentioned project-based-learning method, students acquire necessary knowledge and skills, and capacities of accounting such as:

- *The task of forming a learning project:* students have chances of formation and development of capabilities, accounting capacity: ability to study documents, ability to collect and process information and data, ability to plan tasks in advance.

- *The task of theoretical studies:* students have chances of understanding necessary knowledge of an accountant; the relationship between knowledge of probability and statistics with actual accounting. Thereby, students form and develop skills, accounting capacities needed for themselves: ability to search documents; ability of creativity; ability of problem-solving; ability of information technology; ability of applying mathematics knowledge to explanation of direct situations, and solving practical problems of accounting.

- *The task of studying about actual accounting:* students have chances to learn the routine of an accountant, then forming and developing skills and accounting capacities such as: capacity of fostering qualifications by themselves; communication capacity; ability to deal with real working situations; ability to write a text; organization capacity; ability to assess their professional activities in some aspects.

Experiments have shown that, when implementing the project, field tours to companies create more excitement and passion in learning for students, and better understanding of actual accounting in real working environment. This proves that the project is feasible and effective in teaching. In other words, using project-based-learning method for probability and statistics contributes to the formation and development of skills and accounting capacity for college students.

2.2.5. Measure 5: Innovating and compiling lectures, textbooks, materials consistent with awareness of students in accounting under development of professional capacity.

2.2.5.1. *Basis for measures establishment*

2.2.5.2. *Purpose and meaning of the measure*

Purpose: Innovating content lectures and textbooks of probability and statistics to change inadequacies in the content of probability and statistics compared to actual accounting.

Meaning: This measure helps students visualize easier what they will learn? Which textbooks are used? Thereby, the purpose of the course will be achieved and the learning outcomes of the training program will be met.

2.2.5.1. *Implementation method*

- a) Renewing the goal of lectures and textbooks of probability and statistics under development of professional capacity.
- b) Renewing the structure and content of probability and statistics
 - * Renewing the structure and content of probability and statistics
 - * Renewing the implementation of the program and course content
- c) Innovating the compilation of textbooks and the selection of reference books

2.2.5.4. *Note the implementation of the measure*

CONCLUSION OF CHAPTER 2

Chapter 2 has proposed and formulated 5 measures and system of techniques to teach probability and statistics for accounting students in industrial colleges under development of professional capacity, namely:

Measure 1 provides students with basic knowledge of probability and statistics under the target and learning outcomes of an accountant training program at industrial colleges under development of professional capacity. Technique 1: Adding knowledge of probability and statistics at high schools to help accounting students acquire basic knowledge of probability and statistics in accountant training programs at industrial colleges; Technical 2: Using some positive teaching methods to help students actively acquire knowledge of probability and statistics; Technical 3: Guiding students how to self-study to meet knowledge standards, technical skills of probability and statistics in college training programs under development of professional capacity.

Measure 2 designs problems and situations, which represent interdisciplinary relationships between probability and statistics with some accounting subjects (regulated in the accounting curriculum at industrial colleges) under development of professional capacity. Technique 1: Selecting illustrative examples in teaching probability and statistics related to accounting knowledge in the accounting curriculum at industrial colleges; Technical 2: Asking students to learn specialized knowledge, then see whether probability and statistics can be applied to when solving specialized problems.

Measure 3 formulates a "bridge" between knowledge content of probability and statistics and actual accounting (in the socio-economic development) to establish and develop accountant capacity in the future. Technique 1: Formulating a "bridge" between knowledge of probability and statistics at industrial colleges and accounting contained knowledge under development of professional capacity; Technical 2: Formulating a "bridge" between situations in actual accounting and knowledge of probability and statistics in training programs at industrial colleges.

Measure 4 strengthens activities for students: practicing and having internship programs at production and trading companies and administrative agencies through the assignment of a "project" for students. Technique 1: Creating chances for students to practise: field tours; giving students chances to practise in actual accounting, asking them to study about accounting and finding relationship with probability and statistics; Technical 2: Creating good

conditions for students to practise accounting via probability and statistics assignments in order to solve problems of a production company, or an administrative agency; Technical 3: Asking students to participate in a probability and statistics learning project in order to establish accounting capacity for students.

Measure 5 innovates and compiles lectures, textbooks, materials consistent with awareness of students in accounting under development of professional capacity: Innovating and compiling lectures, textbooks, materials consistent with awareness of students in accounting under development of professional capacity.

With current time duration for probability and statistics at industrial colleges, teachers should pay attention to time distribution and lesson plans in details when using the above mentioned teaching measures. If these above measures are implemented well, students will meet the learning outcomes of the subject, the reality of accounting, be confident in practice and eventually reach Vietnam accounting standards.

Chapter 3

PEDAGOGICAL EXPERIMENTS

3.1. Purposes, requirements, tasks, organizational principles and content of pedagogical experiments

3.1.1. Purposes of experiments: to test scientific hypotheses, consider feasibility and effectiveness of the proposed measures in the thesis.

3.1.2. Requirements of experiments; 3.1.3. Tasks of experiments; 3.1.4. Organizational principles of experiments; 3.1.5. Content of experiments

3.2. Time, objects, procedures, methods of evaluating results of pedagogical experiments

3.2.1. Time and objects of pedagogical experiments

Basing on the specific requirements of the thesis, we conducted the experiments in two times.

First time: From January to June 2014, the first experiment was conducted according to research methods. The objects of the study are students in CCK08KT1 class (65 students) at Phuc Yen College of Industry. The teacher is also the author of the research who has 11 years of teaching experience.

Second time: From March to June 2015, the second experiment was conducted. The objects are students in 2 classes of Vinh Phuc Technique and Economic College. The sample of the study is CDKT7A class taught by the author; and the control group is CDKT7B class taught by Mai Tran Minh, a teacher who has 10 years of teaching experience.

3.2.2. Process, methods of implementation

3.2.3. Methods of evaluating results of the pedagogical experiments

3.2.3.1. Assessment content

The effectiveness of using methods in teaching Probability and Statistics for accounting students in industrial colleges under development of students' professional capacity has adapted to higher education goals through class teaching, which is evaluated according to the followings:

-Classroom atmosphere, students' excitement, students' acquisitiveness with proposed measures in the thesis.

-Students' understanding of theoretical knowledge and their performance in professional practice to establish and develop a number of essential elements of an accountant.

- Students' improvement in learning as well as professional practicing through assessments from other teachers

3.2.3.2. *Methods of evaluating results of the pedagogical experiments*

To assess the above contents, we apply: written tests; oral test; questionnaires for students; classroom observation; interview; mathematical statistical methods.

3.3. Procedures of pedagogical experiments

3.3.1. Pedagogical experiment in stage 1 (from January to June 2014)

Pedagogical experiment in stage 1 was carried out to test feasibility of pedagogical measures which will be proposed in Chapter 2.

3.3.1.1. *Analysis of students' quality before implementation of case study method*

3.3.1.2. *Content of pedagogical experiment in stage 1*

Step 1: The teacher taught experimental lessons and observed the students to assess level of their interest and acquisitiveness.

Step 2: Students did 02 written tests after finishing the course.

Step 3: The teacher delivered questionnaires and interviewed students after experimental class.

3.3.1.3. *Results of pedagogical experimental in stage 1*

a) **Qualitative results**

After conducting pedagogical experiment, we found that: when there was no pedagogical experiment, the class was quiet and students passively received knowledge. The students found Probability and Statistics very difficult and academic and lacked applications. When applying experiment, the teacher found that class atmosphere was more exciting and the students were more confident. The students actively learn the subject because they thought that it is important for studying some professional subjects in professional practices in future. The results confirmed the feasibility and effectiveness of the proposed measures in chapter 2.

b) **Quantitative results**

To evaluate the effectiveness of the proposed measures of the thesis, the students were asked to do two tests, each of which lasts in 50 minutes.

The first test aimed at evaluating the effectiveness of acquiring theoretical knowledge of student. The second one aimed at assessing their ability of application of Probability and Statistics in their accounting profession.

Comment: Generally, the percentage of students achieving good and excellent marks is relatively high. The students have good basic knowledge, and inference skills. This demonstrates that the implementation of teaching Probability and Statistics for accounting students using measures in the thesis has provided students theoretical knowledge and knowledge of application of theory into accounting practices, as well as formed and developed necessary

elements of accountants' capacity for students.

3.3.2. Pedagogical experiment in stage 2 (From March to June 2015)

The purpose is to test the feasibility and effectiveness of the measures proposed in Chapter 2 of the thesis.

3.3.2.1. Analysis of students' quality before implementation of experiment

3.3.2.2. Content of pedagogical experiment in stage 2

Drawing the lesson from stage 1, the authors improved the limitations of measures for ensuring more feasibility of measures

3.3.2.3. Results of pedagogical experiment in stage 2

a) Qualitative results

Due to teaching process was consistent with experimental teaching practice; the experimental class was more exciting than the control class. Students in experimental class study actively and achieve knowledge well. They understood more deeply about accounting and were able to form professional capacity through studying Probability and Statistics.

b) Quantitative results

The students in both experimental and control class were asked to do two tests lasting in 50 minutes. The first test aimed to evaluate the effectiveness of students' acquirement of theoretical knowledge. The second tests aimed to assess their ability of application of Probability and Statistics in their accounting profession.

Results of the test No.1

Table 3.4. Frequency of student' marks of the test No. 1 (Pedagogical Experiment stage 2)

X_i	3	4	5	6	7	8	9	10	Total students	\bar{x}	$\overline{S^2}$
Experiment	2,56	12,82	17,95	20,52	23,08	15,38	7,69	0	39	6,282	1,349
Control	4,76	9,52	23,82	28,57	19,05	9,52	4,76	0	21	5,952	4,244

Results of the test No.2

X_i	3	4	5	6	7	8	9	10	Total students	\bar{x}	$\overline{S^2}$
Experiment(n_1)	2,56	10,26	12,82	20,51	28,20	17,96	7,69	0	39	6,462	1,928
Control (n_2)	9,5	19,05	23,81	28,58	14,3	4,76	0	0	21	5,333	1,883

Table 3.6. Frequency distribution table of student' marks of the test No. 2 of experimental - control groups

Comment: The students of both experimental and control groups took the exams seriously. However, in the control group, teaching process focused mostly on academic knowledge and lacked application of theory into practice. Therefore, students' performances in the exam were not really good. They still found difficult to do the test, so the percentage of students achieving the points 3, 4, 5 is higher than that in the experimental group. For the experimental group, the students were given the test in the form of practical situations so they could do it better than the students in control group. The percentage of students

achieving the points 7, 8, 9 is much higher than that in the control group.

After considering the way students in the experimental and control group presented in the test and their marks gained, it is concluded that experimental students clearly understood professional knowledge and practical problems. They could use initial data to make up practical problems and used professional knowledge of Probability and Statistics to solve the problems. They were also more confident than the students in the control group. This result showed that the implementation of proposed measures in the thesis has provided students habits, demands and ability in applying professional knowledge of Probability and Statistics to solve practical problems, especially in accounting profession.

Using statistical hypothesis test, the researcher found that the average score of the experimental group is higher than the control group, which indicates the effectiveness of the proposed pedagogical measures of the thesis.

CONCLUSION CHAPTER 3

After determining the purposes, objects, pedagogical experimental methods, we conducted experiments two times. The results and data were analyzed by means of observation method; statistical method; survey method. Here are some conclusions:

1) The proposed pedagogical measures in the thesis can be applied in teaching Probability and Statistics for accounting students in Industrial Colleges. These measures have initially brought effectiveness and contribution to improve students' learning quality in Probability and Statistics subjects.

2) The measures and the implementation of proposed measures have helped students not only acquiring professional knowledge but also practical knowledge. They have fostered students some experiences in life and in career and provided students ability of accepting and cooperation with others. The students have had opportunities to assert themselves and understand more explicitly the role of Probability and Statistics to specialized subjects of accounting curriculum and practical profession. This is very important for students because it can be considered as initial background for students' accounting activities in their future career.

3) Through implementation of learning activities in the teacher's lectures, the students have achieved practical experience of accounting profession, as well as formed and developed some necessary skills and capabilities of accounting profession.

Thus, the experimental results are proof which was tested for scientific hypothesis of the study. It initially proved that the proposed measures are feasible and able to apply in appropriate circumstances.

CONCLUDE

In conclusion, the thesis has obtained the following results:

1) The thesis has reviewed and analyzed relevant ideological and practical issues as well as given some new results, such as: The definition of accounting capacity; a system of 15 necessary capacities of accountants and 11 elements of accounting capacity which can be formed and developed through teaching Probability and Statistics in accounting curriculum in Industrial Colleges. Especially, the thesis has analyzed and clarified characteristics of accounting students in terms of physiology, psychology, ages and attitudes toward learning in Industrial Colleges.

2) Investigation of situations in two industrial colleges, one college of Economic and Technology and one industrial university (college level), the thesis has clarified some basic aspects of teaching Probability and Statistics for accounting students in industrial colleges under development of professional capacity.

3) Doing a survey on examples, exercises in textbooks, lectures of Probability and Statistics subject in one industrial college, one college of Economic and Technology and one industrial university (college level), the thesis has confirmed the need of innovation in teaching curriculum and lectures of Probability and Statistics for accounting students in industrial colleges under development of professional capacity.

4) The thesis has proposed five measures in teaching Probability and Statistics for accounting students in industrial colleges under development of professional capacity. Five measures are presented in a unified structure (scientific background of the measures, purposes and significance of the measures, ways of implementation and some notices in using the measures).

5) The thesis has proposed a system of more than 40 examples (in chapter I and chapter II) and some application exercises of Probability and Statistics subject in economic field in general and in accounting profession in particular that are suitable with curriculum, content and accounting students in industrial colleges in Vietnam these days.

6) The thesis has implemented pedagogical experiments to illustrate the feasibility and effectiveness of the proposed pedagogical measures. The results showed that proposed pedagogical measures are initially feasible and obtained good effect.

From the above results, it can be concluded that the scientific hypothesis of the research is acceptable. The tasks of the research have been completed. The contributions of the research can be implemented and applied in actual teaching Probability and Statistics for accounting students in industrial colleges under development of professional capacity. The research can be a reference for teachers and students in teaching and learning Probability and Statistics in universities and colleges training accountants./.

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