A STUDY ON THE FACTORS RELATING TO STUDENTS' LEARNING ACHIEVEMENT IN STATISTICS AT ASSUMPTION UNIVERSITY

by

Ms. Anita P. Causaren

A Thesis of the Twelve-Credit Course
ED 7000 Master's Thesis

Submitted in Partial Fulfillment
of the Requirements for the Degree of
Master of Education
in Curriculum and Instruction
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ABSTRACT

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This study was designed mainly with the aim of studying the factors relating to students' learning achievement in Statistics II at Assumption University. The independent variable used were: (1) students' computational background; (2) students' attitudes toward Statistics II; (3) students' strategic practices used in learning Statistics II; (4) tutorial classes attended; (5) students' perceptions on teaching Statistics II. The dependent variable was students' learning achievement measured by mid-term score, final score and total score in Statistics II examinations.

For students' computational background in Mathematics for Business and Statistics I, the population was explored by using students' results in both subjects. For students' attitudes towards Statistics II, students' strategic practices used in learning Statistics II, tutorial classes attended and students' perceptions on teaching Statistics II, four hundred twenty nine students were randomly selected and completed the questionnaires. Correlation analysis, independent sample t-test and chi-square were used to evaluate the data. Interviews were also conducted to eighteen students to have more discussions of the data.

Students' computational background in Mathematics for Business and Statistics I and students' attitudes toward Statistics II had significant positive relationship with students' learning achievement in Statistics II.

Students' perceptions on teaching Statistics II did not have significant relationship with students' learning achievement. Students' strategic practices used in learning Statistics II had significant relationship only on the part of the students who got high marks. Students attitudes toward Statistics II have a significant relationship with students' strategic practices used in learning Statistics II. Students' perceptions on teaching Statistics II have a significant relationship with students' strategic practices used in learning Statistics II.

There was a difference in learning achievement in Statistics II between students who attended tutorial classes and those who did not attend such a class. There were

differences in students' attitudes toward Statistics II, students' perceptions on teaching Statistics II, students' strategic practices used in learning Statistics II between students who attended tutorial classes and those who did not attend such a class.

According to the findings, two experimental researches are recommended:

1. Comparative study on students' strategic practices used for studying Statistics
2. Comparative study on teaching techniques in Statistics.

The results from the comparative studies would be used in designing the following training programs:

1. Students' training program on learning strategy.
2. Instructors' training program on teaching techniques.

The outcome from the researches and training programs will certainly benefit not only students and instructors but also administrators in making and developing plan and policy, both short term and long term.

CHAPTER I

INTRODUCTION

Background of the Study

The subject matter of statistics has become increasingly important in modern society which has entered the information age, as it provides the means for analyzing and summarizing information and for making rational decisions in all aspects of human activities ranging from economic and business to engineering and technology. As part of the training programs various statistics courses are offered both at undergraduate and graduate levels at Assumption University with a view to enriching the students with the basic concepts and skills in methods and applications of statistics.

Because the importance and applications of statistics have increased in recent years, statistics educators have had to face difficulties as they arose. In this view, most of the attempts focused upon are what an instructor could do to improve teaching statistics but paid little attention on factors that relate to students' learning achievement. Many of the difficulties in statistics courses may not be a result of insufficient aptitudes, rather, they may be a reflection of factors related to statistics achievement. Based on the research done by Gal & Ginsburg (1994), the factors related to statistics achievement are students' attitude and beliefs toward statistics, students' expectation and motivation. It is well known that a large proportion of students in statistics are only taking this course because it is a requirement for their majors (Gordon, 1999) 1995

and so then it brings a negative attitude of statistics into the classroom (Gal & Ginsburg, 1994).

Charles (1995) identified the factors which relate students' academic performance such as sex, age, study habit, past academic performance, outside help received in the form of coaching classes and private tutorials, socioeconomic background and types/location of school attended. It was indicated that study habits, past academic experience and attending private tutorials are the highest predictors of academic performance.

Coleman (1996), cited in Jones (1998:116) attempted to determine the factors which relates school achievements among college students. The major factors are the socioeconomic composition and achievement orientation of fellow students. When students attend schools in which academic achievement is valued, their interest in academic endeavors and their academic achievement increase. Attendance at school in which academic performance is not valued tends to decrease students' academic interest and achievement. It also appeared that peers' attitude does account for a significant amount of variance in students' achievement.

Chandra (1997) concluded that students' attitude and beliefs about statistics have a great impact on students' achievement. Students must open their minds in both mathematical and statistical concepts.

Another aspect considered relating to students' learning achievement is the sociological factors that affect students' motivation, continued participation and overall results (Dancer, 2000). Many students leave school because of inappropriate choices when choosing their degree, lack of knowledge about the course and dissatisfaction with overall university atmosphere. Students are more also likely to leave school if they were not part of a group and/or lacked support from family or friends (Dancer, 2000).

Assumption University

Assumption University (AU), was originally initiated in 1969 under the name Assumption Business Administration College (ABAC). It was formally established in June 1972 and accredited by the Ministry of Education and the Ministry of University Affairs in May 1975. The university is administered by the Montfort Brothers of St. Gabriel, a worldwide Catholic Religious Order devoted to education and philantropic activities. The official medium of instruction at the university is English and it has a formal links and cooperation agreements with a large network of international institutions of higher learning in America, Europe, Asia, etc. for scholastic exchange and research program. The university has a student body of more than 16,000 including foreign students from 42 countries. It also has a high caliber faculty from different countries in different fields bringing students into close touch with pragmatic aspects of life. (ABAC Educational Leadership, 2002).

AU as a Catholic University is a community of students and scholars for whom the dimension of faith and spiritual perceptions are of a great significance. AU has a philosophy of education which is committed to variety and plurality of ideas and views based on truth and integrity, bound by its pledge to be a light leading men and women towards the true source of all knowledge and life. AU is determined to accept, absorb and develop people of all faiths without exception, including non-Christians, within their culture and their communities. The pluralism is the norm of the university. This is shown by AU Version 2000, " The University is an international community of scholars, enlivened by Christian inspiration, engaged in the pursuit of truth and knowledge, serving the human society, especially through the creative use of interdisciplinary approaches and cyber technology ." (Srivichairatana, 2002).

AU envisions its graduates as:

- healthy and open minded persons, characterized by personal integrity and independent mind and creative thinking
- professionally competent, willing to exercise responsible leadership, for economic progress in a just society
- able to communicate effectively with people from other nations and to participate in globalization.

AU leads to a constant pursuit of excellence and has taken measures to determine "Quality". It is constantly and positively promoting the idea of peace, harmony and goodwill to all. (ABAC Educational Leadership, 2000)

AU at present has two campuses: the first campus is located at Ramkamhaeng Soi 24, Huamark, Bangkapi, Bangkok, Thailand. It is where the university started its operation in 1969, the new campus is located in Bangna. It started operating in March, 2000.

Statistics II at Assumption University

Statistics II is a course required to be taken by all Business Administration students and Communication Arts. This course is a pre-requisite to Business Research. All students must take Statistics I prior to Statistics II. Statistics II covers the standard method of statistical inference needed for marketing research, economics, finance, and management science. The purpose of the course is to provide students in the business sciences with enough understanding of statistical ideas and methodology to communicate knowledgeably and effectively with specialists in these technical areas. Because of the widespread availability of computer software packages, statistics become a revolutionizing statistics education. Each year, more and more students enter statistics course with a good experience in computer technology and an expectation of using computer packages to solve problems in statistics. Because of this trend, students were required to learn how to read and interpret computer outputs. The computer output used in the course is SPSS for windows version 11.

Statement of the Problem

While many teachers of statistics are likely to focus on transmitting knowledge, many students are likely to have trouble with statistics. Few students can learn statistics

without any difficulties with observable improvement in understanding statistical concepts and in analyzing statistical problems. Many other students have difficulty learning statistics effectively in spite of receiving the same amount of instruction in the class. Many students enrolled in statistics courses with a negative attitude. Statistics courses are viewed by most students as an obstacle standing in the way of attaining their desired degree (Perney & Ravid, 1991, cited in Gal & Ginsburg, 1994). Students cannot escape from taking the statistics subject, but for many students, the lesson doesn't seem to stick. Students always complain that they don't have enough knowledge and skill about the subject matter. Students come to class not fully ready to embrace the learning environment oriented toward problem solving. Instead they carry a baggage that includes negative attitude about the subject, unconstructive belief about the relevance (or lack there of) of statistics for their future career (Robert & Soxe, 1982, cited in Gal & Ginsburg, 1994). In the context of Assumption University, most students in Statistics courses seem not to be interested in studying in class. Some of them complain that they do not have enough knowledge and skill to learn in the class. They prefer to go to a private tutor with a belief they would be able somehow to pass the course. Most of the time they come to class to be only physically present but mentally absent. The researcher believes that those factors relating to students learning achievement in statistics in the context of Assumption University should not be isolated. They must be found to make teaching and learning statistics more relevant and meaningful.

The Mathematics Department in the Faculty of Business Administration of Assumption University is very concerned about students' learning achievement in statistics. The department is increasingly under pressure to improve the overall pass rates and the percentage of students who complete the course in a minimum time. Knowledge of the key factors relating to students' learning achievement is beneficial when considering the possible help that can be given to students, especially students who are most in need of help.

Research Questions

The researcher arrived at the following research questions:

1. Does the students' learning achievement in Statistics II has a relationship with the following factors:
    - students' computational background (by using Mathematics for Business and Statistics I results).
    - students' attitudes toward Statistics II.
    - students' perceptions on teaching statistics II
    - students' strategic practices used in learning Statistics II
2. Is there a relationship between students' tutorial classes attended and their computational background from high school?
3. Are there relationships among students' attitudes toward Statistics II, students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II?

4. Is there any difference between students who attended tutorial classes and those who did not attend such a class on the following factors:
    - learning achievement
    - attitudes toward Statistics II
    - perceptions on teaching Statistics II
    - strategic practices used in learning Statistics II
5. What are the factors relating to students' learning achievement in Statistics II?

Research Objectives

This research was designed with the aim of determining the factors related to students' learning achievement in Statistics II at Assumption University.

The objectives of the study were as follows:

1. To determine the relationship between students' learning achievement in Statistics II and the following factors:
    - students' computational background (by using Mathematics for Business and Statistics I results).
    - students' attitudes toward Statistics II.
    - students' perceptions on teaching Statistics II
    - students' strategic practices used in learning Statistics II
2. To determine the relationship between students' tutorial classes attended and their computational background from high school?

3. To determine the relationship among students' attitudes toward Statistics II, students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II.
4. To find out whether there is a difference between students who attended tutorial classes and those who did not attend such a class on the following factors:
    - learning achievement
    - attitudes toward Statistics II
    - perceptions on teaching Statistics II
    - strategic practices used in learning Statistics II
5. To determine the important factors related to students' learning achievement in Statistics II.

Research Hypotheses

1. There is a relationship between students' learning achievement in Statistics II and the following factors.
    - students' computational background (by using Mathematics for Business and Statistics I results).
    - students' attitudes toward Statistics II.
    - students' perceptions on teaching Statistics II
    - students' strategic practices used in learning Statistics II
2. There is a relationship between students' tutorial classes attended and their computational background from high school.

3. There are relationships among students' attitudes toward Statistics II, students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II.

4. There is a difference between students who attended tutorial classes and those who did not attend such a class on the following factors:
    - learning achievement
    - attitudes toward Statistics II
    - perceptions on teaching Statistics II
    - strategic practices used in learning Statistics II

Significance of the Study

Assumption University, as a learning institution tries to improve students' learning achievement, to have its graduates healthy and open minded, professionally competent, able to communicate effectively and to participate in globalization. Since these are the important vision of Assumption University, this research is determining the factors relating to students' learning achievement in Statistics II. So the benefit of the research can be classified as:

1. To provide the information to Assumption University on factors relating to students' learning achievement since the University has urged to develop a progressive students' learning achievement.

2. To provide the information to the instructors on factors relating to students' learning achievement so that the instructors can modify and adjust their methods of teaching for ending up with better students' learning achievement.
3. To provide the information to the students on factors relating to their learning achievement so that they will be aware of what they are doing and how to improve their learning achievement.

Theoretical framework

The theoretical framework was drawn based on different models and theories of learning which were related to factors relating to students' learning achievement depicted in the literature review in chapter II. The framework covering all the main areas of factors influencing students' learning achievement was from the theories of Wang et al. (1992), Walberg (2000), Hagedorn (1995) and Charles (2000).

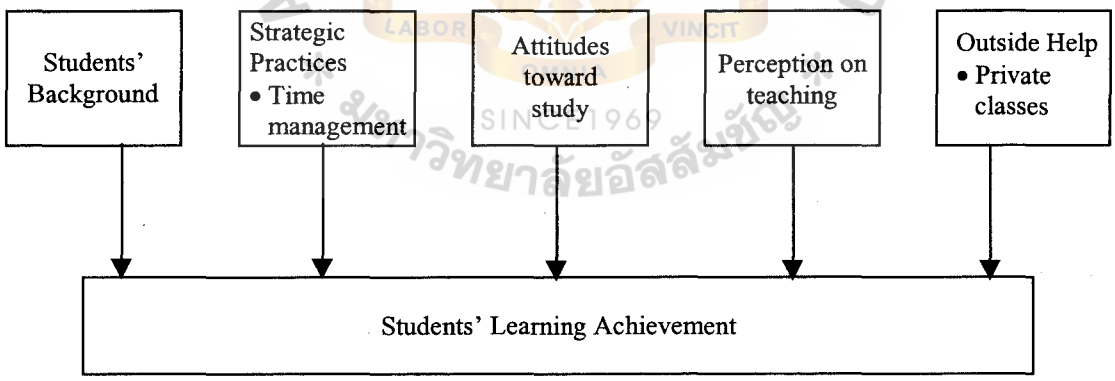

Figure1: Theoretical framework of factors relating to students' learning achievement

On the basis of the theoretical framework shown above, the following conceptual framework had been proposed for the study.

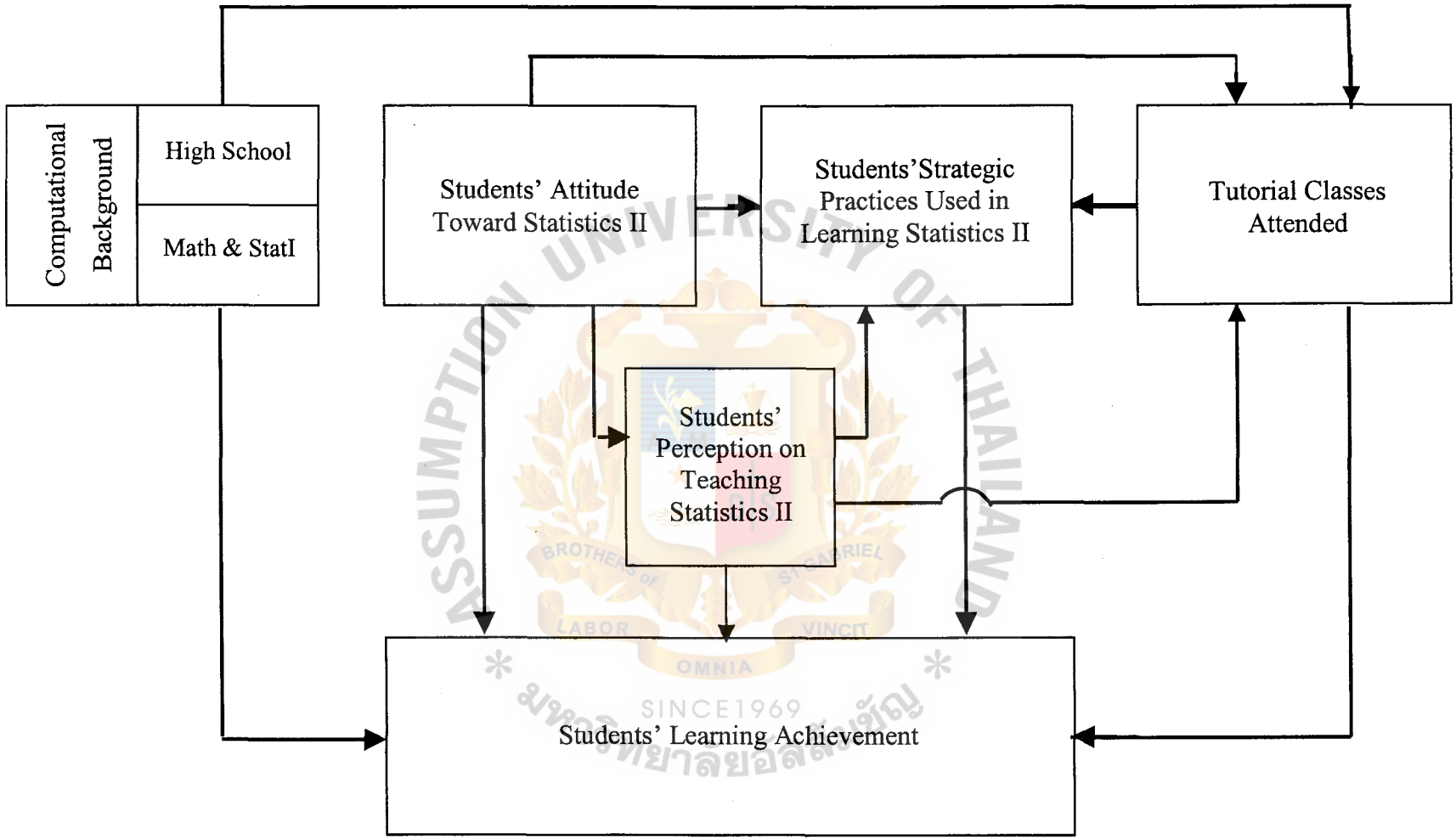

Figure 2: Conceptual Framework of Factors Relating To Students' Learning Achievement in Statistics II

Scope and Limitation of the study

Though learning achievement is a problem of global interest, this study will be confined to the learning achievement of students who took Statistics II final examination in the second semester of 2001 under the Faculty of Business Administration at Assumption University. Statistics I students were not included in this study for they just entered the University and were not yet aware of factors that would relate to their learning achievement in the context of Assumption University.

Factors to be included in this study were only those factors identified by the researcher which were mentioned in the conceptual framework. The independent variables used were : (1) students' computational background; (2) students' attitudes toward Statistics II; (3) students' practices used in learning Statistics II; (4) students' tutorial classes attended; (5) students' perceptions on teaching Statistics II. The dependent variable was students' learning achievement in Statistics II measured by mid-term score, final score and total score in the Statistics II examination.

Definition of Terms

For the uniformity and clarity of understanding of the thesis, a basic definition of terms was given/stated as follows;

1. Statistics II: This is a pre-requisite subject to the Business Research and a basic course offered to Business Administration students which covers the standard methods of statistical inference needed for marketing research, economics, finance and management sciences.

2. Students' computational background: this means the students' computational background in high school based on program attended as well as students' results from Mathematics for Business and Statistics I at Assumption University.
3. Students' attitudes toward Statistics II: this means students' thinking, feeling and expectation towards the subject matter.
4. Students' strategic practices used in learning Statistics II: these are the practices implemented by the students in obtaining good performance in Statistics II which include time management, learning steps and preparation for examinations.
5. Students' tutorial classes attended: private classes attended by students outside the University.
6. Students' perceptions on teaching Statistics II: this is students' insights or observation on how instructors prepared, taught, and handled the subject matter.
7. Students' learning achievement: this consisted of the students midterm examination scores, final examination scores and total scores in Statistics II in the second semester of the school year 2001. The total score was 100 marks.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter presents a review of the literature and research related to the factors relating to students' learning achievement and serve as a guideline to establish a conceptual framework for the study.

This review of related literature consisted of three parts:

Part I : Theories of School Learning.

Part II : Learning Theories Related to Computation.

Part III : Factors Relating to Students' Learning Achievement.

Part I: Theories of School Learning

Caroll's Model of School Learning

Caroll's model of school learning consists of six constructs:(1) aptitude; (2) ability to comprehend instruction; (3) perseverance; (4) clarity of instruction; (5) matching the task to student characteristics; (6) opportunity to learn. Caroll proposed that the specific teacher, students' behaviors and students' characteristics were the only variables needed to predict school learning (Huitt et al, 1995). Caroll's model of learning became a departure for other models to follow, like for example Bruner's model of school learning. This model recognizes the primary importance of students' ability and included constructs such as: (1) aptitude; (2) prior knowledge; (3) verbal IQ

(4) students' background. He also stressed on the importance of motivation, by employing such constructs as perseverance, self-concept of the learner, and attitude toward school subject matter (Wang et al, 1992:30).

Mode of Educational Productivity

Walberg's model of educational productivity which was cited by Wilkins, (2000) identified nine theoretical constructs that exhibit consistent causal influences on students' learning achievement: (1) students' age; (2) ability (including prior achievement); (3) motivation; (4) quantity and quality of instruction; (5) psychological environment of the classroom; (6) influence of the home; (7) influence of the peer group; (8) outside of school; (9) media exposure. These factors have consistently been found to predict students' learning achievement in mathematics and science. Based on the finding of Wilkins (2000) students' personal factors, instructional experiences, and environment were found to be related to the development of students' learning achievement in mathematics.

Model of Adaptive Instruction

The model of adaptive instruction (Wang and Walberg, 1984, cited in Wang et al, 1992:31) is designed to help schools create learning environment that maximize each student's opportunities for successes in school. The model focused in the variables associated with: (1) instructional delivery systems; (2) program design; (3) implementation. The model also included large practical variables such as: (1) efficient allocation and use of teachers' and students' time; (2) practical classroom

management system; (3) systematic teachers' feedback and reinforcement of student learning behavior and progress; (4) instructional interactions based on the diagnosed learning needs of individual students; (5) flexible learning needs of individual students; (6) flexible administrative organizational patterns responsive to program implementation and staffing needs.

Mastery Learning Model

In Bloom's Mastery Learning Model cited by Wang, (1995:326) cognitive entry behavior and affective entry characteristics as the type of factors relating to students' learning are used. With respect to cognitive entry characteristics, the constructs are: (1) aptitude; (2) prior knowledge; (3) home background. With respect to affective entry characteristics, the constructs are: (1) perseverance; (2) self-concept; (3) attitudes toward school; (4) specific subject matter. From the model, it was observed that students' attitude for learning is one of the best predictors of students' achievement. It was also demonstrated that if students' time for learning the academic material was not held constant, then students' mastery of the prerequisite skills, rather than aptitude is a better predictor of school learning (Huitt, 1995).

Path Analysis Model

Hagedorn (1995:261) in his path analysis model established background variables such as: (1) school academic achievement; (2) attitude toward study; (3) perceptions toward teaching; (4) strategic practices. Based on Hagedorn (1995: 261) these are factors to predict students' learning achievement in Mathematics.

Part II: Learning Theories Related to Computation

Constructivist Theory of Learning

One of the theories of learning which is related to this study is constructivist theory of learning. This theory describes learning as an individual process in which learners develop their own understanding of the topics they study rather receiving understanding in an already organized form (Eggen & Kauchak, 1998: 199). Constructivists view students as bringing to the classroom their own ideas, experience, and beliefs which affect how they understand and learn new materials. Rather than receiving material in a class as it is given, students restructure the new information to fit into their own cognitive frameworks. Students actively and individually construct their own knowledge rather than copying knowledge "transmitted", "delivered" or "conveyed" to them.

Based on the context of constructivist principle, students in learning statistics, regardless of how clearly a teacher explains them something, they will understand the material only after they have constructed their own meaning for what they are learning. Students would like to learn something new, interpret the new information by using the knowledge they already have.

Most researches found out that students, if they are motivated to struggle with their own learning they will learn better. If the students cannot learn better alone, joining in a group activities provide them opportunities to express their ideas both orally and in writing. Practicing exercises by themselves or in group will also help them learn

better, but practicing only familiar problems to them, will not help them at all. In other words, students cannot learn to think critically, analyze information and communicate ideas. The most difficult part of statistics topics is the probability which many students hate. Students often have conflict of their own beliefs and intuition about probability. Students learn better when activities are structured to help students evaluate the difference between their beliefs about chance, events and actual empirical results (Garfield, 1994).

Learning is enhanced if students have opportunities to express ideas and get feedback on their ideas. For any feedback students receive, they must know how to reflect on it, make adjustment and try again.

For statistics learning, it involves more than mastering facts and calculations, therefore, students must know how to use their ability to reason, communicate and apply their statistical knowledge.

Bruner's Theory of Learning

Another theory of learning which is related to this study is Bruner's Theory of Learning. Based on this theory, the primary purpose of education is the learning skills in such a way that they can be used in other worthwhile situation (Bruner, 1966, cited in Gibson, 1976:162). The school curricula should be organized to help students first master the early basic skills of a subject and later the learning of a more advanced

nature will be facilitated. In this theory, Bruner used statistical concepts to illustrate the basic principles that are applicable to all areas of teaching and learning.

Based on the context of Bruner's theory of learning, learning involves understanding basic relationship in the structure of a subject, rather than merely knowing facts and techniques. Once a student effectively relates one aspect of knowledge to another, he will acquire a sense of direction that will add excitement to his learning process. This understanding of relationships will aid the students' retention of material and his transfer of it to new learning situation.

The basic foundation of a subject matter must be taught in a form simple enough to be meaningful at the student's early age. It must not be postponed until the student has reached a certain level of maturity, or else the student will get problems in the future. The teacher must know how to motivate students to learn, so that the students' desire to learn will be carried over from the environment of classroom to the rest of his world. Bruner feels that a teacher can best stimulate learning by creating interest in the material itself so that the students can realize that it is worth knowing.

Based on this theory, learning basic statistical skills must be started at the students' early age. Students cannot just memorize the facts and techniques in solving mathematical problems. They need understanding basic relationship in the structure of statistics subject. Students need to understand the subject in such a way they can relate it to other subject in meaningful ways.

This theory also emphasized that once the students realized the importance of the subject, they will become interested and they will realize that it is worth knowing. With this emphasis, those factors that might influence students' learning achievement could be minimized, if could not be avoided totally.

Part III: Factors Relating to Students' Learning Achievement

Attitudes

The study of attitudes have been an important area of interest to psychologists, who often were also interested in related concepts such as propaganda. Educators have been interested in attitudes because of their possible impact on learning, and while attitudes have not been convincingly linked to achievement, they have been long considered an important component of the most important outcome of education: learning.

Attitude has been a difficult concept to define adequately, primarily because it has been defined by so many, but also because of the word's differing lay uses and connotations. One of the earliest definition of attitude was proposed by Thomas and Znaniecki, 1918, cited in AECT, 2001).

> **Attitude is a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related.**

More recently, Zimbardo and Leippe (1991, cited in AECT, 2001) defined attitude as:

> **An evaluative disposition toward some object based upon cognition, affective reactions, behavioral intentions, and past behaviors ... that can influence cognition, affective responses, and future intentions and behaviors.**

Attitudes are latent and not directly observable in themselves, but they can act to organized and provide direction to actions and behaviors that are observable. Many refer to attitudes as "predisposition to respond". Attitudes are related to how people perceive the situations in which they find themselves. Also, attitudes vary in direction (either positive or negative), in degree (the amount of positiveness or negativeness) and in intensity (~~die~~ the amount of commitment with which a position is hold; Smith 1982 cited in AECT, 2001).

Components of Attitudes

A major issue regarding attitudes is the extent to which they are related to subsequent behavior. In other words, is what people say, they will do related to what they do? The empirical usefulness of the attitude construct and the measurement of attitudes is directly linked with their relationship to actual behavior. This is because attitudes are thought to consist of three components: the cognitive, the affective and the conative. The cognitive component consists of the knowledge about the object of the attitude, or the properties attributed to the object. In addition to knowledge, attitudes also incorporate an affective component, that is, the extent to which the persons likes or

dislikes the object of the attitude. Finally, attitudes have a conative component which relates to intended behavior regarding an object (Saha, 1995: 391).

Importance of Attitudes

Traditionally when instruction is designed, there are two categories of outcomes in mind: those directed toward cognitive goals, and those related to the attitudes of the learner. There is a little necessity to argue the importance of the acquisition of knowledge by a student as a result of instruction. Achievement is the paramount objective of most instructional activities. However, it may also be important to recognize the need for establishing attitudinal goals and for planning activities designed to facilitate affective outcomes in learners as a consequence of an instructional situation.

The most powerful rationale for the need to promote attitude positions in learners would be to demonstrate a direct relationship between attitudes and achievement, or liking and learning. Researches like Fenneman (1973) and Simonson (1978) cited in AECT (2001) have identified such a relationship. However, most educational and psychological researchers are reluctant to claim that there is any cause and – effect linkage between these two learner's variables (Zimbardo and Leippe, 1991 cited in AECT, 2001). There are too many intervening forces likely to influence the relationship between how a person feels and how he or she behaves. Attitudes are thought to "predispose" persons to act in positive attitudes toward a topic are felt to orient the person in a positive manner toward that idea, but not to predict actions directly.

The impact of attitude on learning is only one reason for interest in attitudes. There are other arguments that explain why attitudes of learners are important. First, most educators would agree that there are times when it is legitimate, and important, for learners to accept the truth of certain ideas – in other words, to accept an attitudinal position. The importance of voting is an attitude position that most would agree is important. Second, while the strength of the relationship between attitudes and achievement is unclear, it seems logical that students are more likely to remember information, seek new ideas, and continue studying when they react favorably to an instructional situation or like a certain content area. Learners tend to do what they like, not what they do not like. They gravitate toward their interests. Third, there are some instances when influencing student's attitudes is not desirable, so educators should be aware of which techniques affect attitudes. In this way, possible bias can be recognized and eliminated. Lastly, students' attitudes toward a situation can tell the teacher a great deal about the impact of that situation on the learning process. Obviously, attitudes need to be measured in order to know if they have been influenced. As a result of quantitatively and qualitatively assessing the opinions of students toward the learning activities in which they are participating, it may be possible to improve the quality of procedures. One of the most important techniques of evaluation is to ascertain attitudes toward some event, object or person. End-of-course evaluations of attitude toward courses and course contents are a standard activity in schools.

In summary, attitudes are learned "predisposition to respond" held by individuals that make them likely to act in certain ways. Attitudes are not observable, but they do not serve to help produce observable actions in people.

Theories of Attitudes

1. Consistency Theories

The basic assumption of these theories is the need of the individual for consistency. There must be consistency between attitudes, between behaviors and among attitudes and behaviors. A lack of consistency causes discomfort so that an individual attempt to ease the tension by adjusting attitudes or behavior in order to once again achieve balance or consistency. One of the earliest consistency theories was balanced theory (Himmelfarb and Eagly, 1974; Kiesler, Collins and Miller, 1969; O'Keefe, 1990, cited in AECT, 2001).

Relationship among the perceiver, another person and an object are the main focus of balance theory (Heider, 1958, cited in AECT, 2001). Relationship is either positive or negative, based on the cognitive perceptions of the perceiver. In this theory, there are eight possible configurations, four balanced and four unbalanced. Unbalanced states are recognized as being unstable. Under these conditions, perceivers attempt to restore balance by changing their attitudes toward objects or other persons.

Affective-cognitive consistency theory examines the relationship between attitudes and beliefs (Rosenberg, 1956, cited in AECT, 2001). An unstable state occurs when

an individual's attitudes toward an object and knowledge about an object are inconsistent. Persuasive communications attempt to change the affective component of an attitude system by changing the cognitive component of attitude. In other words, providing an individual with new information that changes the cognitive component of attitudes will tend to cause that individual to change overall attitudes toward an object.

Festinger's theory of cognitive dissonance examines consistency among cognitive elements or beliefs about oneself, behavior, or environment. Dissonance occurs when elements are logically inconsistent or psychologically inconsistent because of cultural mores, specific opinions deviating from more encompassing opinions, or information or experiences. Dissonance motivates the individual to reduce the dissonance and return to consonance. When faced with dissonance, the individual seeks to avoid situations or informations that may increase dissonance (Festinger, 1957 cited in AECT, 2001).

2. Learning Theories

Learning theories of attitude received major emphasis by Hovland and his associates in the Yale Communication Research Program. They proposed that opinions tended to persist unless the individual underwent some new learning experience. Persuasive communications that both present a question and suggest an answer serve as learning experiences. Acceptance of the suggested answer is dependent on the opportunity for mental rehearsal or practice of the attitude response, and on the number of incentives

included in the communication. Hovland and his colleagues assumed that as people processed persuasive message content, they rehearsed the message recommended attitudinal response, as well as their initial attitudes. For attitude change to occur, more than rehearsal and practice had to take place. The Yale researchers emphasized the role of incentives and the drive-reducing aspects of persuasive messages as mechanisms for reinforcement, thereby creating acceptance of new beliefs and attitudes (Hovland, Janice and Kelly, 1953 cited in AECT, 2001).

3. Social Judgement Theory

Social judgment theory focuses on how people's prior attitudes distort their perceptions of the positions advocated in persuasive messages, and how such perceptions mediate persuasion. In general terms, the theory assumes that a person's own attitudes serve as a judgmental standard and anchor that influence along a continuum a persuader's advocated position is perceived to lie (Sherif and Houland, 1961 cited in AECT, 2001). Social judgment theory – is an attempt to apply the principles of judgment to the study of attitude change.

According to Sherif, Sherif and Nebergall (1965, cited in AECT, 2001), an individual's initial attitude serves as an anchor for the judgment of related attitude communications. Opinions are evaluated against this point of reference and are placed on an attitudinal continuum. Opinions that most characterized the individual's own opinion are in the latitude of acceptance. Those opinions found most objectionable are

placed in the latitude of rejection. The latitude of non commitment consists of those opinions that are neither accepted nor rejected.

Communication that falls within the latitude of acceptance is assimilated, and if judged to be fair and unbiased will result in a change in attitude. Within the limits of the latitude of acceptance, the greater the difference between the initial opinion and the communicated opinion, the greater the attitude change. Though some changes is possible when opinions fall within the latitude of rejection, the greater the discrepancy the less the change in attitude. (Himmelfarb and Eagly, 1974; Kiesler et al., 1969; Insko, 1967, cited in AECT, 2001).

Social judgment theory's core propositions can be summarized as follows (Eagly and Chaiken, 1993, cited in AECT, 2001).

1. A person's current attitude serve as a judgmental anchor for new attitude positions.
2. Latitude widths determine whether a message's position will be assimilated or contrasted (e.g., accepted or rejected). Positions falling within the latitude of acceptance will be assimilated toward a person's current attitude. Positions falling within the latitude of rejection will be contrasted away from the person's own attitude.
3. Ego involvement of a person broadens the latitude of rejection and narrows the latitude of non commitment.

4. Both assimilation and contrast effect increase as a positive function of a message's position and their recipient's attitudes.

5. Ego involvement increases the anchoring property of initial attitudes.

6. Greater assimilation produces more positive evaluation of message content, which produces greater amounts of attitude change. Conversely, greater contrast produces more negative evaluations of message content, which produces lesser amounts of attitude change.

7. Ambiguity enhances the likelihood of judgmental distortions. Therefore, other effects are greater when recipients are exposed to persuasive messages whose content positions are ambiguous.

4. Functional Theories

A fundamental question about attitudes concerns this purpose: That is, what function do attitudes serve? Understanding the purposes of attitudes are to identify the characteristics of functional theories. Attitudes serve different functions for different individuals or for the same individual in different settings.

Functional theories hold that successful persuasion entails implementing change procedures that match the functional basis of the attitude one is trying to change. Katz (1960 Cited in AECT, 2001) proposed that any attitude held by an individual serve one or more of the four distinct personality functions. The more of these

functions that contributed to an attitude system, the strong and less likely it was that the attitude could be changed.

There were four identified personality functions of attitudes: 1) utilitarian function; 2) knowledge function; 3) ego-defensive function; 4) value-defensive function. In order to obtain a change of attitude, there must be a discrepancy between the need being met by the attitude and the attitude itself. Attitude change is accomplished by recognizing the function of the attitude for the individual, and designing strategies to produce a disparity between the attitude and one or more of the attitude functions.

The utilitarian function acknowledges the behaviorist principle that people are motivated to gain reward and avoid punishments from their environment. Utilitarian attitudes are instrumental in securing positive outcomes of preventing negative ones.

The knowledge function – of attitudes presumes a basic human need to gain a meaningful, stable, and organized view of the world. Attitudes supply a standard for organizing and simplifying perceptions of a complex and ambiguous environment. Attitudes provide a way of sizing up objects and events so they can be reached to in a meaningful way. If people's attitudes toward school are positive, then when they are asked about schools they will be likely to say positive things without needing to "think about it too much."

The ego-defensive-function emphasizes the psychoanalytic principle that people use defense mechanisms such as denial, repression, and projection to protect their self-concepts against internal and external threats. People protect their feelings by developing convenient, if sometimes biased, attitudes that do not require active involvement in threatening or unfamiliar situations.

The value-expressive function acknowledges the importance of self expression and self-actualization.

Attitudes are means for expressing personal values and other aspects of self-concept. A person who draws self-esteem from being a liberal and an environmentalist is motivated to hold attitudes that reflect these ideologies (Eagly and Chaiken, 1993, cited in AECT, 2001).

The central theme of functional theories is that changing an attitude requires understanding its motivational basis, or its function for the individual. Knowing what function an attitude performs for a person helps guide the designer of the persuasive message who wants to change the attitude. Whatever function attitudes perform they provide a frame of reference for comprehending and categorizing objects, persons, and events, and only by understanding an attitude's function can attitude change efforts be successful.

Bolagi (1996) conducted a study to examine the influence of students' attitudes toward mathematics on 280 students. A set of 8 items were administered to the students to measure the factors that influenced students' attitudes toward mathematics with regard to their like or dislike of mathematics; their best of least preferred topics; their like or dislike of mathematics teacher; and like or dislike for the school. It was found out that the personality and interrelationship of the teacher with the student is the most crucial variable in attitude formation. The result from the study suggested that the need for the teacher to develop positive relations with student, to stress classroom activities which involve active teaching/learning process and students' participation, and to engage students meaningfully in the subject, so that fruitful and satisfying result is assured.

In the study of the attitude of bridging mathematics students to mathematics, Milne (1992, cited in Maeshall, 2000) defined attitudes in term of confidence, motivation, perceived usefulness of mathematics, mathematics anxiety, attitude toward success in mathematics, and casual attributes (ability level, effort, quality of teaching, application) in mathematics. Milne's research showed that motivation, attitude to success, and perceived usefulness of mathematics were high for the students throughout the course. It was found out that female students had lower confidence level, higher anxiety, and stronger attitudes towards success than males. Students who dropped out of the course had less confidence, less motivation, and did not see mathematics as useful.

A study of 14,651 eight-grade students, including 2,920 in the Republic of South Korea, 4,644 in Singapore, and 7,087 in United States was conducted by Chen (2001) on "A Cross-National Study of Factors Influencing Mathematics Achievement for Eight-Grade students". The first objective of the study was to determine the internal factor structure of six latent variables investigated such as : (1) home environment; (1) (2) peer influence; (3) school environment; (4) educational aspirations; (5) attitude toward mathematics and (6) study habits. The second objective was to examine the effects of the above six variables on mathematics achievement as measured by the TIMSS (Third International Mathematics and Science Study). The third objective was to investigate whether the same internal factor structure and pattern of influences existed for the students from the three selected countries. The learning model used was based on Walberg's educational productivity model and was tested by the LISREL multi-sample approach. The TIMSS mathematics achievement test and students' background questionnaires were used to collect the data. The study found different factor structures and different influences on the mathematics achievement across the three selected countries. Home environment, attitude toward mathematics, and educational aspiration emerge as the most important and consistent predictors of mathematics achievement for the three countries. For Korean students, the effects of the six manipulable variables on mathematics achievement were most discrepant with the proposed model, whereas the effects for Singaporean students were least discrepant. Furthermore, the Singaporean learning model supported the value of Walberg's educational productivity model.

Yeh (1991), conducted a study on the "Relationship of Academic Achievement to the Variables of Achievement Motivation, Study Habits, Intellectual Development, and Junior College Point Entrance Examination Scores among Junior College Students in the Republic of China (Taiwan)." Achievement Motivation Questionnaire, Survey of Study Habits and Attitudes and Scale of Intellectual Development were administered to 802 junior college students who enrolled in Min-Shin Engineering Junior College during the first semester of 1989-90 school year in Taiwan. The major findings of the study were: (1) a weak but positive correlation was found between achievement motivation and academic achievement, and achievement motivation interacted with study habits when predicting academic achievement; (2) study habits was the most predictor on academic achievement, but good students preferred to study hard rather than have better study methods; (3) the group of subjects, with a mean age of 16 years and having not made conscious decisions about their careers demonstrates only one stage of intellectual development in the data analysis; and (4) because JCJEE scores only had a low correlation with academic achievement, it was suggested that JCJEE scores is a minor initial predictor of academic achievement.

Attitudes and Academic Achievement

Successful complement of at least one statistics course is a requirement in many post-secondary programs. Students often view these courses as overwhelming learning and survival tasks that cause a great deal of stress. (Sorge and Schau, 2002). Instructors and students alike believe that students' attitudes toward statistics impact their statistics achievement and even their willingness to try to complete these

courses. Attitudes toward statistics affect a large number of students in their college (and eventually professional) careers (Sorge and Schau, 2002).

From the research of Sorge and Schau (2002) on "Impact of Engineering Students' Attitudes on Achievement in Statistics: A Structural Model", they examined possible causal relationship among undergraduate engineering students' previous academic success, their attitudes toward statistics and their achievement in a required introductory statistics course. They used Pruned Statistics Attitudes-Achievement Structural Model which included six attitudes latent constructs such as difficulty (factor of task difficulty), cognitive competence (factor of students' expectancy for success in statistics), affect (students' positive and negative feelings about statistics), previous success (previous academic achievement) and statistics achievement which included quizzes, a mid-term exam and a final exam.

From the study, it was found out that students who reported higher previous achievement were higher achievers in their introductory statistics course. Previous academic achievement had large positive direct effect on students' statistics achievement. There was lack of a relationship between value and achievement but a complex relationship between difficulty and value. The direct effect from difficulty to value was large and positive. There was a positive direct effect between affect and achievement. This findings suggests higher self-concept about their statistical abilities encourages students to like statistics more, which improves their achievement.

The findings from Pruned Model support theoretical and educational expectations. As expected engineering students who reported more prior academic success also achieved more highly in their introductory statistics course and felt more confident in their statistical skills. Students who felt that the domain of statistics was easier to learn also expressed more self-confidence in their ability to learn statistics. Students who were more self-confident about their abilities in statistics also like statistics better. Students who like statistics valued it more highly and achieved more.

Tutoring

Another factor relating to students' learning achievement is tutoring. Tutoring is a type of teaching in which one student (or a small group of students) receives personalized and individualized instruction (Medway, 1995: 271).

In tutoring, the person doing the teaching is called a tutor, while the student is called a tutee.Tutoring most often supplements traditional classroom instruction which is typically conducted in a large groups for those students who require remedial help and those who have difficulty learning by conventional methods. Tutoring also is used for students with special needs or life circumstances who are unable to participate in a regular instructional program.

Tutoring is widely used with learners of all ages. Most often it is used with learners in primary and elementary school settings; however, tutoring also is practiced in a

secondary education, higher education, adult education, and vocational education settings.

In most cases, tutoring refers to instruction not provided by a student's regular teacher. The tutor may be a paid private instructor, a volunteer, a school aide, a parent or guardian, another student, or a computer or other teaching machine. The tutor may or may not be similar to the learner in age, ability, background, or personal characteristics. The tutor may or may not be trained as an instructor; he or she may focus on one or several subject matter areas; and, like a large group instructor, the tutor may or may not reinforce, encourage, and counsel the student. Another usage of the word tutor is a college or university official who advises undergraduates, maintains discipline standards, and has teaching assignments.

According to Cohen et al. (1982) cited in Medway (1995), there are many benefits for tutors and tutees across a wide variety of academic and social measures. Tutoring improves school achievement, self-concept, and attitudes toward school, and a student gain more by being tutored than they do through lectures and large group discussion. An excellent study by De Paulo et al. (1989) cited in Medway (1995) showed that the benefits of tutoring are particularly impressive when tutors are older than tutees, when tutors and tutees work in a cooperative context, and when both tutors and tutees are high achievers. This finding clearly shows the advantages of tutoring for competent students as well as those who require more than large group instruction can provide.

The effectiveness of tutoring greatly depends upon the quality of the tutorial relationship, the training of the tutor, and the way. The tutoring is organized and structured. This is true regardless of the age of the tutor. Medway (1991) concluded based on research studies, that the more tutors plan ahead, provide learning tips, employ question-asking strategies, use reinforcement, and have high expectations for tutee success, the greater the benefits of tutoring.

The tutor's attitude toward tutoring and the tutee is very important. The tutor should be encouraging, accepting, and reassuring. Tutor and tutee should have a good interpersonal relationship and feel good working together. They should cooperate with one another and each should respect the efforts of the other.

Dancer (2000) conducted a study on "Factors Influencing Performance in First Year Economics and Econometrics", using a sample of 696 first year students in an Australian university. In the study, the broad hypothesis, is that, the key characteristics that determine performance in the first-year course in economics and in econometrics are different. This further refined into a number of specific hypothesis (1) the TER (Tertiary Entrance Rank) has the same effect in both courses; (2) females perform better than males in both courses; (3) the level of mathematics undertaken at school affects performance in econometrics but not in economics; (4) tutorial attendance has a similar effect on the final result in both courses; (5) international students are at a disadvantage in economics but not in econometrics; (6) coaching in the final year of high school disadvantages the student. Using regression model it was

found out that there were some very important differences between the key characteristics affecting performance in the first-year course in economics and econometrics. Ability factors such as TER (Testing Entrance Rank), the mathematical ability, and whether a student enrolls in a Commerce degree or another degree were important factors for differentiating success in economics and econometrics. Attendance and tutorials, mostly attending lectures and motivation for enrolling economic related degree show all the differences. Gender and age as a part of socioeconomic factors were very different for the two courses.

Charles (2000) conducted a research which was undertaken primarily to identify the factors which affect students' academic performance in the vital examination and to find out the relationship between these factors and students' performance, and to offer suggestions for improving students' performance and to minimize the limitation of the existing examination. "A Study of the Factors Influencing the Academic Performance of Std. X Students of Greater Bombay at the S.S.C. Examination", covered over 1,000 students drawn from 12 city schools. The study included a cross sections of students in terms of sex, age, socioeconomic background and types, interest and location of school students attended. The tools used in the study were intelligence and personality test, school records of students past academic performance, (Stds VIII to X), teachers' perceptions of students' performance and separate questionnaires to students, top rankers, examiners and moderators which yielded a fund of valuable data. It was found out that academic factors like personal efforts, study habits, past academic performance, outside help received in the form of

coaching classes and private tutorials, are the highest predictors of academic performance at the S.S.C. examination.

Strategic Practices used in Learning

Another factor relating to students' learning achievement is students' strategic practices used in learning.

Once students shift from the skills emphasis on elementary grades to the content emphasis on secondary grades, they face greater demands to read information from textbooks, take notes from lectures, work independently, and express understanding in written composition and on paper and pencil test (O'Neil & Bondah, 1999). For students who haven't acquired such important academic skills, the task of mastering content often comes with failure, particularly in general education classes. In response to this challenge, many students with learning problems have acquired and used specific strategies to become successful despite their knowledge and skill deficiencies.

Strategic practices are an individual approach to accomplish learning goals. It is an individual's way of organizing and using a particular set of skills in order to learn content or accomplish other learning goals more effectively and efficiently in school as well as in nonacademic settings (Woolfolk, 1998:307). Therefore, the teacher who teaches strategic practices teaches students how to learn, rather than teaching them specific curriculum content or specific skills.

One of the best known strategic practices for helping students understand and remember what they read is a procedure called PQ4R. The method was developed by Thomas and Robinson, 1972 (Woolfolk, 1998: 311). The acronym means preview, question, read, reflect, recite and review.

1. Preview: Students must survey or scan the material to get an idea of the general organization and major topics and subtopics. Students must pay attention to the headings and subheading and identify what they read about and study.
2. Question: For each major section, students must write questions that are related to the topic. Students must turn the headings and subheadings into questions
3. Read: The questions that students formulated can be answered as paying attention to the main ideas, to support details and other data in keeping with their purposes.
4. Reflect: Students have to try to think of examples or create images of the material while reading. Students must elaborate and try to make connection between what they are reading and what they already knew.
5. Recite: Students must practice remembering the information by stating points out loud in asking and answering questions. Students may use headings, highlighted the words, and note on major ideas to generate questions.

6. Review: In the final step, students must actively review the material, must focus on asking themselves questions and rereading the material only when they are not sure of the answers.

Anderson based on Woolfolk (1998:313) suggested several reasons for the effectiveness of PQ4R's method. First the PQ4R's method makes students more aware of the organization of a given chapter. Second, The PQ4R's method requires students to study the chapter in sections instead of trying to learn all the information at once. Creating and answering questions about the material force students to process the information more deeply and with greater elaboration (Woolfolk, 1998: 313). The PQ4R's method is proven as the most appropriate method especially for older students to increase their academic learning achievement (Woolfolk, 1998: 313).

Education involves more than increasing content knowledge and skills. Students also must learn how to manage their learning. Strategies learners want to and know how to take responsibility for optimizing their learning in both academic and nonacademic contexts (Biggs 1987, cited in Mayer, 1995: 472).

Strategic learners have at least five different knowledge bases they call upon and integrate to help meet educational or performance goals. They are: knowledge about themselves as learners; knowledge about different types of academic tasks; knowledge about strategies and tactics for acquiring, integrating, and applying new learning; prior content knowledge; and knowledge of both present and future contexts

in which the knowledge could be useful. Learners must also know how to integrate and use their knowledge and skills to meet their learning goals and how to monitor their progress so they can adjust what they are doing if a problem occurs.

Knowing what to learn and how to learn, students must also want to learn. Effective learning requires the integration of skill and will components. Motivation and positive affect for learning interact with and result from many factors. These factors include goal setting, goal analysis, and goal using; efficacy expectations; outcome attributions; interest; valuing; instrumentality; and utility value.

Strategic learners must have the metacognitive awareness and control strategies needed to integrate, orchestrate and manage their studying and learning. This self-regulation involves a number of interacting activities, which dynamically impact each other. These activities include: creating a plan to reach a goal; selecting the specific strategies to use to achieve the goal; implementing the methods selected to carry out the plan; monitoring progress on both a formative and summative basis; modifying the plan, the methods, or even the original goal, if necessary; and evaluating what was done to decide if this would be a good way to go about meeting similar goals in the future. Evaluating the entire process helps students build a repertoire of effective strategies that can be used in the future when similar situation arise (Mayer, 1995: 472).

Holmes, et al (1999) investigated the differences in learning process between a group of postgraduate MBA and undergraduate business students and the relationship

between the relevant variables identified as affecting strategic practices within each group. The variables include students age, gender, cultural background, prior education levels, strategic practices and style of self-regulatory control adopted and students' grade point average (GPA). The results achieved for both groups indicated that the students reported the use of affective strategic practices (attitude to study, anxiety, control, ability to concentrate, motivation and time management) are significantly positively correlated with students' general point average (GPA). In contrast, students' reported use of cognitive strategic practices (ability to process information, select main ideas, use study aides, utilize self-testing, and use of test strategies) appear to be unrelated to students' academic performance.

Perceptions on Teaching

Another factor relating to students' learning achievement is perceptions on teaching. Teaching is perceived as a two-way interaction between teachers and students. What the students learn depends largely on the degree of commitment to the teaching task on the part of the professor (Suwandee, 1994). Gusky (1988, cited in Suwandee, 1994) pointed out that modern research studies investigating, teaching and learning have yielded one important finding, among others, that the quality of college teaching has a very strong affect on students' learning despite the influence of other factors such as students' backgrounds and previous learning experiences. Gadzella, Tomcala, Fullwood, Lytton and Benton (1977) based on the research of Suwandee (1994) stated the important characteristics of a professor: (1) knowledge of subject matter; (2) interest of subject matter; (3) presents materials in a flexible manner; (4) informal and establishes

rapport; (5) uses clear comprehensive vocabulary. Rieley, Ryan, and Lifshitz (1969) cited in Suwandee (1994) advocated the list of qualities important to good teaching: (1) systematic organization of subject matter, (2) good speaking ability: (3) ability to explain clearly; (4) ability to encourage thought; (5) symphatetic attitude toward students; (6) expert knowledge of subject; (7) enthusiastic toward subject; (8) fairness in making and grading tests; (9) tolerance toward student disagreement; (10) pleasing personality. Students appear to be the best source to provide rich information concerning teaching performances. Theall and Franklin (1990) stated that "students' opinion can provide important information, and that valid questions, answered by students in the context of appropriate data-collection processes, will yield reliable and useful results." Students are appropriate sources when they are describing: (1) the instructor's professional and ethical behavior; (2) student-instruction relationship; (3) workload; (4) what they have learned in the course; (5) fairness of grading; (6) instructor's ability to communicate clearly (Suwandee, 1994).

Students are in a good position to judge the quality of the classroom teaching they receive is widely recognized. To bring more fruitful development and improvement in the teaching performance, professors must listen to what the students have to say. Professors have to become more student-focused (Suwandee, 1994). As Howe (1967) pointed out:

> **We have the obvious fact that students do pay for the instruction they receive, they are not simply a necessary evil to be tolerated as part of the educational endeavor, but are the purpose of it. The**

opinions of those who eat the pudding certainly ought to be considered if we wish to know how the pudding taste.

Based on the research of Irby (1978) cited in Suwandee (1994), employed factor analysis and analyzed sixteen studies dealing with students' perceptions of teachers. He found a heavy cluster response on four aspects: (1) organization/clarity; (2) enthusiasm/ stimulation; (3) instructor knowledge; (4) group interactional skill. Students feel that professors should know and be interested in the subject matter he or she teaches. Beyond that, the professor should serve the needs of the students, present materials so that students can understand it, and have definite standards in grading students' tests and assignments. (Gadsella et al, cited in Suwandee, 1994).

Brown (1974) study revealed that college students have varying perceptions of teaching styles: (1) a pattern of emphasis on personal warmth dimension at the expense of the remaining two dimensions: intellectual skill and academic rigor; (2) a pattern of emphasis on warmth with the academic rigor and intellectual skill dimension being equally weighted and receiving slightly less emphasis than warmth; (3) a pattern of emphasis showing heavy to moderate emphasis on the intellectual skill dimension; (4) a pattern showing slightly greater emphasis for academic rigor, preference for personal warmth being excluded; (5) a pattern showing equal emphasis on personal warmth, intellectual skill and academic rigor (Brown, 1977, cited is Suwandee, 1994).

According to Suwandee (1994), the assumption is made that differences among institutions in their departmental structures, courses, and teachers are all likely to affect students' learning to some degree. Gusky (1988) as cited by Suwandee (1994) conducted a study to investigate the effects of the institution, department, course and teacher on earn credit rates. The study have significant findings, ~~that is,~~ differences in teachers accounted for 52 percent of the explained variation in earned credit rates, ~~which~~ differences in institutions accounted for 42 percent, differences in departments accounted for 4 percent, and differences in courses accounted for 2 percent. These finding clearly showed that teachers are the most important factor in the differences in earned credit rates. On the quality of teaching in higher education the finding reflected on two major themes: (1) the quality of teaching has great impact on students' learning, despite the strong influence of other factors, such as the students' backgrounds and previous learning experiences; (2) college students who have had successful learning experiences have tended to persist in their learning and they more likely complete their studies. These findings confirm the notion that "teachers do make a difference."

From the model of teaching developed by Lowman (1985) cited in Suwandee (1994), two dimensions are depicted: (1) intellectual excitement; (2) interpersonal rapport. In creating intellectual excitement, two key components of skills are apparent: Clarity of the instructor's communications and his/her positive emotional impact on students. Clarity is related to what a teacher presents, while positive emotional impact stems from the way in which material is presented. According to Lowman, to be able to

present his lessons clearly, a teacher must prepare and organize his material as though he, too, knows little about it. To do this teachers must focus on the early observation, essential milestones, key assumptions, and critical insights in a subject and not be distracted by the qualifications and limitations that most concern them as scholars. A teacher who can accomplish these goals will be able to explain a complex subject simply. This accomplishment will benefit students a great deal since students who are consistently exposed to clear presentations will be most able to correctly define, illustrate and compare and contrast. In interpersonal rapport, Lowman (1985, cited in Suwandee, 1994) views college classroom as complex interpersonal arenas in which a variety of emotional reactions affect how much is learned and how the members of the class feel about it. A teacher needs to be aware of these interpersonal phenomena and use skill in communicating with students in such a way the motivation and enjoyment are enhanced and independent learning is promoted. This awareness can be accomplished in two ways. First, stimulation of negative emotions, and especially anxiety and anger toward students, should be avoided. Second, positive emotion, for example, the feeling that the teacher respects the students as individual capable of performing well, should be promoted.

Suwandee (1994) conducted a study on "Students' Perceptions of University Instructors' Effective Teaching Characteristics in the Faculty of Science, Mahidol University" with the following objectives: (1) to provide university instructors in Thailand with a greater understanding of students' perceptions of what characteristics are important in college and university teaching; (2) to identify effective teaching characteristics which

promote learning; (3) to identify factors influencing students' perceptions of effective teaching. The independent variables were: (1) students' gender; (2) students' academic status; (3) students' grade point average. The dependent variables were: (1) students' perceptions of effective teaching characteristics included under the "knowledge" component; (2) students' perceptions of effective teaching characteristics included under the "preparation / organization / clarity" component; (3) students' perceptions of effective teaching characteristics included under the "enthusiasm / stimulation" component; (4) students' perceptions of effective teaching characteristics included under the "instructor-group interaction component; (5) students' perceptions of effective teaching characteristics included under the "instructor-individual students' interaction" component; (6) students' perceptions on effective teaching characteristics included under "examination / grading" component. The subjects for the study were 505 science students at the Faculty of Science, Mahidol University composed of freshmen (N = 184), sophomores (N = 88), juniors (N = 122), and seniors (N = 111). The survey instrument used in the study was developed from 17 studies found in the literature on the area of teaching effectiveness. The data analysis used were mean, t-test and MANOVA. The findings were: (1) students' gender significantly affected their perceptions of valued teaching characteristics in two components: knowledge and instructor-group interaction, Male students placed higher importance on knowledge and instructor-group interaction than female students did; (2) students' academic status significantly affected their perceptions of valued teaching characteristics in the instructor-group interaction component. Freshmen placed less importance of knowledge, instructor-group interaction, and instructor-individual students interaction than senior students did; (3) students' grade

point average (GPA) did not significantly affect their perceptions of valued teaching characteristics. The perceptions of students with a GPA above the median did not differ significantly from those of students with a GPA below the median. The teaching characteristics listed in order of importance by students are: (1) has a good knowledge of his/her subject; (2) makes difficult topics easy to understand; (3) is willing to help students in and out of the classroom; (4) is well prepared for class; (5) explains clearly. The teaching components listed in order of importance by students are: (1) preparation / organization / clarity; (2) examination / grading; (3) knowledge; (4) instructor-individual student interaction; (5) instructor-group interaction.

Computational Background

Another factor relating to students' learning achievement is computational background. Vaughn & Bos (1998:334) based on the research of Kosi (1981) on the factors relating to mathematics achievement identified variables that have significant influences on students' mathematics achievement: psychological factors such as intelligence/cognitive ability, destructibility and cognitive strategic practices; educational factors such as the quality and amount of instructional intervention across the range of areas of mathematics (e.g., computation, measurement, time and problem solving, and personality factors such as persistence, self-concept, and attitude toward mathematics. Considering these factors, it is not surprising that many students have difficulty in learning mathematics. Most students having an average or above-average intelligence have been identified as inactive learners and as likely to use cognitive strategies. Because much of their educational intervention has focused on

computation, they often have limited exposure to other elements of mathematics, including measurement, time and practical problem solving. They are unable to apply the computation skills to everyday math problems. Many of these students have lowered self-concepts and lack of persistence, which are characteristics that may interfere with learning mathematics skills. (Vaughn & Bos , 1998 : 335).

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

The primary purpose of this study is to determine the factors relating students' learning achievement in Statistics II. This study explored the population and employed the descriptive-survey research with correlation analysis, independent sample-t-test and chi-square to evaluate the data. Data were also described through interviews.

Population

The population of this study of 1161 students from which the participating respondents were drawn, focused on students of Assumption University under the Faculty of Business Administration who took Statistics II final examination in the second semester of 2001.

Sample

The sample of this study consisted of 429 students drawn from a population of 1161 students. The sample was drawn by using SPSS Selected Cases/Random Sample Command. The nineteen students who were interviewed were included in 429 students.

Sampling Frame

The sampling frame of this study was obtained from the computer data files retrieved from Assumption University computer system. First, all retrieved files were transformed into the format from DBF or EXCEL to SPSS data files so that they could be manipulated by SPSS for windows version 11. Only Business Administration students who took the final examination in Statistics II in the second semester of 2001 were selected and the resulting file became the sampling frame of the study.

Sampling Procedures

A sample of 450 students were randomly selected from the sampling frame by using SPSS Select Cases/Random Sample Command.

The key variables contained in this file were student ID codes, subject codes, section numbers, classroom numbers and instructor names for all subjects the students registered in the first semester of 2002. Subject codes were then analyzed and tabulated to find the common subjects to all students in the registration list of the first semester of 2002. The analysis revealed that all of them registered in at least one of the following subjects:

Finance Credit and Banking

Business Research

Statistics II

Production Management

Ethics Seminar

A series of SPSS commands were generated to create labels (addresses) for posting on the first page of the questionnaires sent to selected students through their instructors of the five subjects mentioned above. The label contained the information about the students' names, students' codes, subject code, subject name, instructors' names, section number and classroom number so that instructors knew exactly in which sections the students were. The coordinators of the subjects were asked to distribute the questionnaires to instructors. The instructors then distributed the questionnaires according to the students' names on the label, then collected them back and returned to the coordinators. The researcher then picked up the collected questionnaires from the coordinators. However the researcher found out later that out of 450 distributed questionnaires only 429 were answered completely.

This study was conducted in the first semester of 2002 after the grades of Statistics II had been released, then the students knew that their answers would not affect their grades any more. Therefore they would answer the questionnaire completely and sincerely.

Instrumentation

1. Questionnaire

The instrument used in this study was a questionnaire attached in Appendix A. The questionnaire was developed by the researcher for describing, analyzing and interpreting the research questions and research hypothesis.

The questionnaire obtained answers for the most important factors relating to students' learning achievement based on students' opinion, students' computational background in high school, students' attitudes toward Statistics II, students' strategic practices used in learning Statistics II, students' tutorial classes attended and students' perceptions on teaching Statistics II to be used for answering the research questions and research hypothesis. The questionnaire was in the form of multiple choice questions, open-ended questions and five point Likert scales ranging from 1, which means "strongly disagree", to 5 which means "strongly agree".

The demographic profile of the students regarding students' names, students' codes, gender, nationality and Statistics II section were not included in the questionnaire since they could be retrieved from the computer data files.

Computational background in Mathematics and Basic Statistics (Mathematics for Business and Statistics I at Assumption University), students' learning achievement regarding mid-term scores, final scores and total scores were also retrieved from the computer data files.

Questionnaire

1. What are the important factors for your learning achievement in Statistics II?
2. What program of study did not attend in high school?
3. How long did you normally concentrate during the lecture?
4. What did you do to catch up the missing lesson/unclear lesson?
5. How many classes did you miss in Statistics II?
6. How did you normally prepare for examinations?

7. What is the most effective preparation used for Statistics II examinations?
8. Choose the level of importance for each item of strategic practices.
    - time plan
    - learning steps
    - preparation for examination
9. Choose the most important source of information for selection of tutorial classes for Statistics II.
    - Friend
    - Instructor
    - Advertisement
10. Did you ever attend tutorial classes in Statistics II?
11. What was your main reasons for attending tutorial classes?
12. What type of Statistics II tutorial classes did you attend?
13. What was your main reasons for not attending tutorial classes?

Students' Attitudes Toward Statistics II

- Statistics II was in interesting subject.
- Statistics II was a boring subject.
- The knowledge I had learned in Statistics II would help me in other class of my major.
- I am interested and willing to acquire further knowledge of statistics.

Students' ~~Preparation on Teaching Statistics II~~

- My instructor in Statistics II seemed knowledgeable in the area.
- My instructor in Statistics II was always well prepared for the lesson.
- My instructor in Statistics II could give good examples of the concepts.
- My instructor in Statistics II taught very fast.
- My instructor in Statistics II made the lesson interesting.
- My instructor in Statistics II was helpful when the students got confused.
- My instructor in Statistics II was friendly.

Students' Strategic Practices used in Learning Statistics II

- I normally listened to my instructor's explanations.
- I asked my instructor when I did not understand my lesson.
- I came to class only for my attendance.
- I normally reviewed my lesson in Statistics II.
- I normally did exercise by myself.
- I normally set and followed my time management for studying Statistics II.
- I normally reviewed Statistics II before going to class.
- I normally reviewed Statistics II after class.

The questionnaire was examined by four experts in the field of research for its clarity, accuracy and validity. Reconstruction of the questionnaire, revision of wording and the organization of the content of the questionnaire were based on the results of the pre-test and from the suggestions of the experts.

To determine the reliability of the questionnaire, a pilot study was conducted on 53 students of Statistics II who took the final examination in the second semester of 2001 under Faculty of Business Administration. The data gathered from the pilot study were examined through the SPSS version 11 Reliability Test Cronbach's Alpha.

The Alpha coefficient's scale showed:

1. Students' Attitudes Toward Statistics II
   Alpha Coefficient Scale = 0.8361
2. Students' Perceptions on Teaching Statistics II
   Alpha Coefficient Scale = 0.7319
3. Students' Strategic Practices used in Learning Statistics II
   Alpha Coefficient Scale = 0.7155

In the actual study of the sample of 429 students, the Alpha Coefficient's scale showed:

1. Students' Attitudes Toward Statistics II
   Alpha Coefficient Scale = 0.7077
2. Students' Perceptions on Teaching Statistics II
   Alpha Coefficient Scale = 0.7395
3. Students' Strategic Practices used in Learning Statistics II
   Alpha Coefficient Scale = 0.75

2. Interview

Another instrument used for the study was an individual in-depth interview consisting of an open-ended questions. This was used to elicit responses from students about suitable factors relating to their learning achievement in Statistics II. The questions

were concerned with students attitudes toward Statistics II, students' strategic practices used in learning Statistics II, students' tutorial class attended and students' perceptions of teaching Statistics II.

Interview Questions

Students' Attitudes Toward Statistics II

1. Did you like Statistics? Why?
2. What did the teacher do that made you like or dislike Statistics?
3. Did you think Statistics is useful? Why?
4. Did you enjoy doing exercises in Statistics? Why?
5. How much effort did you put in studying Statistics?
6. Did the amount of effort you put into the work make a difference?
7. Did you think what you felt about Statistics relate to your learning achievement? Why?

Students Strategic Practices used in Learning Statistics II

1. Did you have any study plan for Statistics? Why?
2. Did you read your lesson before coming to class?
3. Did you review your lesson after class?
4. Did you prefer to do exercises alone or with others? Why?
5. Did you think doing the exercises help you understand the lesson?
6. Did you do additional exercises at home?
7. How did you prepare for the examination?

8. Did you try to change the way you studied?
9. Did you think the practices you implemented relate to your learning achievement? Why?

Students' Tutorial Class

1. Did you study in tutorial classes? Why?
2. What language the tutor used in teaching?
3. How did the tutor teach?
4. Did the tutor repeat the explanation of the teacher?
5. Did the tutor give additional exercises?
6. Did the tutor have his or her own exercises or using formal classroom exercises?
7. Did the tutor assign you to do exercises?
8. Was the tutor friendly, relaxing and can teach very well?
9. Was it necessary for you to take tutorial classes?
10. If you had not taken tutorial classes, did you think you will pass the course?
11. What can you say about the learning environment in the tutorial class and in the formal classroom.
12. Did you think studying in tutorial classes help you get better marks/pass the course?

Perceptions of Teaching

1. Could you tell me the teaching style of your instructor?
2. Did you think the explanation of the teacher are easy to understand?

3. Did you think the teacher is qualified to teach the subject?
4. Did you think your teacher knowledgeable about the subject matter?
5. Did your teacher used visual aids?
6. Did your teacher used the time allocation for the class?
7. Was your teacher helpful and friendly?
8. Did the class size suits for the subject matter?
9. What teaching method did you think the best for all students?
10. What did you think the instructors' qualifications and behavior that relate to higher student achievement?

Data Collection

A permission from the university authorities was requested prior to the conduct of the study. The researcher secured the permission from the Chairperson of Mathematics, the Dean of the Faculty of Business Administration and the Vice President for Academic Affairs. After the researcher got the approval, the study was conducted. The questionnaires were distributed to selected students who took Statistics II examination in the second semester of 2001. (For distribution of the questionnaires, see sampling procedure pages 33-35). The interview was conducted to nineteen students by the researcher herself.

Data Analysis

The data collected was encoded and processed by SPSS statistical software version 11 for the presentation, analysis and interpretation in accordance to the research objectives, research questions and research hypothesis.

For the presentation of data (descriptive purposes), the frequencies, percentages, mean and standard deviation were used.

To answer question no. 1, the researcher explored the entire population for computational background and the findings were explained by bar charts, correlation analysis was used to determine the relationship between learning achievement and students' attitudes toward Statistics II, students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II.

To answer question no. 2, chi-square was used to measure the relationship between students' tutorial class attended and computational background in high school.

To answer question no. 3, correlation analysis was used to determine the relationship among students' attitudes toward Statistics II, students' perceptions on teaching Statistics II, and students' strategic practices used in learning Statistics II.

To answer question no. 4, independent sample t-test was used to find out the difference between students who attended tutorial classes and those who did not attend such a

class on the following factors: learning achievement, attitudes toward Statistics II, perceptions on teaching Statistics II and strategic practices used in learning Statistics II.

To answer question no. 5, frequencies and bar chart were used to display the important factors relating to students' learning achievement in Statistics II.

Data collected for this study was also from the interview which was later described to find out in depth the suitable factors related to students' learning achievement. Nineteen students were interviewed individually which were divided into two groups: those who were attended tutorial classes and others who did not attend such a class. Then, each group were sub-divided into three cases: those with the low grade, average grade and high grade in Statistics II.

CHAPTER IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter shows the presentation and the results of data analysis of factors relating to students' learning achievement. This chapter consists of two parts: the first part concerns the presentation of data and the second part is about data analysis.

Presentation of data

The population of this study were the students of Assumption University who took Statistics II final examination in the second semester of 2001.

From all students (N = 1161) who took Statistics II examination in 2/2001(Table 4.1), there were 1073 Thai students and 88 non-Thai students. Among the group of Thai students 70.3% passed the examination and from the group of non-Thai students 43.2% passed the examination. More than half of 1161 students were female of whom 73.4% passed the examination. There were 797 students who could not follow Assumption University study plan of whom 64.6% passed the examination. From 432 students who had already selected their major 72.2% passed the examination. And out of 1072 students who took Statistics II one or two times 70.4% passed the examination.

Table 1. Characteristics of all students (N = 1161) who took Statistics II final examination in 2/2001 (Details in Appendix B)

Characteristics of all students	Number of students	Examination result (%)		
		Pass	Fail	Total
Nationality:				
Thai	1073	70.3	29.7	100
Non-Thai	88	43.2	56.8	100
Gender:				
Male	545	62.4	37.6	100
Female	616	73.4	26.6	100
Statistics II registered:				
Followed AU. study plan	364	76.1	23.9	100
Not followed AU. study plan	797	64.6	35.4	100
Major selection:				
Yes	432	72.2	27.8	100
No	729	65.8	34.2	100
No. of times taken Statistics II:				
One or two	1072	70.4	29.6	100
More than two	89	41.6	58.4	100

Source: AU. registration files (2/2001)

From the table given above, those students who could follow Assumption University study plan, their performance in Statistics II final examination was higher than those who could not follow Assumption University study plan even though the percentages of passing the Statistics II examination were both more than 50%. The similar pattern also showed in a group of those students who had already selected major and a group of students who had not yet selected major. From those who took Statistics II more than two times, below 50% could pass the examination. This phenomenon could be explained that the students really had problem in understanding and comprehension. By the gender of students, it was obvious that female students could perform better than the male students. Percentage of passing in the group of Thai students is higher than percentage of passing in the group of non-Thai students, the reason might be that Thai students could seek help from another such as tutorial class easier than non-Thai students.

The sample for this study were students who took Statistics II in the second semester of 2001 and were taken from the population of 1161 students.

From the sample of students (n = 429) who took Statistics II final examination (Table 2), 129 students could follow Assumption University study plan of whom 66.7% passed the examination. There were 404 students who took Statistics II examination one or two times. Out of these 64.4% passed the examination. From 150 students who had already selected major 64.0% passed the examination. The number of Thai students who took Statistics II examination were 401 and 64.3% passed the examination. From 378 students who had had Mathematics background, 63.2% passed the examination and from 233 female students, 70.0% passed the examination.

Table 2. Characteristics of sample students (n = 429) who took Statistics II final examination in 2/2001 (Details in Appendix B)

Characteristic of students in the sample	Number of students	Examination result (%)		
		Pass	Fail	Total
Nationality:				
Thai	401	64.3	35.7	100
Non-Thai	28	42.9	57.1	100
Gender:				
Male	196	54.6	45.4	100
Female	233	70.0	30.0	100
Program attended in high school				
Mathematics related	378	63.2	36.8	100
Non mathematics related	51	60.8	39.2	100
Statistics II registered:				
Followed AU. study plan	129	66.7	33.3	100
Not followed AU. study plan	300	61.3	38.7	100
Selecting major:				
Yes	150	64.0	36.0	100
No	279	62.4	37.6	100
No. of times taken Statistics II:				
One or two	404	64.4	35.6	100
More than two	25	40.0	60.0	100

Source: AU. registration files (2/2001)

From the information given above, the percentage of failures who took Statistics II more than two times was more than 50.0%. It could be said that these students really had problem in understanding and comprehension. It was also obvious that more than 50.0% of non-Thai students failed the Statistics II examination and the reason was the same as mentioned in the population that Thai students could seek help from another source such as tutorial classes easier than non-Thai students.

Analysis and Interpretation of Data

I. Descriptive Statistics

1. Students' Computational Background

Students' computational background was considered based on two courses required before taking Statistics II. The two courses were Mathematics for Business and Statistics I. This was not included in the hypothesis testing for the researcher could explore the entire population.

The first three bar charts (Figure 3) displayed the relationship between grades in Statistics I and average mid-term score, average final score and average total score obtained in Statistics II.

The next three-bar charts (Figure 3) displayed the relationships between grades in Mathematics for Business and average mid-term score, average final score and average total score obtained in Statistics II.

From the first three-bar charts, it could be seen obviously that those students who could get high grades in Statistics I could also get high scores from both Statistics II mid-term and final examinations. And from the last three bar charts, it could be seen also that those students who could get high grades in Mathematics for Business could also get high scores from both Statistics II mid-term and final examinations. Therefore it could be concluded that the students' background in Mathematics for Business and Statistics I did have a relationship with students' learning achievement in Statistics II.

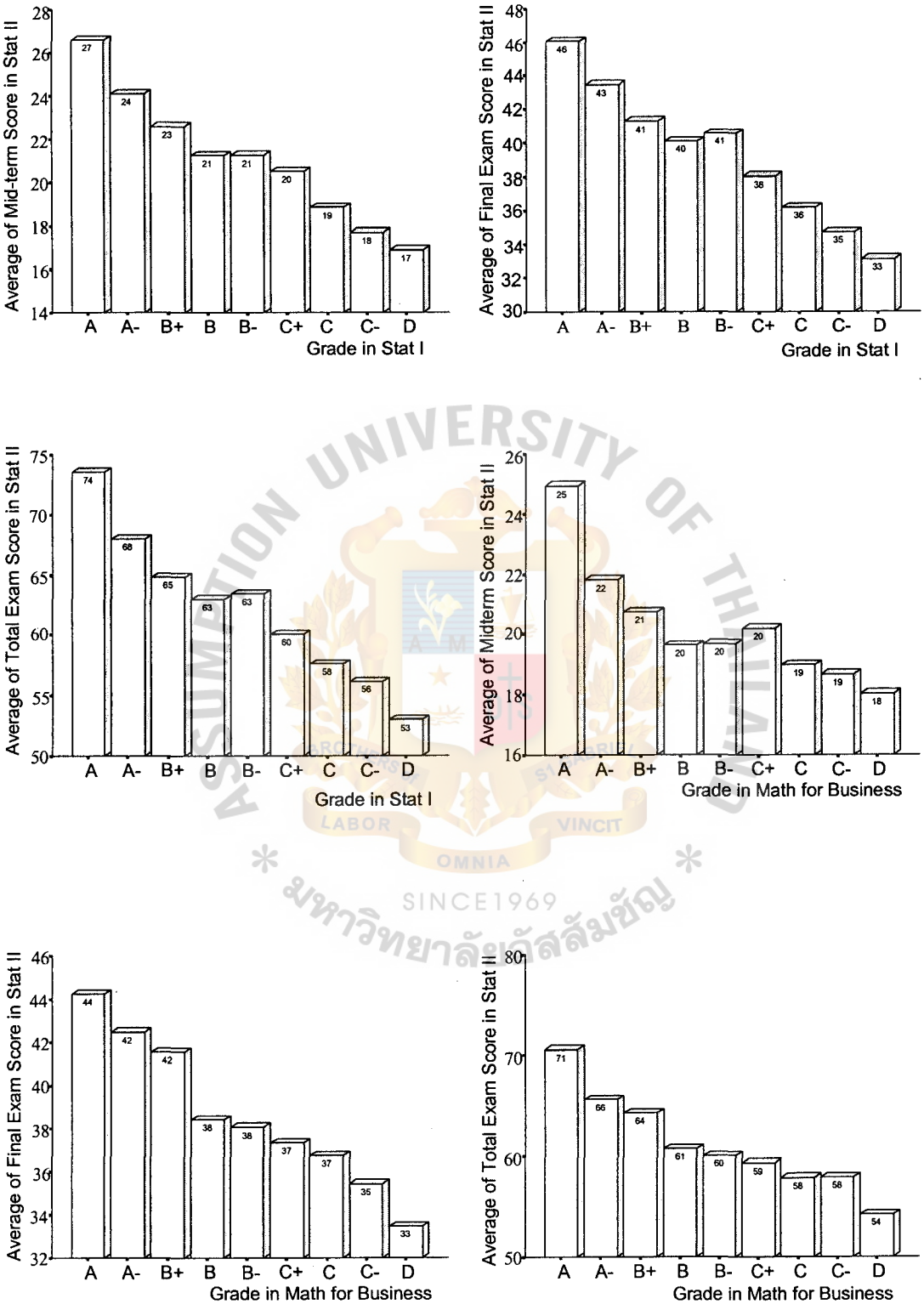

Figure 3. Students' computational background in Statistics I and Mathematics for Business

2. Students' Attitudes Toward Statistics II

Students' attitudes toward Statistics II is a student way of feeling, thinking and expectation about the subject matter.

From students' response to their attitudes toward Statistics II (Table 3), 41.7% of students agreed that Statistics II was an interesting subject, 31.9% undecided whether Statistics II was a boring subject, 43.4% agreed that the knowledge they had learned in Statistics II would help them in other classes of their major and 40.3% undecided whether they were interested and willing to acquire further knowledge of Statistics.

From the information given below, students knew that the knowledge that they had learned in Statistics II would help them in other classes of their major. In spite of Statistics II being a computational subject, still many students felt that it was an interesting subject not a boring one.

Table 3. Degree of agreement (%) of students' attitudes toward Statistics II

Students' Attitudes Toward Statistics II	Degree of agreement (%)					
	SDI	DI	U	A	SA	Total
Statistics II was an interesting subject	7.0	19.1	25.2	41.7	7.0	100
Statistics II was a boring subject	14.5	29.1	31.9	20.5	4.0	100
The knowledge I had learned in Statistics II would help me in other classes of my major	4.7	12.4	29.4	43.4	10.3	100
I am interested and willing to acquire further knowledge of Statistics	8.9	23.8	40.3	21.7	5.4	100

SDI = Strongly Disagree, DI = Disagree, U = Undecided, A = Agree, SA = Strongly Agree.

From those who responded that Statistics II was an interesting subject (Table 4), the mean was 3.23 with a standard deviation of 1.06. Based on the level of agreement (SDI = Strongly Disagree, DI = Disagree, U = Undecided, A = Agree, SA = Strongly Agree), the mean of 3.23 implied that students knew that Statistics II was an interesting subject since the mean pointed toward the right side of the scale. From the examination result, the means of those who passed and those who failed the course were similar to each other (not much different) and the mean also pointed to the right side of the scale. In the next category whether that Statistics II was a boring subject, the mean of the total was 2.7 with a standard deviation of 1.07. The mean of 2.07 implied that the students did not agree that Statistics II was a boring subject since the mean pointed to the left side of the scale. The means of those who passed and those who failed the course were almost the same and also pointed to the left side of the scale. From the response that the knowledge the students learned in Statistics II would help them in any other classes of their major, the mean of the total was 3.42 with a standard deviation of 0.99. This emphasizes that students really knew that Statistics was very important for other courses of their major. Without the knowledge of Statistics they would not be able to understand the subjects of their major that required statistical skills. The means of those who passed and those who failed the course were not much different and pointed to the right side of the scale. In the last category that students were interested and willing to acquire further knowledge of Statistics, the mean of the total was 2.91 and standard deviation was 1.01. This implied that the students still undecided whether they would acquire further knowledge of Statistics. From the examination results the means of those who passed

and those who failed the course were closed to each other and they gave the sense that students did not decide yet whether they should acquire further knowledge of statistics.

Table 4. Mean and standard deviation of students' attitudes toward Statistics II

Students' Attitudes toward Statistics II	Total		Examination Result			
			Pass		Fail	
	Mean	SD	Mean	SD	Mean	SD
Statistics II was an interesting subject	3.23	1.06	3.24	1.09	3.19	1.01
Statistics II was a boring subject	2.70	1.07	2.76	1.11	2.62	1.00
The knowledge I had learned in Statistics II would help me in other classes of my major	3.42	0.99	3.49	0.97	3.30	1.00
I am interested and willing to acquire further knowledge of Statistics	2.91	1.01	2.89	0.99	2.94	1.04
Average	3.07	.75	3.10	0.76	3.01	0.74

3. Students' Perceptions on Teaching Statistics II

Based on the students' perceptions on teaching Statistics II (Table 5), 55.7% of students agreed that their instructor in Statistics II was always well prepared for the lesson, 53.8% also agreed that their instructor in Statistics II seem knowledgeable in the area. On the response that their instructor could give good examples of the concepts, 43.1% of the students agreed, as well as on the response that the instructor in Statistics II was helpful when students got confuse 36.8% also agreed. But for the response on whether their instructor in Statistics II made the lesson interesting, 36.4%

of the students were undecided and 27.3% were also undecided whether their instructor in Statistics II was friendly.

Based on table 5, it cannot be denied that the instructors in Statistics II always came to class well prepared for the lesson.

Table 5. Degree of agreement (%) of students' perceptions on teaching Statistics II

Students' perceptions on teaching Statistics II	Degree of agreement (%)					
	SDI	DI	U	A	SA	Total
My instructor in Statistics II seem knowledgeable in the area	1.6	4.4	21.7	53.8	18.4	100
My instructor in Statistics II was always well prepared for the lessons	1.2	5.1	16.6	55.7	21.4	100
My instructor could give good examples of concepts	3.7	13.5	29.1	43.1	10.5	100
My instructor in Statistics II taught very fast	11.4	24.0	32.2	28.7	3.7	100
My instructor in Statistics II made the lesson interesting	19.6	29.8	36.4	13.3	0.9	100
My instructor in Statistics II was helpful when students got confused	6.3	17.7	31.7	36.8	7.5	100
My instructor in Statistics II was friendly	11.2	20.0	27.3	26.8	14.7	100

SDI = Strongly Disagree, DI = Disagree, U = Undecided, A = Agree, SA = Strongly Agree

From the response that the instructor in Statistics II seem knowledgeable in the area (Table 6), the mean was 3.83 with the standard deviation of 0.84. Based on the level of agreement (SDI = Strongly Disagree, DI = Disagree, U = Undecided, A = Agree, SA = Strongly Agree) the mean of 3.83 emphasized that since it pointed to the right side of the scale, the students could not deny that their instructors seem knowledgeable in the area. The mean of those who passed and failed the course were not much different and pointed also to the right side of the scale. In the second item that their instructors in Statistics II was always well prepared for the lesson, the mean

for the total was 3.91 with a standard deviation of 0.83. The mean emphasized that their instructors were always well prepared for the lesson since the mean pointed to the right side of the scale. The mean of those who passed and failed the course were almost the same and pointed toward the right side of the scale. In the third item that their instructor could give example of the concepts, the mean was 3.43 with a standard deviation of 0.98. The mean of 3.43 implied that the students could not deny that their instructors had always good examples for them since the mean pointed toward the right side of the scale. The means of those who passed and those who failed the examination were not much different and pointed toward the right side of the scale. From the response that their instructors taught very fast, the mean was 2.89 with a standard deviation of 1.06. The mean of 2.89 emphasized that the students did not agree that their instructors in Statistics II taught very fast since the mean pointed toward the right side of the scale. From those who passed the course, the mean was 2.79. This implied the students did not agree that their instructors taught very fast since the mean pointed toward the left side of the scale. But for those students who failed the course, the mean was 3.08. These students agreed that their instructors taught very fast since the mean pointed to the right side of the scale. From the response that their instructors made lessons interesting, the mean of the total was 2.46 with the standard deviation of 0.98. This emphasized that the students did not agree that the instructors made lessons interesting. This could be seen from the mean of those who passed and those who failed the course as well. In the response that their instructors were helpful when students got confused, the mean of the total was 3.21 with the standard deviation of 1.03. This implied that the students could seek help

from their instructors when they got confused. The mean of 3.21 pointed to the right side of the scale. The means of those who passed and those who failed the course were not much different and pointed to the right side of the scale. The last item was that their instructors were friendly. Based on the mean of the total (3.21) implied that the students felt that their instructors were friendly. From mean (2.99) of those who passed the course, it implied that their instructors were not friendly but for those who failed the course, felt that their instructors were friendly.

Table 6. Mean and standard deviation of students' perceptions on teaching Statistics II

Students' perceptions on teaching Statistics II	Total		Examination Result			
			Pass		Fail	
	Mean	SD	Mean	SD	Mean	SD
My instructor in Statistics II seem knowledgeable in the area	3.83	0.84	3.79	0.86	3.90	0.79
My instructor in Statistics II was always well prepared for the lessons	3.91	0.83	3.90	0.86	3.92	0.77
My instructor could give good examples of concepts	3.43	0.98	3.33	1.00	3.60	0.91
My instructor in Statistics II taught very fast	2.89	1.06	2.79	1.09	3.08	0.98
My instructor in Statistics II made the lesson interesting	2.46	0.98	2.37	0.98	2.61	0.97
My instructor in Statistics II was helpful when students got confuse	3.21	1.03	3.15	1.03	3.33	1.00
My instructor in Statistics II was friendly	3.14	1.22	2.99	1.23	3.39	1.17
Average	3.27	0.62	3.19	0.60	3.40	0.64

4. Students' Strategic Practices used in Learning Statistics II

From Table 7, it could be seen that 53.4% of students agreed that they listened in class and surprisingly 31.5% agreed that they came to class only for attendance. 35.4% did not ask their instructors when they did not understand the lesson. 54% were

undecided whether they normally set and follow their time management for studying Statistics II or not. More than one-third of the students disagreed that they normally previewed Statistics II before going to class. 38.2% agreed that they normally reviewed the lesson in Statistics II but only 17.1% agreed that they reviewed after class.

Table 7. Degree of agreement (%) of students' strategic practices used in learning Statistics II

Students' strategic practices used in learning Statistics II	Degree of agreement (%)					
	SDI	DI	U	A	SA	Total
I normally listened to my instructor's explanations	2.1	12.8	20.5	53.4	11.2	100
I asked my instructor when I did not understand my lesson	14.9	35.4	23.1	23.5	3.0	100
I came to class only for my attendance	10.0	20.7	17.2	31.5	20.5	100
I normally reviewed my lesson in Statistics II	6.3	21.4	28.7	38.2	5.4	100
I normally did exercises by myself	2.8	10.7	9.1	58.3	19.1	100
I normally set and follow my time management for studying Statistics II	6.3	18.5	54.0	17.1	4.2	100
I normally previewed Statistics II before going to class	31.8	36.2	27.6	4.0	.5	100
I normally reviewed Statistics II after my class	13.4	22.8	43.7	17.1	3.1	100

SDI = Strongly Disagree, DI = Disagree, U = Undecided, A = Agree, SA = Strongly Agree

Based on table 8, the means of those who passed and failed the course for most items were not much different. It implied that those who passed and failed the course had similar practices.

Table 8. Mean and standard deviation of students' strategic practices used in learning Statistics II

Students' strategic practices used in learning Statistics II	Total		Examination Result			
			Pass		Fail	
	Mean	SD	Mean	SD	Mean	SD
I normally listened to my instructor's explanations	3.59	.92	3.51	1.01	3.72	.74
I asked my instructor when I did not understand my lesson	2.64	1.09	2.53	1.09	2.83	1.07
I came to class only for my attendance	3.32	1.28	3.31	1.34	3.33	1.19
I normally reviewed my lesson in Statistics II	3.15	1.02	3.20	1.01	3.06	1.04
I normally did exercises by myself	3.80	.96	3.85	.97	3.72	.94
I normally set and follow my time management for studying Statistics II	2.94	.88	2.94	.85	2.95	.93
I normally previewed Statistics II before going to class	2.05	.89	2.01	.89	2.12	.90
I normally reviewed Statistics II after my class	2.74	.99	2.75	1.00	2.72	.98
Average	3.03	.62	3.01	.62	3.06	.60

Time management

From the total number of students who passed the course (n=270), 60.7% responded that the level of importance of time management (Table 9) for studying was moderate, 33.2% responded that it was high and 7.0% responded it was low (Table 9). From those who failed (n=159), 57.2% responded high and 11.3% responded low. From the time management done by the students, the mean of those who passed the course was 2.94 with a standard deviation of 0.85. The mean of those who failed the course was 2.95 with a standard deviation of 0.93. Therefore, it could be concluded that the students were aware very well about the time management but they did not implement it properly.

Table 9. Time management done by students and its level of importance

Statistics II Examination Result	% of students responding to the level of importance of time management				Time management done by students	
	Low	Moderate	High	Total	Mean	SD.
Pass (n=270)	7.0	60.7	33.2	100	2.94	0.85
Fail (n=159)	11.3	57.2	31.4	100	2.95	0.93

Learning steps

Out of 270 students who passed the examination (Table 10), almost 50% of them stated that the level of importance of learning steps (preview, in class, review) was high, 45.2% indicated moderate and only 5.2% answered low. It could be said that students realized the importance of learning steps. Once students were asked how they performed in the learning steps, it was found out that the means for step one (preview) were 2.01 for those who passed and 2.12 for those who failed. The means for step two (in class) were 3.51 for those who passed and 3.72 for those who failed. The means for step three were 2.75 for those who passed and 2.72 for those who failed. The means for the two groups of students were similar. It was noticed that the means of step two (in class) were higher than means of step one (preview) and step three (review). This implied that students did not actually implement all learning steps, in fact they implemented step two (in class) and almost ignored step one (preview).

Table 10. Learning steps done by students and its level of importance

Stat II Exam Result	% of students responding to the level of importance of learning steps				Learning steps done by students					
					Preview		In Class		Review	
	Low	Moderate	High	Total	Mean	SD.	Mean	SD.	Mean	SD.
Pass (n=270)	5.2	45.2	49.6	100	2.01	0.89	3.51	1.01	2.75	1.0
Fail (n=159)	5.0	52.2	42.8	100	2.12	0.9	3.72	0.74	2.72	0.98

Preparation for examinations

From 270 students who passed the course (Table 11), 80.0% stated that the level of importance of preparation for examination was high, 18.1% stated that the level of importance of preparation for examination was moderate and only 1.9% stated low. These percentages reviewed that most students realized the importance of preparation for examination. Once the students' preparation for examination was observed, it was found out that the means of those students who passed the examination and those who failed were similar and pointed to the high scale. Hence, for the preparation of the examination, students not only realized its importance but also actually implemented it.

Table 11. Preparation for examinations done by students and its level of importance

Stat II Exam Result	% of students responding to the level of importance of preparation for examination				Preparation for examination done by students	
	Low	Moderate	High	Total	Mean	SD.
Pass (n=270)	1.9	18.1	80.0	100	3.74	.93
Fail (n=159)	1.9	19.5	78.6	100	3.58	.91

5. Students' Tutorial Classes

Out of 429 surveyed students, 289 attended tutorial classes (Table 12). There were two types of tutorial classes: the whole-semester class and not-the-whole-semester class. There were 209 students who attended the whole-semester class of whom 74.6% passed the course. From 80 students who attended not-the-whole-semester tutorial class, 60.6% passed the course. From those students who passed the course, 56.3% sought information for selection of tutorial classes from their friends and from those who failed the course, 50.4% sought information from advertisements.

It could be concluded that students sought information for tutorial classes mostly from their friends and they preferred to take tutorial classes for the whole semester.

Table 12. Percentage of students concerning tutorial classes attended

Stat II Exam Result	Attending tutorial classes (n = 289)	Source of information for selection of tutorial classes (%)				Type of tutorial classes	
		Advertise ment	Friend	Instructor	Total	The whole semester (n=209)	Not the whole semester (n=80)
Pass	70.3	40.7	56.3	3.0	100	74.6	60.6
Fail	29.7	50.4	42.1	7.6	100	25.4	40.0

The students were also asked for the main reason of attending tutorial classes (Table 13 and figure 4), the reasons were: (1) They were taught in Thai, (2) They did not understand in the formal class (3) They wanted to get good grades, respectively.

Table 13. Reasons for attending tutorial class

Reason for attending tutorial classes	% of students (n=271)
Taught in Thai with exercises and old examinations	39.9
Did not understand in class (teacher taught too fast)	37.6
Wanted to get good grades and pass the course	5.5
No computational background	4.4
The subject was difficult	4.1
Others	8.5
Total	100

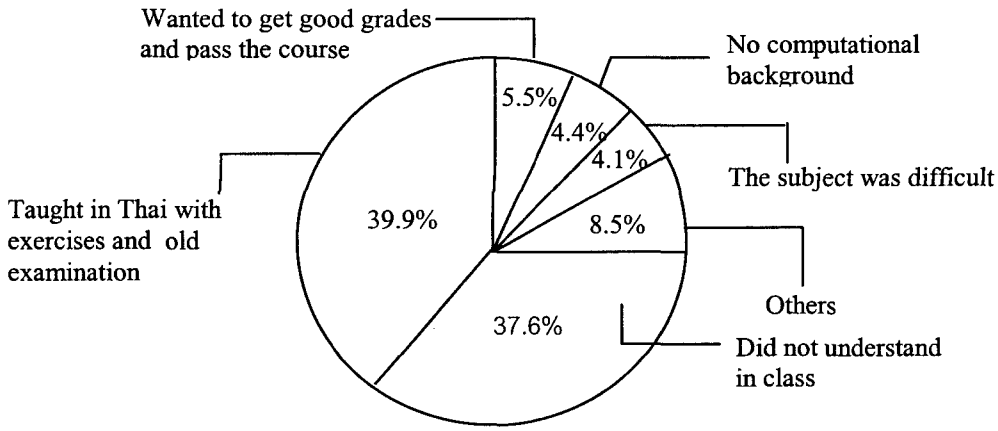

Figure 4. Pie chart for students' reasons for attending tutorial classes

When students were asked for the main reason of not attending tutorial class (Table 14 and figure 5), the reasons were: (1) they could understand in the formal class; (2) they could help themselves when facing problems or difficulties; (3) they did not want to waste their time or money, respectively.

Table 14. Reasons for not attending tutorial classes

Reason for not attending tutorial classes	% of students (n=128)
Could understand in the formal class	21.9
Could help myself when facing problems or difficulties	21.1
Did not want to waste time	16.4
Did not want to waste money	14.8
Could not understand Thai	10.2
Laziness	3.1
Too exhausted to take tutorial classes	2.3
Others	10.2
Total	100

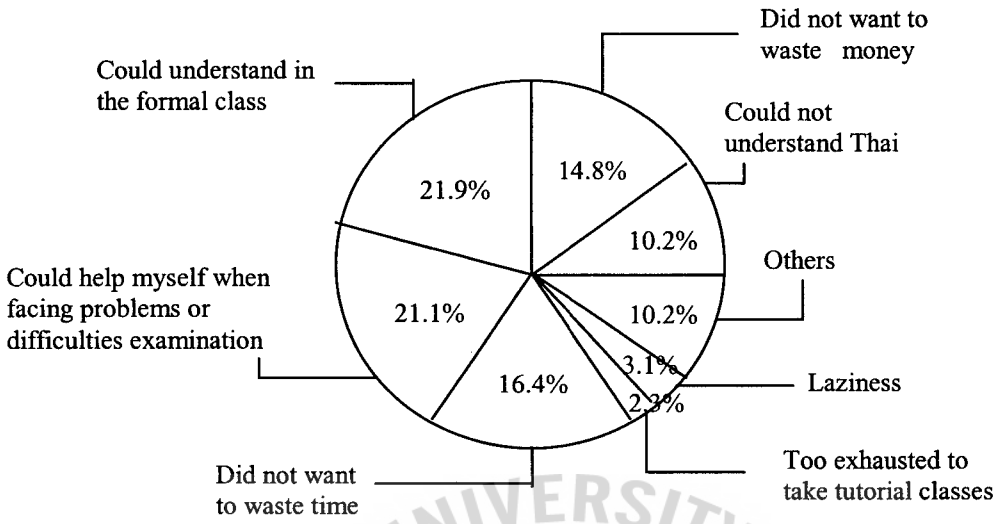

Figure 5. Pie chart for students' reasons for not attending tutorial classes

Table 15 and Figure 6 revealed that 38% of students (n = 429) ranked "strategic practices used in learning Statistics II" as the first factors relating to their learning achievement in Statistics II. 33.6% of students ranked "computational background" as the second one. 19.1% of students ranked "tutorial classes attended" as the third one and the last one was "attitudes toward Statistics II."

Table 15. The most important factors relating to students' learning achievement in Statistics II by students' opinions

Factors relating to students' learning achievement in Statistics II by students' opinions	% of respondents (n = 429)		
	Total	Pass	Fail
Computational background	33.6	20.1	13.5
Attitudes toward Statistics II	9.3	5.3	4.0
Strategic practices : Time management	4.9	3.5	1.4
Learning steps	15.9	10.0	5.9
Preparation for examination	17.2	11.0	6.2
Tutorial classes attended	19.1	13.1	6.0
Total	100	63	37

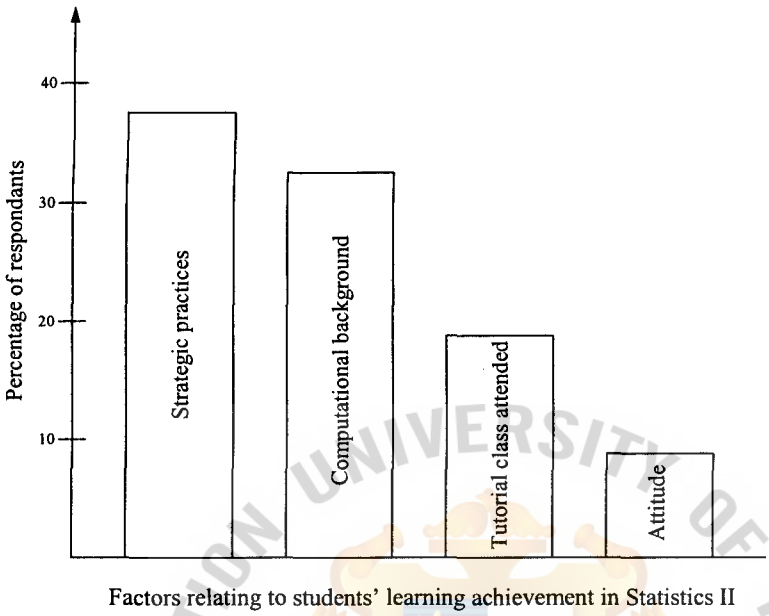

Figure 6. Students' opinion on factors relating to their learning achievement

II. Relationship between Students' Learning Achievement and the Following Factors:

- **Students' Attitudes Toward Statistics II**
- **Students' Perceptions on Teaching Statistics II**
- **Students' Strategic Practices used in Learning Statistics II**

Hypothesis 1a: H_o: There is no relationship between students' attitudes toward Statistics II and their learning achievement.

H_a: There is a relationship between students' attitudes toward Statistics II and their learning achievement.

Based on the correlation matrix (Table 16), it revealed that a significance relationship does exist between students' attitudes toward Statistics II and their learning achievement measured by mid-term score at $\alpha = .05$. The correlation coefficient (r) is 0.148 which indicates a positive and weak correlation. A value of r = .148 stated that once students' attitudes toward Statistics II increase, their mid-term score also increases, however, it was found out also that students' attitudes toward statistics II did not have any significance relationship on their learning achievement measured by final score and the total score.

Table 16. Correlation Matrix for students' attitudes toward Statistics II and their learning achievement

		Total Score	Mid-term Score	Final Score	Attitudes toward statistics II
Total score	r	1	.778	.918	.145
	p	.	.000	.000	0.16
Mid-term Score	r		1	.464	.148
	p		.	.000	.003*
Final score	r			1	.060
	p			.	.320
Attitudes toward Statistics II	r				1
	p				.

Hypothesis 1b: H_o: There is no relationship between students' perceptions on teaching Statistics II and their learning achievement.

H_a: There is a relationship between students' perceptions on teaching Statistics II and their learning achievement.

Based on the correlation matrix (Table 17), it revealed that students' perceptions on teaching Statistics II did not have any significant relationship with students' learning achievement measured by total score, mid-term score and final score.

Table 17. Correlation Matrix for students' perceptions on teaching Statistics II and their learning achievement

		Total Score	Mid-term Score	Final Score	Perceptions on teaching Statistics II
Total score	r	1	.778	.918	-.049
	p	.	.000	.000	.422
Mid-term Score	r		1	.464	.086
	p		.	.000	.085
Final score	r			1	-.044
	p			.	.465
Perceptions on teaching Statistics II	r				1
	p				.

Hypothesis 1c:

H_0: There is no relationship between students' strategic practices used in learning Statistics II and their learning achievement.

H_a: There is a relationship between students' strategic practices used in learning Statistics II and their learning achievement.

Based on the correlation matrix (Table 18), it was shown that there was no significant relationship between students' strategic practices and their learning achievement measured by total score, mid-term score and final score. Therefore, the hypothesis stated above was rejected.

Table 18. Correlation Matrix for students' strategic practices used in learning Statistics II and learning achievement

		Total Score	Mid-term Score	Final Score	Strategic practices
Total score	r	1	.778	.918	.077
	p	.	.000	.000	.202
Mid-term Score	r		1	.464	.053
	p		.	.000	.287
Final score	r			1	.015
	p			.	.805
Strategic practices	r				1
	p				.

Hypothesis 2:

H_o: There is no relationship between students' computational background in high school and tutorial classes attended.

H_a: There is a relationship students' computational background in high school and tutorial classes attended.

Based on the p-value of .001 (Table 19), it could be concluded that there was significant relationship between students' computational background in high school and tutorial classes attended. ✓

Table 19. Chi-square test for relationship between students' computational background in high school and tutorial classes attended

	Tutorial Classes attended	
	χ^2	p - value
students' computational background in high school	18.57	.001*

Significance at p-value = .001

Based on Table 19a, it could be seen that only 56.7% of students in Science and Mathematics background from high school attended tutorial classes whereas more than 73% of students in another background from high school attended tutorial classes including those students who came from Commercial Colleges.

Table 19a. Crosstab between tutorial classes and program in high school attended

Tutorial classes attended		Background in high school				
		Arts Language	Arts Mathematics	Science Mathematics	Commercial Colleges	Others
Yes	Count	19	118	80	60	12
	%	73.1	76.1	56.7	73.2	48
No	Count	7	37	61	22	12
	%	26.9	23.9	43.3	26.8	52
Total	Count	26	155	141	82	25
	%	100	100	100	100	100

Hypothesis 3a:

H_o: There is no relationship between students' attitudes toward Statistics II and their perceptions on teaching Statistics II.

H_a: There is a relationship between students' attitudes toward Statistics II and their perceptions on teaching Statistics II.

Hypothesis 3b: H_o: There is no relationship between students' attitudes toward Statistics II and their strategic practices used in learning Statistics II.

H_a: There is a relationship between students' attitudes toward Statistics II and their strategic practices used in learning Statistics II.

Hypothesis 3c: H_o: There is no relationship between students' perceptions on teaching Statistics II and their strategic practices used in learning Statistics II.

H_a: There is a relationship between students' perceptions on teaching Statistics II and their strategic practices used in learning Statistics II.

Hypothesis 3a to 3c were explained by Table 20. The table revealed that there was a significant relationship between students' attitudes toward Statistics II and students' perceptions on teaching Statistics II at $\alpha = .05$. It also revealed that there was a significant relationship at $\alpha = .05$ between students' attitudes toward Statistics II and students' strategic practices in learning Statistics II at. It was further revealed that there was a significant relationship at $\alpha = .05$ between students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II. It could be explained that students' attitudes toward Statistics II had a positive correlation with students' perceptions on teaching Statistics II. Students' attitude toward Statistics II and students' strategic practices used in learning Statistics II also

had a positive correlation as well as students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II.

Table 20 Correlation matrix for students' attitudes toward Statistics II, students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II

Items		Attitudes toward Statistics II	Perceptions on teaching Statistics II	Strategic practices used
Attitudes toward statistics II	r	1	.278	.444
	p	.	.000*	.000*
Perceptions on teaching statistics II	r		1	.358
	p		.	.000*
Strategic practices used	r			1
	p			.

III Difference between Students Who Attended Tutorial Classes and Those Who Did Not Attend Such a Class on the Following Factors:

- **learning achievement**
- **attitudes toward Statistics II**
- **perceptions on teaching Statistics II**
- **strategic practices used in learning Statistics II**

Hypothesis 4a: H_0: There is no difference on students' learning achievement between students who attended tutorial classes and students who did not attend such a class.

H_a: There is a difference on students' learning achievement between students who attended tutorial classes and students who did not attend such a class.

Based on the p-value (.018) of the t-test (Table 21), there is a significant difference on learning achievement at $\alpha = .05$ between students who attended tutorial classes and students who did not attend such a class measured by mid-term score. For the learning achievement measured by total score, it could be seen from the p-value (.514) that there was no significant difference between students who attended tutorial classes and students who did not attend such a class. Similarly for the learning achievement measured by final score, it could be seen from the p-value (.184) that there was no significant difference between students who attended tutorial classes and students who did not attend such a class.

Table 21. t- test for students' tutorial classes attended and their learning achievement

Score	Students' tutorial classes attended					
	Yes		No		t-test	
	Mean	SD	mean	SD	t	p-value
Mid-term	20.80	6.37	19.09	7.39	2.369	.018*
Final	40.06	8.01	38.54	8.59	1.333	.184
Total	63.38	10.09	62.22	13.09	.656	.514

Significance at p-value = .018

From further investigation through the following figures (Figures 7-9), it could be noticed that students who had got high grades in Statistics I could get high scores in

Statistics II (mid-term scores, final scores and total scores), therefore it was confirmed once again that computational background in Statistics I had an effect on learning achievement in Statistics II. It could be noticed also that graph of scores for students who attended tutorial classes was always above graph of scores for those who did not attend. However attending tutorial classes would have a strong impact on learning achievement in Statistics II only for students who had got grade ranged from C to C+. Attending tutorial classes had a weak impact on learning achievement for students who had got high grades in Statistics I.

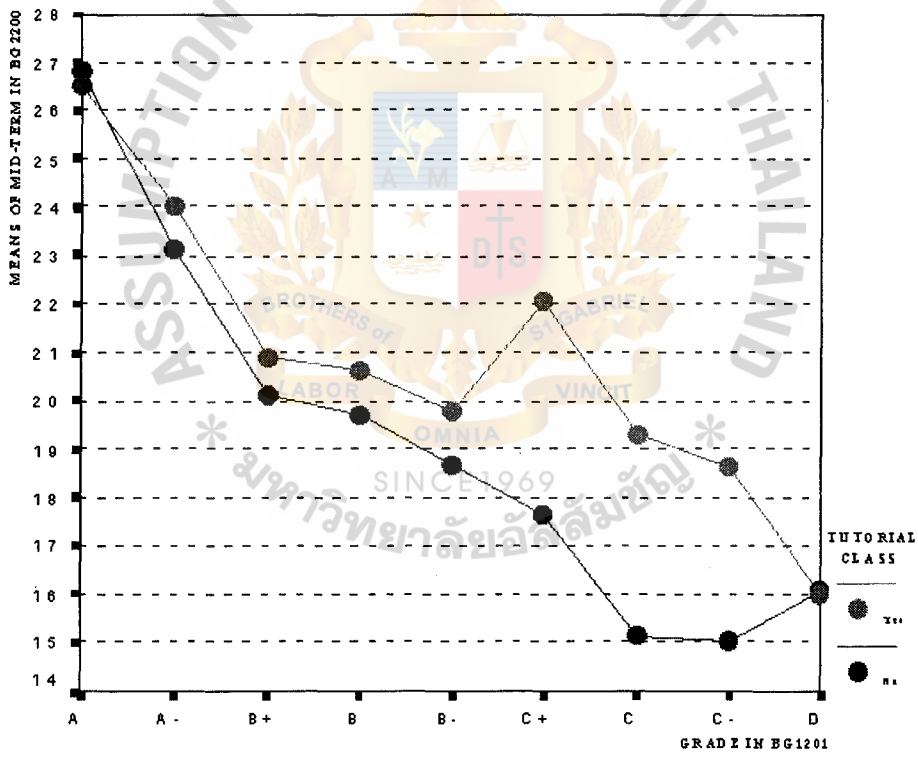

Figure 7. Comparison of L.A [a] (midterm score) between two groups of students [b]

[a] Learning achievement [b] those who attended and did not attend tutorial class

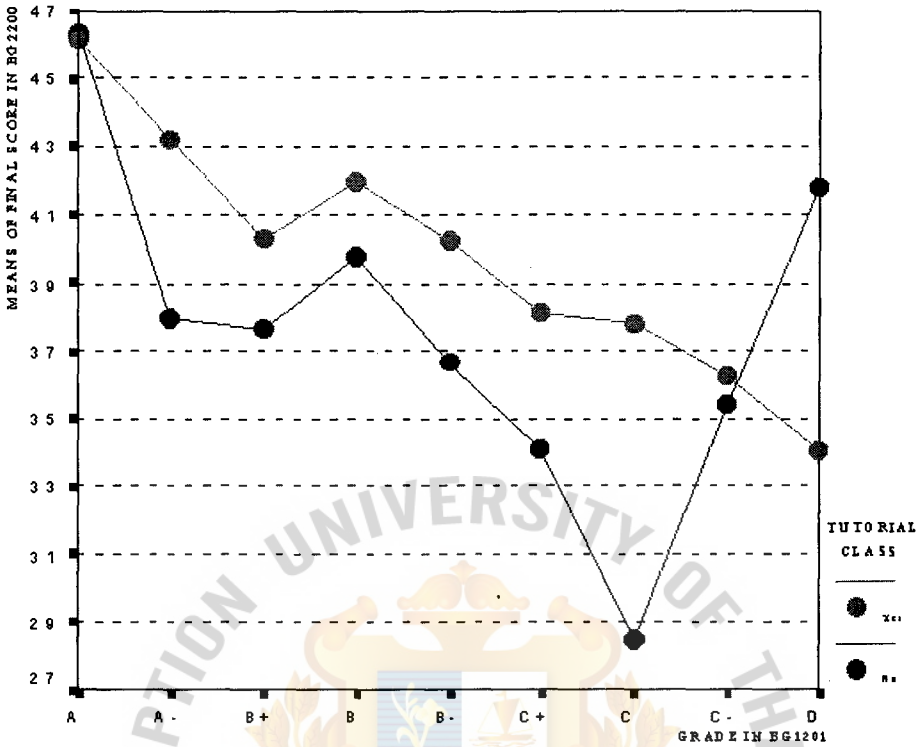

Figure 8. Comparison of LA (final score) between two groups of students

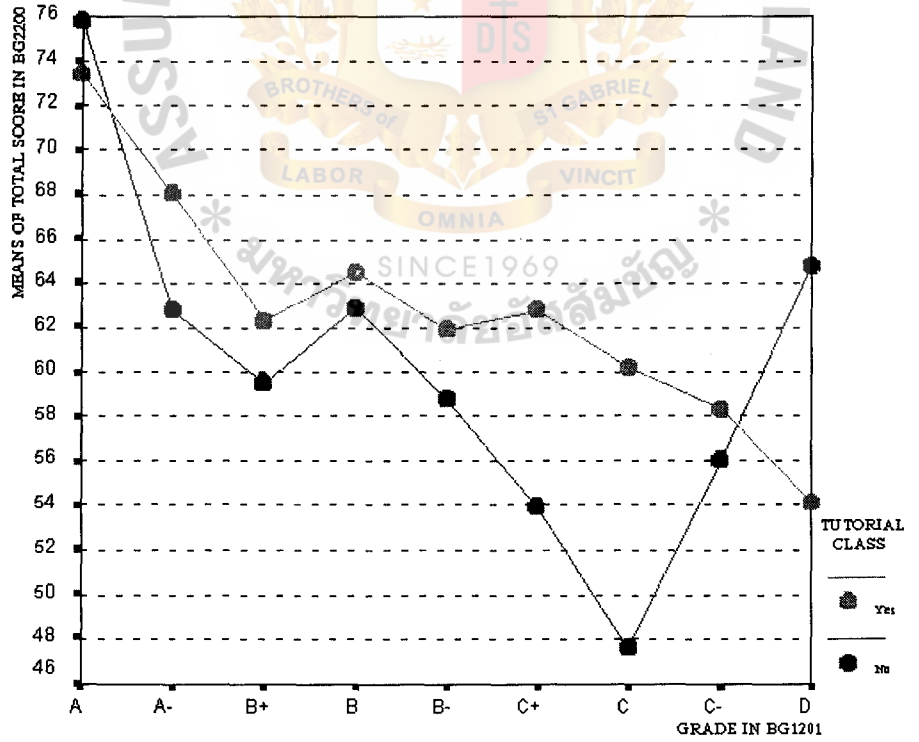

Figure 9. Comparison of LA (total score) between two groups of students

Hypothesis 3b: H_o: There is no difference in students' attitudes toward Statistics II between students who attended tutorial classes and students who did not attend such a class.

H_a: There is a difference in students' attitudes toward Statistics II between students who attended tutorial classes and students who did not attend such a class.

Based on the p-value of .068 (Table 22), the conclusion shows no difference in the attitudes toward Statistics II between students who attended tutorial classes and those who did not attend such a class.

Table 22. t-test on attitudes toward Statistics II between two groups of students (Those who attended and did not attend tutorial classes)

	Tutorial classes attended					
	Yes		No		t-test	
	Mean	SD	mean	SD	t	p-value
Students' Attitudes toward Statistics II	3.02	.736	3.16	0.782	-1.831	.068

Hypothesis 3c: H_o: There is no difference in students' perceptions on teaching Statistics II between students who attended tutorial classes and students who not attend such a class.

H_a: There is a difference in students' perceptions on teaching Statistics II between students who attended

tutorial classes and students who did not attend such a class.

The p-value of .000 (Table 23), indicated that there was a significant difference in the students' perceptions on teaching Statistics II between those who attended tutorial classes and students who did not attend such a class at $\alpha = .05$. It could be seen also that students who did not attend tutorial classes had higher mean than those who attended. Students who did not attend tutorial classes had better perceptions on teaching Statistics II.

Table 23. t-test on students' perceptions on teaching Statistics II between two groups of students (Those who attended and did not attend tutorial classes)

	Tutorial classes attended					
	Yes		No		t-test	
	Mean	SD	mean	SD	t	p-value
Students' perceptions on teaching statistics II	3.17	595	3.47	0.634	-4.692	.000*

Significance at p-value = .000

Hypothesis 3d: H_o: There is no difference in students' strategic practices used in learning Statistics II between students who attended tutorial classes and students who did not attend such a class.

H_a: There is a difference in students' strategic practices used in learning Statistics II between students who attended tutorial classes and students who did not attend such a class.

Based on the p-value of .000 (Table 24), the conclusion shows a significant difference in the strategic practices used in learning Statistics II between those who attended tutorial classes and students who did not attend such a class at $\alpha = .05$.

Table 24 t-test on students' strategic practices used in learning Statistics II between two groups of students (Those who attended and did not attend tutorial classes)

	Tutorial classes attended					
	Yes		No		t-test	
	Mean	SD	mean	SD	t	p-value
Students' strategic practices used	2.95	.642	3.20	0.667	-4.057	.000*

Significance at p-value = .000

Differences between Students Who Attended Tutorial Classes and Those Who Did Not Attend Such a Class

A. Students Who Attended Tutorial Classes

Students' Attitudes Toward Statistics II

Based on the students who attended tutorial classes and got low marks in Statistics, when they were studying Statistics, they did not like it that much in the sense that they

hate calculation and they felt that doing calculation all the time was a boring job. They hate doing Statistics not because of the teacher but they did not enjoy dealing with numbers. But in spite of these students' attitudes toward Statistics, students found out the importance of it. Students found out that Statistics is very useful in doing the research, in predicting something and in thinking. Students also claimed that, if they put lots of effort into the work, they would be able somehow to get good grades more than what they were expected to get. Aside from this, students thought that what they felt about Statistics relate to their learning achievement. Students knew that if they have positive attitudes toward Statistics, it would contribute a lot to their learning achievement, that is the possibility of getting better marks.

On the part of those who attended tutorial classes and got average marks in Statistics they claimed that they did not like Statistics. It has a lot of details, calculation, could not understand the teacher's explanations and could not apply it in everyday life. In doing the exercises, the students did not enjoy that much. The students did the exercises just only for the sake of passing the examination. But the students realized the usefulness of Statistics. The students found out that knowing Statistics was very useful in other subjects like Business Research, Marketing Research and in their further study. While students were studying Statistics, they did not put a lot of effort into the work. Students had to seek help from tutorial classes outside the university with the hope of passing the exam. But students found out that if they only put a lot of effort into the work they would have a chance to get a better mark. This group of

students who got average marks thought that what they felt about Statistics relate to their learning achievement. They thought that if they have only positive attitudes toward Statistics they could have good performance.

From those students who attended tutorial classes and get higher marks in Statistics, they claimed that they like Statistics because it is calculation and it was very useful in other subjects they had like Business Research, Marketing Research and in their further studies. The students did enjoy doing the exercises by themselves and in studying Statistics they put a lot of effort into the work that makes a difference in their performance in Statistics. The students knew that what they felt about Statistics related to their learning achievement. Because this group of students had positive attitudes toward Statistics, they could obtain what they would like to obtain, that was, having a higher marks.

Students' Strategic Practices used In Learning Statistics II.

Students who attended tutorial classes and got low marks in Statistics stated that when they were studying Statistics they did not have any study plan. They did not even review the lesson before and after class because they were lazy and they hated reading a book with lots of formulas. They preferred listening to teacher's lecture or to their tutor rather than reviewing or reading the book by themselves. But these students knew the importance of doing exercises. They knew that doing the exercises would help them to understand the lesson better and they preferred doing the exercises by themselves to have more concentration. If they could not understand or solve

anything, they would ask their friends or their teacher for explanations. The problem was, these students did not have continuous practice of the exercises because they did not want to and did only additional exercises at home if they were forced to do it. To prepare for the examination, they practiced doing the exercises, just only two to three days and if they could not do it, they would take this tutorial classes hoping they would be able to pass the course. If the result of the examination was not good, they did not want to try to change the way they studied, instead dropped the course. These students knew that the practices they implemented in studying Statistics relate to their learning achievement. They claimed that if they only practice the exercises regularly, read the lesson every now and then, they would be able to get more than what they deserve. In this case, students knew the importance of strategic practices but did not want to implement properly.

The group of students who attended tutorial classes and who got an average marks in Statistics never had any study plan. The students just prepared two or three days before the examination, read the books and practiced the exercises. Sometimes the students read the books before they came to class and reviewed after class. In doing the exercises, the students preferred to do the exercises alone in the sense they did not want their friends to interfere in their understanding and if they got a hard time of doing it, that was the only time that they would ask their friends to help them. The students knew that practicing the exercises continuously would help them to understand better and would help them to get better grade than what they were expecting to get. The students did also extra exercises but not regularly, only if they

have time to do it. Because the students did not prepare well for the examination, did not try to change the way they studied, they were afraid that they would not pass the subject, so, the only source they had, was to study at tutorial classes. But the students did believe that the practices they implemented in studying Statistics related to their learning achievement. Based on them if they had only practiced regularly, reviewed the lesson before and after the class, they would be able to get better mark which was higher than what they got. These students, like the students who got low marks in Statistics, knew the importance of strategic practices but they did not implement in the right way.

On the part of the students who attended tutorial classes and who got high marks in Statistics stated when they were studying Statistics, did not have any study plan either. Like students who got low marks and average marks in Statistics, these students also did not read the lesson before coming to class and did not even review the lesson after class. They were lazy but they claimed that in the class they listen very well and did whatever exercises the teacher gave in and out of the classroom. In doing the exercises, the students did enjoy doing it either by themselves or with their friends. With their friends, they could discuss how the problems should be solved. The students knew that doing the exercises regularly would help them to understand the lesson easily, so in this case, they did practice also additional exercises at home. For the mid-term examination, the students admitted that they did not prepare well so they were not satisfied with the result, so they change the way they studied for the final examination. They practiced more, read and review the lesson every now and

then and by doing these, the results of everything was good. They could get high marks. So, in this case, it can be proven that the strategic practices implemented by the students related to their learning achievement. The more the students will study the lesson, the more they will have good performance.

Tutorial Classes Attended

Students who got low marks in Statistics attended tutorial classes because they claimed that in the formal classroom they could not understand the lesson very well, either the teacher was talking too fast or too slow that made them bored inside the classroom. They also claimed that too many topics to be taken up in the formal classroom and hard for them to catch up since the lesson was in English. In the tutorial classes, the tutor taught in Thai and discussed only the summary of each topic discussed in the class. Even the exercises given in the formal classroom and by the tutor were discussed in Thai which they claimed was better than in English because they could understand more. Aside from this, these students like tutorial classes because the tutor have a file of old examination papers which gave them an idea how the exam would be look like and how they would be able to answer. These students also claimed that studying in tutorial classes, they felt more relax because the tutor was friendly and like an older brother or sister to them. Since they could not understand very well in the class because the medium of instruction is in English, they thought that it was necessary for them to take tutorial classes. But these students accepted that attending tutorial classes would not guarantee that they will pass the

course. They need also constant practice of doing the exercises, but they need someone to explain in Thai language.

Based on the students who got average marks in Statistics, they attended tutorial classes because they could not understand the lessons in the formal classroom. The students claimed that in the formal classroom a lot of detail to be discussed with a lot of formulas and they could not just applied those, so they need someone who could explain to them in brief. Aside from this, in the formal classroom, the medium of instruction was in English. Since, they could not understand the lessons easily in the formal classroom because of the English language, they need to take tutorial classes. In the tutorial classes, the lessons was given in Thai which these students believed that they would be able somehow to understand the concepts much more better. But they admitted that, the style of teaching in the formal classroom and in the tutorial classes were almost the same. The tutor also used the same book and the same exercises discussed in the class with the additional exercises given by the tutor. The only difference was that the medium of instruction in the tutorial classes was in Thai and the lesson was given in brief. The tutor summarized everything. Aside from this, in the tutorial classes, students claimed that they felt more relax and the tutor was friendly to all of them. They admitted also that it did not mean that once they took tutorial classes they would pass the course. It was also up to them whether they would practice the exercises regularly, read and review the lesson all the time. These students, like the students who got low marks, took tutorial classes because it was in Thai language.

On the part of the students who got high marks in Statistics, they attended tutorial classes because according to them sometimes they could not understand the lessons in the formal classroom. The tutor had a compilation of the old examinations, extra exercises and only taught the very important points. Also, most of the time they were lazy to read or to review the lesson, so, they need someone who could teach them in Thai language especially if they could not interpret in English language. Studying in the tutorial classes had no difference in the formal classroom. The tutor also used the same books, gave and assigned exercises. Only the medium of instruction was different since the tutor taught in Thai. The tutor also was more friendly and they felt more relax. For these students, because they were lazy and they were shy to asked their teacher in the formal classroom, they thought it was necessary for them to take tutorial classes. These students admitted that to pass Statistics course did not depend upon whether they were attending tutorial classes or not. If they would not read or review the lesson, practice doing the exercises regularly they would not be able to pass the course also. It can be concluded that attending tutorial classes would not guarantee the students to pass, only, the students need someone to explain in Thai language.

Students Perceptions on Teaching Statistics II

The students who attended tutorial classes and got low marks in Statistics stated that they did not like much the teaching style of the teacher in the sense that the teacher taught fast and asked to do exercises in and out of the classroom without giving or showing any solutions. Since the teacher taught fast, most of the time it was hard for the students to understand the teacher's explanation even though the teacher was

using some visual aids. But the students thought that the teacher was knowledgeable about the subject matter and qualified to teach the subject and always consumed the time allocation for the class. On the other hand, the students also claimed that the teacher was not helpful and friendly at all. The teacher was in a hurry all the time and did not want to talk to students at all. For them, to increase the students' learning achievement, the teacher must not talk too fast in explaining, must not be too serious and must be considerate of the students' idea. In solving exercises, the teacher and the students must solve together. In other words, there must be an interaction between the teachers and the students. The teacher must be friendly, helpful, not too serious and while teaching must learn how to give jokes and must have time with the students. In this case, the teacher would be able to catch students attention and their interests to learn Statistics.

To those students who attended tutorial classes and got average marks in Statistics they stated that their teachers in Statistics was stressing too much on the concepts and only a little bit on the exercises and explaining too fast which was hard to understand. But they claimed that the teacher was knowledgeable about the subject matter and always prepared for the class and could present the lesson beautifully through power-point and consumed the time allocated for the class. They thought also that the teacher was qualified to teach the subject, but must talk slowly and must teach based on the level of the students. The students wanted that their teacher be helpful, friendly, not too serious in the class, and considerate. The students did believed that if

the teacher would have this kind of qualifications it would help to increase their learning achievement.

On the part of those students who attended tutorial classes and got high marks in Statistics they claimed that they did not like at all the teacher's teaching style in the sense that the teacher was focusing too much on the concepts and gave too little time for the exercises. Aside from this they also claimed that the teacher's explanations were not clear enough in the sense the teacher was talking too fast and eating the words. These students did believe that although the teacher was knowledgeable about the subject matter, could present the lesson impressively through power-point, the teacher was not qualified to teach the subject. The teacher could not make the students to understand the lesson and not helpful and friendly either. These students thought that the best teaching method was that the teacher must teach with excitement, must talk slowly, with clear pronunciation and a loud voice, must make the classroom enjoyable and funny, give some interesting examples, must not be too serious, strict and must be helpful and friendly. The students claimed that if the teacher could have these kinds of qualifications, they would become interested in the subject and would help to boost up their learning achievement.

B. Students Who Did Not Attend Tutorial Classes

Students Attitudes Toward Statistics II

Based on the students who did not attend tutorial classes and who got low marks in Statistics II, they stated that they did not like Statistics because it is calculation which

was hard for them to understand and apply. They claimed that they need deep understanding of it which was difficult because the subject itself was too broad. They did not have ~~also~~ either a good foundation of it. But these students realized the importance of Statistics to other subjects they had like Business Research, Marketing Research and in their further study. The students sometimes enjoyed doing the exercises if were not difficult. The students also put a lot of effort into the work before the exam. They practiced very hard doing the exercises but even though, the amount of effort they put into the work did not make any difference because the results was not so good which they claimed they could not understand the problems very well. The students thought that, what they felt about Statistics relate to their learning achievement. If they had only a positive attitudes toward Statistics, they would concentrate more and would not only practiced doing the exercises nearly the exam day and the results would be better than what they had got.

The group of those who did not attend tutorial classes and got average marks in Statistics stated that they did not like Statistics because it was difficult to understand and the subject itself was too complex. Aside from this, also because of the teacher. The teacher did not seem to care on his teaching of coming to class late and dismissing the class early. The students claimed that Statistics is a subject that they could not just learn it by themselves but depend on the teacher. In spite of these difficulties, students found out the usefulness of Statistics, that it is useful in other subjects they had like Business Research, Marketing Research and in taking further study. In doing the exercises they did not enjoy because they were difficult and so

many formulas to remember and to use. They could not also find the correct answer either and what formula to be used in that particular problem. The students claimed that they put a lot of effort in studying Statistics, but the amount of effort they put into the work did not make any difference because during the examination, they could not do well. The students thought that what they felt about Statistics relate to their learning achievement. They claimed that if they have positive attitudes toward the subject, they would strive more and would have a greater opportunity to get a higher mark.

The students who got higher marks in Statistics and did not attend tutorial classes claimed that they like Statistics because they like calculations and for them Statistics is practical and could be used it in real life. The teacher had always additional exercises to help them understand the lesson more. To these students, they knew that Statistics is very useful in business and they could really apply and use the concepts of it. It could be a supporting material for the research proposals and very useful in evaluating the data. The students also claimed that doing the exercises, they enjoyed very much that helped them get a higher mark in the examination. Because they like calculations and they enjoyed doing them, they could say that they also put a lot of effort on it but without pushing themselves. The students could also tell that their attitude toward Statistics relate to their learning achievement. If the students only had a positive attitudes toward Statistics and concentrated on the domain of it, the students would be able somehow to get a better mark.

Students Strategic Practices used in Learning Statistics II

The students who did not attend tutorial classes and got low marks in Statistics claimed that when they were studying Statistics they did not have any study plan because they were lazy to do it and if they would have they would not be able to follow it also. The students never even bothered to read the lesson before the class or reviewed it after the class because they were also lazy and did not know what to read. They claimed that they only reviewed if it was near the exam day. Doing the exercises, the students preferred to do by themselves to have more concentration and if they could not solve, they asked their friends or their teacher. The students knew that doing the exercises would help them to understand the lesson better and be able to get good marks but in spite of this they seldom did and they did additional exercises at home if they were given an assignment. Preparing for the examination, the students prepared two weeks before the exam, reviewed the lesson and practiced doing the exercises which they claimed not enough for them especially for the mid-term, so the students changed the way they studied for the final exam. The students knew that the strategic practices they implemented relate to their learning achievement. They could say that if they only work hard, doing their job as a student they would be able somehow to get better marks.

The students who did not attend tutorial classes and got average marks claimed that they did not have really a study plan. If they will not understand the lesson, they will review at home and read more. These students never reviewed the lesson before coming to class because according to them, they did not know what to read, but after

class they always reviewed especially the lessons that they did not understand. In doing the exercises, the students preferred to do by themselves and in case of difficult problems which they could not solve, they always discussed with their friends. The students understand also that doing exercises in and out of the classroom would help them understand the lesson and get better marks. Preparing for the examination, the students prepared two weeks before the examination which they claimed is not enough for them to get higher than an average grade. When the result of mid-term examination was not good, these students tried their best to change the way they studied in order to pass. They reviewed and practiced more. From this, it could be proven that the students knew the importance of strategic practices to their learning achievement, but they did not like to implement in a right way. The students knew that if they would only work hard in studying Statistics, they would be able to get better marks.

The students who got higher marks in Statistics and did not attend tutorial classes, they knew that Statistics is a challenging subject and complicated, so they planned to read systematically even now and then and asked questions ~~from~~ to the teacher. After every class they would reviewed the lesson and practiced doing the exercises and they preferred to do to the exercises alone to have a full concentration of. Doing the exercises simultaneously, they knew that they would understand the lesson better and would be able to master the subject. From the very beginning of the class they started preparing for the examination by listening thoroughly the lessons and practiced the exercises given. These students knew that the strategic practices they implement

relate to their learning achievement, that is, if they would only practiced doing the exercises regularly, read and review the lesson all the time, their learning achievement would boost up.

Students' Perceptions on Teaching Statistics II

The students who did not attend tutorial classes and got low marks in Statistics stated that their teacher in Statistics could teach very well but only talked fast and used too high vocabulary. The students claimed that the teacher was knowledgeable about the subject, the explanation was understandable and they thought that the teacher was qualified to teach. In teaching, the teacher consumed the time allocation for the class. If the topic was short, the rest of the time was consumed for exercises done by the students. In explaining the lesson, the teacher was using the power-point with good illustrations that correspond to the topic. The students also claimed that the teacher was helpful but not friendly. If someone talked in the class, the teacher always got angry and blame the students. For these students, the best teaching method was that, the teacher must teach based on students' ability, must used simple English, must give exercises for practice in and out of the classroom, collect them and check, must be helpful and friendly. If the teacher possess this kind of qualifications the students would become at ease in the class they would become interested to study that would help them to have better learning achievement.

The students who did not attend tutorial classes and got an average marks in Statistics claimed that their teacher usually started teaching with the theory, explained

everything and afterwards gave a practice, showed solution on the board and gave an assignment, too. The students also claimed that the teacher talked fast so sometimes they could not understand the lesson but they thought that the teacher was knowledgeable about the subject matter and qualified to teach. Also, the teacher consumed the time allocation for the class, taught for 40 minutes and the other 20 minutes for the exercises for the students to practice in class. The teacher taught through the use of the power-point with understandable illustrations. The students also claimed that the teacher was helpful but not friendly. The teacher was helpful in the sense that if the students could not understand and asked questions, the teacher would repeat the explanation. The teacher was not friendly because of not talking to students in and out of the classroom. These students would like their teacher to talk slowly so that they could understand, gave more exercises to do in the class and at home, not too serious and made the students feel at ease in the class that is be friendly. With these qualifications of the teacher, the students would become interested in studying that would help them to have better learning achievement.

The students who got high marks in Statistics and who did not attend tutorial classes stated that their teacher would explain the general detail of the subject, give chance to students to ask questions especially if they could not understand, force the students to do the exercise checked them and if the students did not do, they would be punished. The teacher also gave guidelines to students on how to study. In teaching, the teacher consumed the time allocated for the class, that was, taught for 40 minutes and the rest of the periods for the exercise and taught through power point with good

illustrations to understand the topic or the exercises clearer. In this case the students claimed that the teacher was knowledgeable about the subject matter and qualified to teach. The teacher was only helpful and friendly. Helpful in the sense that once they asked questions, the teacher was willing to help them. The students said that the teacher was friendly because the teacher talked to them in and out of the classroom. In Statistics, it was hard to motivate students to participate, so the best teaching method is student-centered learning in order to be successful. Students must be eager enough to study by themselves. If students were good, eager to study, the student-centered learning would be effective. If the students would not moved, strict teaching must be implemented. Many students would like their teacher to teach according to their abilities, clear explanation, friendly and helpful. With these teacher's qualifications the students would be motivated and would help themselves to increase their learning achievement.

CHAPTER V

FINDINGS, CONCLUSION, DISCUSSIONS AND RECOMMENDATIONS

Students' learning achievement has always been the interest of human society throughout the history of civilization. Many educators believe that students' learning achievement is one of the most important topics in the field of education that should be given full attention. Educators believe that students' learning achievement always impeded by factors that contribute to the hindrance of students' success. Previous studies mentioned lots of factors that relate to students' learning achievement, but most of them were conducted in another field of study and in another subject. Thus, this study was focused on students who took Statistics II final examination in the second semester of 2001 under the Faculty of Business Administration at Assumption University.

This study used five independent variables: (1) students' computational background; (2) students' attitude toward Statistics II; (3) students' strategic practices used in learning Statistics II; (4) tutorial class attended and (5) students' perception on teaching Statistics II and one independent variable: students learning achievement in Statistics II.

This study was conducted with the following objectives:

1. To determine the relationship between students' learning achievement in Statistics II and the following factors:

- students' computational background (by using Mathematics for Business and Statistics I results).
- students' attitudes toward Statistics II.
- students' perceptions on teaching Statistics II.
- students' strategic practices used in learning Statistics II.

2. To determine the relationship between students' computational background from high school and tutorial classes attended.

3. To determine the relationships among students' attitudes toward Statistics II, students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II.

4. To find out whether there is a difference between students who attended tutorial classes and those who did not attend such a class on the following factors:
   - learning achievement.
   - attitudes toward Statistics II.
   - perceptions on teaching Statistics II.
   - strategic practices used in learning Statistics II.

5. To determine the important factors relating to students' learning achievement in Statistics II.

This study involved as survey of 429 students who took Statistics II final examination in the second semester of 2001. The sample was chosen from the sampling frame of 1,161 students by using SPSS Select Cases/Random Sample Command. The instrument used for this study was a questionnaire and an interview. Four hundred

and fifty (450) questionnaires were distributed to students but only four hundred and twenty nine were completely answered. The questionnaire was used to obtain information regarding students' background in high school, students' attitudes toward Statistics II, students' strategic practices used in learning Statistics II, tutorial classes attended and students' perceptions on teaching Statistics II. Students' computational background in Mathematics for Business and Statistics I, as well as their mid-term scores, final scores and total scores were obtained from the computer data files. In analyzing the data, the researcher explored both the population and the sample. To analyze students' computational background in Mathematics for Business and Statistics I, the researcher explored the whole population. The data collected were checked, coded and analyzed using SPSS for windows version 11. To describe the data set, the researcher used frequencies, mean, standard deviation and percentages. To analyze and interpret the data the researcher used correlation, independent sample t-test and chi-square. Eighteen students were interviewed and divided into two groups: (1) those who attended tutorial classes and (2) those who did not attend such a class. Each group consists of students who got low, average and high marks in Statistics II examination. Interviewed was done to obtain more information regarding students' attitudes toward Statistics II, students' strategic practices used in learning Statistics II, tutorial classes attended and students perceptions on teaching Statistics II.

Findings

This study composed of five research questions which were presented and answered accordingly.

1. Does the students' learning achievement in Statistics II have a relationship with the following factors:
    - students' computational background (by using Mathematics for Business and Statistics I results).
    - students' attitudes toward Statistics II.
    - students' perceptions on teaching Statistics II.
    - students' strategic practices used in learning Statistics II.

Students' Computational Background (by using Mathematics for Business and Statistics I results)

Analysis revealed that those students who could get high grades in Mathematics for Business could also get high scores from both Statistics II mid-term and final examinations and those who could get good grades in Statistics I could also get high scores from both Statistics II mid-term and final examinations. Therefore, it could be concluded that students' background in Mathematics for Business and Statistics I did have relationship with students' learning achievement in Statistics II. ✓

Students Attitudes Toward Statistics II.

From the results of analysis, it was found out that students' attitudes toward Statistics II had significant positive relationship with students' learning achievement. Likewise, from the results of the interview, it was found out that students' attitudes toward Statistics II was related to students' learning achievement.

Students' Perceptions on Teaching Statistics II.

Based on the results of the analysis and interview, it was found out that students' perceptions on teaching Statistics II did not have significant relationship with students' learning achievement.

Students' Strategic Practices used in Learning Statistics II.

From the results of analysis, students' strategic practices used in learning Statistics II did not have a significant relationship with students' learning achievement. But from the results of the interview it was revealed somehow that students' strategic practices used in learning Statistics II was related to the learning achievement of those students who got high marks.

Learning Achievement

Students' computational background (in Mathematics for Business and Statistics II) and students' attitudes toward Statistics II were found to have relationship with students' learning achievement.

Students' attitudes toward Statistics II were found to have positive significant relationship with students' learning achievement.

Students' strategic practices used in learning Statistics II were found out to be related to the learning achievement of those students who got high marks.

2. Is there a relationship between students' tutorial classes attended and their computational background from high school?

Analyses showed that there was a significant relationship between students' tutorial classes attended and their computational background from high school. 56.7% of students in Science and Mathematics program from high school attended tutorial classes, whereas more than 73% of students in other programs from high school attended tutorial classes including those students who came from Commercial Colleges.

3. Are there relationships among students' attitudes toward Statistics II, students' perceptions on teaching Statistics II and students' strategic practices used in learning Statistics II?

Analyses showed that there was a positive relationship between students' attitudes toward Statistics II and their perceptions on teaching Statistics II.

Analyses showed that there was a positive relationship between students' attitudes toward Statistics II and their strategic practices used in learning Statistics II.

Analyses showed that there was a positive relationship between students' perceptions on teaching Statistics II and their strategic practices used in learning Statistics II.

4. Is there any difference between students who attended tutorial classes and those who did not attend such a class on the following factors:
    - learning achievement.
    - attitudes toward Statistics II.
    - perceptions on teaching Statistics II.
    - strategic practices used in learning Statistics II

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Learning Achievement

Analyses showed that there was a difference on learning achievement in Statistics II between students who attended tutorial classes and those who did not attend such a class. However, the big difference was found out from students who had got Statistics I grade ranging from C- to C+.

Attitudes Toward Statistics II

Analyses showed that there was a difference on students' attitudes toward Statistics II between groups of students who attended tutorial classes and students who did not attend such a class. Those who did not attend tutorial classes had more positive attitudes toward Statistics II and higher learning achievement.

Perceptions on Teaching Statistics II

Analyses showed that there was a difference on students' perceptions on teaching Statistics II between group of students who attended tutorial classes and those who did not attend such a class. Students who did not attend tutorial classes had better perceptions on teaching Statistics II. Students who attended tutorial classes did not like the teacher teaching style that much.

Strategic Practices used in Learning Statistics II.

Analyses showed there was a difference on students' strategic practices used in learning Statistics II between groups of students who attended tutorial classes and those who did not attend such a class. Students who did not attend tutorial classes could implement strategic practices properly and systematically especially those who got high marks.

5. What are the factors relating to students' learning achievement in Statistics II? Based on students' opinion, the first factor related to their learning achievement was strategic practices used in learning Statistics II, the second one is computational background in Mathematics for Business and Statistics I, the third one was tutorial classes attended and the last one was attitudes toward Statistics II.

Based on the result of analysis, the factors related to students' learning achievement were students' computational background in Mathematics for Business, students'

attitudes toward Statistics II, students' strategic practices used in learning Statistics II and tutorial classes attended.

Conclusion

This study used five variables to determine the factors relating students' learning achievement in Statistics, which were:

1. Students' computational background (background in Mathematics for Business and Statistics I at Assumption University).
2. Students' attitudes toward Statistics II.
3. Students' strategic practices used in learning Statistics II.
4. Students' perceptions on teaching Statistics II.
5. Students' tutorial classes attended.

However, after the finding had been summarized, it was found out that four out of five factors were related to students' learning achievement in Statistics II. The four factors were:

1. Students' computational background (background in Mathematics for Business and Statistics I at Assumption University).
2. Students' attitudes toward Statistics II.
3. Students' strategic practices used in learning Statistics II.
4. Students' tutorial classes attended.

Discussions

Students' Computational Background and Students' Learning Achievement.

Students' computational background in Mathematics for Business and Statistics I were found to have relationship with students' learning achievement. From the investigation of the students' results in Mathematics for Business and in Statistics I, it was found out that those who got high grades in Mathematics for Business could get high scores in both Statistics II mid-term and final examinations. Students who had got high grades in Statistics I could as well, got high scores in both Statistics II mid-term and final examinations. It was proven that students' background in Mathematics for Business and Statistics I reflect students performance in Statistics II. Students who had good background could easily understand the concepts effectively and efficiently and could engage in both mathematical and statistical reasoning and problem solving. The investigation was supported by Schau and Mattern (1977, cited in Gardner and Hudson, 1999) who observed a post secondary students taking applied Statistics courses. In his study, it was found out that some students were weak once it comes to statistical reasoning and problem solving due to the lack of computational background. It was hard for the students to study in advance level of Statistics, so it was proven that if the students had good foundation of Statistics, it would be easy for them to apply any Statistical concepts which they need in more advance level. From Bruner's model of learning (Wang et al, 1990), it was found out that one factor related to students' learning achievement was students' background. Students' knowledge and skills depend upon on their

background. Students who had good background would always try to perform better to obtain good performance.

Students' Attitudes Toward Statistics II and Students' Learning Achievement

Students' attitudes toward Statistics II was found to have significant positive relationship with students' learning achievement. Although students hate calculation except from those who had got high marks, they realized that having a positive attitudes toward the subject matter would give them a better reflection on their performance. In the class, the more exercises the students had, the more the students were willing to practice and the more the teachers helped them to do the exercises, the more they would become interested. Because the students were willing to pass the subject, they tried their best to put an effort on it and if the results was not so good, the more they tried their best. From this, it could be proven that once students' attitudes toward the subject matter changed, their learning achievement would also changed. Possible, students would be able to get good grades more than what they were expected to get. Aside from this, the students also realized the usefulness of Statistics II to other subjects they had like Business Research, Marketing Research and for their further study, that, without knowing anything about Statistics they would not be able to go on. Milne (1992, cited in Marshall, 2000) conducted a study on students' attitudes toward Mathematics. Although this study was done in Statistics, it could be said that Statistics and Mathematics were related anyway. Based on the research of Milne, once students perceived the usefulness of Mathematics their performance was better and students became interested throughout the course. This

findings of Milne supported the findings of this study. Students must have positive attitudes toward Statistics to be well-prepared for taking higher Statistics courses. This was very important for college students especially those majoring in business who were required to take Statistics courses in order to be able to handle, use or interpret statistical results wisely in their content area (Gal & Ginsburg, 1994). Students must have a positive view of Statistics and appreciation for the potential uses of it and its role to their future career.

Students' Perceptions on Teaching Statistics II and Students' Learning Achievement.

The study revealed no significant relationship between students' perceptions on teaching Statistics II and students' learning achievement. This was inconsistent with Hagedorn et al.'s (1999) finding which they reported a positive strong significant correlation of students' perceptions on teaching and students' learning achievement. Maybe, because, from the study, it was found out that the students could not easily understand the way the teacher explained the lesson because he was talking too fast and stressing too much on the concepts and gave little time for the exercises, so the students put less importance of knowledge. There was no also interaction between teacher and students and students to students. Most of the time only the teacher talked. Students wanted their teacher to include them in the discussion and wanted also their teacher to be friendly and helpful. The students claimed that if their teacher would only talk slowly, helpful and friendly and if could make the class enjoyable, at

least they would become interested and it would help to boost up their learning achievement.

Students' Strategic Practices used in Learning Statistics II and Students' Learning Achievement

Result showed that there was a significant relationship between students' strategic practices used in learning Statistics II and students' learning achievement only on the part of those who got high marks in Statistics II. Perhaps, those who got low marks and average marks did not implement strategic practices properly. These students did not even bother to make a preview, that is, they did not bother to scan the material to get an idea of the major topics and subtopics discussed in the class. They did not practice the exercises regularly and did practicing only a week or less than a week before the examination. Students knew that what they were doing was wrong but still adopted this kind of habit that reflect their attitude toward study. If these students only change their attitude toward study, that is, if they only implement strategic practices properly, they would be able somehow to get better marks that would contribute to higher learning achievement. On the part of students who got high marks, they had the correct way of implementing strategic practices. For them, Statistics is a challenging subject and a complicated one, so, from the very start, they planned to read systematically, reviewed the lesson every after class, practiced the exercises regularly and tried their best to concentrate on the class to have better understanding of the lesson. These kind of attitudes toward study would contributed a lot to students' learning achievement, that is, having a good results from the subject. This finding was consistent with Holres et al.'s (1999) finding which they reported

that student's strategic practices used in term of attitude to study, ability to concentrate, motivation's and time management were significantly positively correlated with students' academic achievement. Strategic practices referred to activities carried out by the learner during the learning process for the purpose of improving learning (Mayer, 1995: 434). For students, learning from teachers and books became a dominant activity in their lives. They were expected to become professional learners, but they were rarely given any training on how to learn (Mayer, 1995). For students to implement strategic practices effectively they must be taught how to become strategic learners, that is, learners who are willing and be able to take significant responsibility for their own learning.

Students' Attitudes Toward Statistics II and Students' Perceptions on Teaching Statistics II

Based on the study, there was a positive relationship between students' attitudes toward Statistics II and students' perceptions on teaching Statistics II. Based on the findings once the teacher was knowledgeable on the subject, could teach based on the students' level and abilities, could make the class lively, not too serious in teaching, helpful and friendly, these qualities of the teacher would relate to students' attitudes toward the subject. Students knew the importance of Statistics in their career. With good qualities of the teacher, the more the students would become interested to learn the subject and the more positive attitudes would be developed.

Students' Attitudes Toward Statistics II and Students' Strategic Practices used in Learning Statistics II

From the study, it was found out that students' attitudes toward Statistics II is related to students' strategic practices used in learning Statistics II. When students' have positive attitudes toward the subject, it would reflect their strategic practices used in learning Statistics II. The students would be able to implement those strategic practices like putting importance to time management, followed the correct way of learning steps and preparation for the examination. Having a positive attitude toward the subject and correct implementation of strategic practices would help the students to increase their learning achievement.

Difference in Learning Achievement between Students Who Attended Tutorial Classes and Students Who Did Not Attend Such a Class

It was found out from the study that there was a difference in learning achievement in Statistics II students who attended tutorial classes and those who did not attend such a class. Between these two groups, the big difference was found out from the students whose got average and low marks.

The students who attended tutorial classes and got low and average marks claimed that attending tutorial classes helped them a lot to pass the course. These groups of students had problems in understanding and computational skills. In the formal class, they could not understand the lesson easily because there were many topics to be

taken up and had only little time to do the exercises. Another reason was that, the medium of instruction was in English. The students could not just interpret, so, they need someone who could explain to them in Thai language. In tutorial classes, the tutor only discussed the summary of each topic and had compilations of exercises. Students claimed that they had more time to do the exercises and could asked the tutor more freely because they could speak in Thai language.

The students who did not attend tutorial classes and got low and average marks claimed that attending formal class was better than attending tutorial classes because the teacher had more experience and they did believe that attending tutorial classes would not improve their computational skills. Actually, these groups of students could understand the lesson in the formal class better than those students who attended the tutorial classes, but only if they were in their own, they could not just applied what they had learned in the class because of the English language. But, these students did not bother to ask anybody for help. They could tell that, if they only strive hard, they would be able to get higher marks more than what they deserve.

From the findings, it was found out that the difference in learning achievement between the students who attended tutorial classes and those who did not attend such a class occurred in the sense that the students who attended tutorial classes had someone who could explain the lesson and the exercises in Thai language.

The students who got high marks, whether they attended tutorial classes or did not attend such a class, had only a slight difference in their learning achievement. Both groups of students had no problem in computational skills and listening in the formal class. Only, the students who did not attend tutorial classes had more positive attitude toward study. The students who attended tutorial classes were lazy, so they need someone who could explain to them in more detail.

Difference in Attitudes Toward Statistics II between Students Who Attended Tutorial Classes and Students Who Did Not Attend Such a Class

Based on the study, there was no difference in students' attitudes toward Statistics II between students who attended tutorial classes and those who did not attend such a class. Both groups of students have positive attitudes toward Statistics II. The students who got low and average marks claimed that Statistics was difficult to understand because it is calculation and the subject itself was too broad and too complex. But in spite of these difficulties, students tried their best to put an effort into the work because the students realized that knowing Statistics would help them to understand the subject of their major like Business Research, Marketing Research and in their further study.

The students who got high marks, from the very beginning they knew that they need to understand Statistics deeply because it was very important in their future both in studying and working. These groups of students already had positive attitudes

toward Statistics. The students found out that having positive attitudes toward the subject matter would give them the best results and everything would flow smoothly.

From the findings, some students attended tutorial classes not because they did not have positive attitudes toward Statistics II but because for them Statistics was difficult to understand and the medium of instruction was in English, so they need someone who could explain to them in Thai language. So, attending tutorial classes did not change students belief that to have statistical knowledge was very important in their future career.

Difference in Perceptions on Teaching Statistics II between Students Who Attended Tutorial Classes and Students Who Did Not Attend Such a Class

From the study, it was found out that there was a difference in perceptions on teaching Statistics II between students who attended tutorial classes and those who did not attend such a class. The students who did not attend tutorial classes had better perceptions on teaching Statistics II.

The students who attended tutorial classes and got low, average and high marks claimed that they did not like their teacher teaching style in the sense that the teacher taught too fast, stressing too much on the concepts, gave only little time for the exercises without showing any solutions and taught not according to the level of the students. In teaching, there was no interaction between teacher and students and students to students and the teacher was not helpful and friendly. Although these

students claimed that the teacher was knowledgeable about the subject matter, it was difficult for them especially on the part of those who got low and average marks to understand the lesson if the teacher taught fast because the medium of instruction was in English. These students thought that there was no way out except to attend the tutorial classes. But they did believe that, if the teacher could only teach slowly with clear pronunciation, could make the class lively and enjoyable, taught based on the level of the students, could give some interesting examples, must be helpful and friendly, the teacher would be able to make the students to participate in the class and could gained easily students' attention and interest. In this case, the teacher would be able to help to increase students' learning achievement.

On the part of those students who did not attend tutorial classes, they had better perceptions of teaching Statistics II because they did believe that studying with the teacher was very much better than with the tutor. The teacher could give them better knowledge about the nature of Statistics. These students claimed that, in Statistics classes, it was hard to motivate students to participate, so, teachers must tried best to teach based on the abilities of the students, must have clear explanation and must be friendly and helpful. With the teacher's qualifications, the students would be motivated and would help themselves to increase their learning achievement.

Difference in Strategic Practices used in Learning Statistics II between Students Who Attended Tutorial Classes and Students Who Did Not Attend Such a Class

The study showed that there was a difference in strategic practices used in learning Statistics II between groups of students who attended tutorial classes and those who did not attend such a class.

Students who did not attend tutorial classes and who got low and average marks did not implement strategic practices properly since the beginning of the course because they were lazy to do it. They did not bother to read the lesson before and after the class and prepared only to three days up to one week for the examination. When they realized that the result was not good they changed the way they studied. These groups of students became more active and gave more importance to time management, learning steps and preparation for the examination. With these changes, the students could past the course but they claimed that if they implement strategic practices properly since the beginning of the course they would be able to get more than what they deserve.

On the part of those students who did not attend tutorial classes and got high marks they knew Statistics is a challenging and complicated, so, from the very start of the course, they implemented strategic practices properly and systematically that ended up in a high learning achievement.

The students who attended tutorial classes and got low, average and high marks did not implement strategic practices because they believed that they would not be able to implement them properly and systematically. Those who got low and average marks claimed that they were not good in calculation. Even though they would implement strategic practices, it would be useless because they could not also follow. Because of these difficulties, they felt that attending tutorial classes would better and would help them to pass the course easily. Those who got high marks, it was not really a problem for them to study in the formal class because they could understand the lesson and they were good in calculation, but because they could not also implement strategic practices properly, so they seek help also from the tutorial classes.

Students' Perceptions on Teaching Statistics II and Students' Strategic Practices used in Learning Statistics II

It was found out from the study that students' perceptions on teaching Statistics II is related to students' strategic practices used in learning Statistics II. When students had good perceptions on teaching, even if they claimed that the subject was complicated and required lot of attention, they would become interested and motivated to study. Once, it happened, naturally, it would relate to students' strategic practices used in learning. The students would be able to implement strategic practices systematically that would help students to increase their learning achievement and achieve their goals.

Students' Computational Background from High School and Students' Tutorial Classes Attended

Based on the study, it was found out that there was a significant relationship between students' computational background from high school and students' tutorial classes attended. The students in the Faculty of Business Administration were not all came from Science program in high school. Those students who did not come from science program, almost 73% of them attended tutorial classes. These students could not adjust themselves in the formal class because of lack of computational background. They were always left behind from those who had background. To cope up with these problems, they seek help from tutorial classes hoping that they would be able to understand better, could pass the course and would help to increase their learning achievement. It was proven once more that students' computational background played an important role in students' learning achievement. If only the students had good background, they would be able to understand statistical concepts and could easily engage in statistical reasoning. Therefore, the students would not seek help from outside sources.

Recommendations

This study highlighted the factors related to students' learning achievement in Statistics II under the Faculty of Business Administration at Assumption University. The factors that found out related to students' learning achievement in Statistics II were: students' computational background in Mathematics for Business and Statistics

I, students' attitudes towards Statistics II, students' strategic practices used in learning Statistics II and tutorial class attended.

According to the findings, two experimental researches are recommended to be conducted:

1. Comparative study on students' strategic practices used for studying Statistics
2. Comparative study on teaching techniques in Statistics.

The results from the comparative studies would be used in designing the following training programs:

1. Students' training program on strategic practices.
2. Instructors' training program on teaching techniques.

The outcome from the researches and training programs will certainly benefit not only students and instructors but also administrators in making and developing plan and policy, both short term and long term.

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Appendix

Appendix A

1 What are the important factors for your learning achievement in Statistics II?

- ○ Computational background
- ○ Attitudes toward the subject
- ○ Time plan
- ○ Learning steps (Preview, Study in class, Review)
- ○ Preparation for examinations
- ○ Tutorial classes

2 What program of study did you attend in high school?

- ☐ Arts-Language ☐ Arts-Mathematics
- ☐ Science-Mathematics ☐ Commercial College
- ☐ Others, please specify _____

3 How long did you normally concentrate during the lecture? (STAT II 2/2001)

- ☐ A few minutes ☐ Only at the beginning of the period
- ☐ Only up to the middle of the period ☐ Only one hour
- ☐ The whole period

4 What did you do to catch up the missing lesson / unclear lesson? (STAT II 2/2001)

- ☐ Nothing ☐ Asked friends ☐ Made photo copies
- ☐ Made up class ☐ Asked instructor

5 How many classes did you miss in Statistics II? (2/2001)

- ☐ Never missed any classes at all ☐ One or two classes
- ☐ Three or four classes ☐ Five or six classes
- ☐ More than six classes

6 How did you normally prepare for examinations? ***(you may answer more than one)***

- ☐ Reviewed by yourself ☐ Discussed with friends ☐ Consulted instructor
- ☐ Attended tutorial classes ☐ Never prepared

7 What is the **most** effective preparation way for Statistics II examinations?
(Choose only one answer)

- ☐ Reviewed by myself ☐ Discussed with friends ☐ Consulted instructor
- ☐ Attended tutorial classes ☐ None

8 Choose the level of importance for each item of strategic practices by putting (✔) in the table given below:

Students' strategic practices in learning Statistics II	Level of importance		
	Low	Moderate	High
Time plan			
Learning steps			
Preparation for examinations			

9 Choose the most important source of information for selection of tutorial classes for Statistics II

☐ Friend ☐ Instructor ☐ Advertisement

10 Did you ever attend the tutorial classes for Statistics II? (2/2001)

☐ Yes *(Go to questions 11 – 12)* ☐ No *(Go to question 13)*

11 What was your main reason for attending the tutorial classes? ***(You may answer in Thai)***

_____

12 What type of STAT II tutorial classes did you attend? (2/2001)

☐ One day before examination ☐ One week before examination
☐ First half of the semester ☐ Second half of the semester
☐ The whole semester

13 What was your main reason for ***not*** attending the tutorial class? ***(You may answer in Thai)***

_____

Please answer numbers 1 – 19 by putting (✔) in the box corresponding to Strongly Agree, Agree, Undecided, Disagree or Strongly Disagree.

No.	***Students' attitudes toward Statistics II***	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	Statistics II was an interesting subject					
2	Statistics II was a boring subject					
3	The knowledge I had learned in Statistics II would help me in other classes of my major					
4	I am interested and willing to acquire further knowledge of Statistics.					

No.	***Students' perceptions on teaching Statistics II***	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
5	My instructor in Statistics II seems knowledgeable in the area					
6	My instructor in Statistics II was always well prepared for the lessons					
7	My instructor could give good examples of concepts					
8	My instructor in Statistics II taught very fast					
9	My instructor in Statistics II made the lesson interesting					
10	My instructor in Statistics II was helpful when students got confuse.					
11	My instructor in Statistics II was friendly					

No.	***Students' strategic practices used in learning Statistics II***	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
12	I normally listened to my instructor's explanations					
13	I asked my instructor when I did not understand my lesson					
14	I came to class only for my attendance					
15	I normally reviewed my lesson in Statistics II					
16	I normally did exercises by myself					
17	I normally set and follow my time management for studying Statistics II					
18	I normally preview Statistics II before going to class					
19	I normally review Statistics II after my class					

Appendix B

Population

	TOTAL		PASS OR FAIL IN STATISTICS II			
			PASS		FAIL	
	Count	%	Count	%	Count	%
Gender						
Female	616	53.1	452	57.1	164	44.4
Male	545	46.9	340	42.9	205	55.6
Nationality						
Thai	1073	92.4	754	95.2	319	86.4
Chinese	50	4.3	17	2.1	33	8.9
Taiwanese	8	.7	5	.6	3	.8
Myanmar	7	.6	5	.6	2	.5
Korean	5	.4	4	.5	1	.3
Uzbekistan	3	.3			3	.8
Vietnamese	3	.3	2	.3	1	.3
Bangladeshi	2	.2	1	.1	1	.3
Japanese	2	.2	1	.1	1	.3
Bhutanese	2	.2	1	.1	1	.3
Cambodia	1	.1			1	.3
Filipino	1	.1	1	.1		
Hong Kongian	1	.1	1	.1		
Indonesian	1	.1			1	.3
Malaysian	1	.1			1	.3
Russian	1	.1			1	.3
Major						
No Major	729	62.8	480	60.6	249	67.5
Marketing	106	9.1	76	9.6	30	8.1
International Business Mgt.	76	6.5	62	7.8	14	3.8
Business Computer	60	5.2	39	4.9	21	5.7
Advertising Management	48	4.1	27	3.4	21	5.7
Accounting	42	3.6	35	4.4	7	1.9
General Management	37	3.2	33	4.2	4	1.1
Hotel Management	28	2.4	16	2.0	12	3.3
ABAC-Wollongong	18	1.6	12	1.5	6	1.6
Finance and Banking	10	.9	6	.8	4	1.1
Property Valuation	7	.6	6	.8	1	.3
Number of times studied STAT II						
1	859	74.0	610	77.0	249	67.5
2	213	18.3	145	18.3	68	18.4
3	53	4.6	24	3.0	29	7.9
4	20	1.7	10	1.3	10	2.7
5	7	.6	1	.1	6	1.6
6	6	.5	1	.1	5	1.4
8	2	.2	1	.1	1	.3
9	1	.1			1	.3
Code numbers of students (The first three digits)						
362	1	.1%	1	.1%		
371	1	.1%			1	.3%
372	2	.2%	1	.1%	1	.3%
381	9	.8%	2	.3%	7	1.9%
382	12	1.0%	6	.8%	6	1.6%
391	9	.8%	5	.6%	4	1.1%
392	13	1.1%	3	.4%	10	2.7%
401	25	2.2%	11	1.4%	14	3.8%
402	25	2.2%	13	1.6%	12	3.3%
411	55	4.7%	33	4.2%	22	6.0%
412	47	4.0%	33	4.2%	14	3.8%
421	141	12.1%	108	13.6%	33	8.9%
422	72	6.2%	40	5.1%	32	8.7%
431	296	25.5%	205	25.9%	91	24.7%
432	89	7.7%	54	6.8%	35	9.5%
441	361	31.1%	275	34.7%	86	23.3%
442	3	.3%	2	.3%	1	.3%
TOTAL	1161	100.0	792	100.0	369	100.0

Appendix C

Sample

	TOTAL		PASS OR FAIL IN STATISTICS II			
			PASS		FAIL	
	Count	%	Count	%	Count	%
Program attended in high school						
Arts-Mathematics	155	36.1	97	35.9	58	36.5
Science-Mathematics	141	32.9	88	32.6	53	33.3
Commercial College	82	19.1	54	20.0	28	17.6
Arts-Language	26	6.1	18	6.7	8	5.0
Others	25	5.8	13	4.8	*12*	7.5
Gender						
Male	196	45.7%	107	39.6%	89	56.0%
Female	233	54.3%	163	60.4%	70	44.0%
Nationality						
Thai	401	93.5%	258	95.6%	143	89.9%
Chinese	15	3.5%	4	1.5%	11	6.9%
Taiwanese	4	.9%	2	.7%	2	1.3%
Myanmar	4	.9%	3	1.1%	1	.6%
Korean	2	.5%	1	.4%	1	.6%
Filipino	1	.2%	1	.4%		
Russian	1	.2%			1	.6%
Vietnamese	1	.2%	1	.4%		
High School						
1	123	28.7%	85	31.5%	38	23.9%
2	81	18.9%	55	20.4%	26	16.4%
3	24	5.6%	12	4.4%	12	7.5%
4	12	2.8%	2	.7%	10	6.3%
5	67	15.6%	44	16.3%	23	14.5%
6	15	3.5%	11	4.1%	4	2.5%
7	65	15.2%	40	14.8%	25	15.7%
8	42	9.8%	21	7.8%	21	13.2%
Major						
No Major	279	65.0%	174	64.4%	105	66.0%
Marketing	38	8.9%	25	9.3%	13	8.2%
International Business Mgt.	28	6.5%	20	7.4%	8	5.0%
Advertising Management	22	5.1%	11	4.1%	11	6.9%
Business Computer	21	4.9%	9	3.3%	12	7.5%
Accounting	15	3.5%	13	4.8%	2	1.3%
Hotel Management	12	2.8%	8	3.0%	4	2.5%
General Management	8	1.9%	6	2.2%	2	1.3%
ABAC-Wollongong	3	.7%	1	.4%	2	1.3%
Finance and Banking	2	.5%	2	.7%		
Property Valuation	1	.2%	1	.4%		
Number of times studied STAT II						
1	321	74.8%	205	75.9%	116	73.0%
2	83	19.3%	55	20.4%	28	17.6%
3	16	3.7%	8	3.0%	8	5.0%
4	4	.9%	2	.7%	2	1.3%
5	2	.5%			2	1.3%
6	2	.5%			2	1.3%
9	1	.2%			1	.6%
Code numbers of students (The first three digits)						
372	1	.2%			1	.6%
381	2	.5%	1	.4%	1	.6%
382	2	.5%	1	.4%	1	.6%
391	1	.2%			1	.6%
392	5	1.2%	1	.4%	4	2.5%
401	7	1.6%	1	.4%	6	3.8%
402	11	2.6%	6	2.2%	5	3.1%
411	22	5.1%	11	4.1%	11	6.9%
412	14	3.3%	12	4.4%	2	1.3%
421	58	13.5%	43	15.9%	15	9.4%
422	20	4.7%	7	2.6%	13	8.2%
431	115	26.8%	72	26.7%	43	27.0%
432	42	9.8%	29	10.7%	13	8.2%
441	129	30.1%	86	31.9%	43	27.0%
TOTAL	429	100.0	270	100.0	159	100.0

Appendix D

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	B1	3.2261	1.0580	429.0
2.	B2	2.7040	1.0715	429.0
3.	B3	3.4219	.9890	429.0
4.	B4	2.9091	1.0087	429.0

Correlation Matrix

	B1	B2	B3	B4
B1	1.0000			
B2	.5002	1.0000		
B3	.3306	.1688	1.0000	
B4	.4966	.3404	.4226	1.0000

N of Cases = 429.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	12.2611	9.0859	3.0143	4

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.0653	2.7040	3.4219	.7179	1.2655	.1027

Inter-item Correlations	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.3766	.1688	.5002	.3314	2.9627	.0143

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
B1	9.0350	5.0806	.6051	.3858	.5719
B2	9.5571	5.7099	.4350	.2625	.6817
B3	8.8392	6.2147	.3839	.1991	.7072
B4	9.3520	5.4296	.5614	.3326	.6034

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

Reliability Coefficients 4 items

Alpha = .7077 Standardized item alpha = .7073

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	B5	3.8298	.8352	429.0
2.	B6	3.9114	.8269	429.0
3.	B7	3.4312	.9754	429.0
4.	B8	2.8928	1.0602	429.0
5.	B9	2.4615	.9819	429.0
6.	B10	3.2145	1.0257	429.0
7.	B11	3.1375	1.2199	429.0

Correlation Matrix

	B5	B6	B7	B8	B9
B5	1.0000				
B6	.5160	1.0000			
B7	.4086	.5544	1.0000		
B8	-.0708	-.0135	.0132	1.0000	
B9	.2983	.3958	.6090	-.0017	1.0000
B10	.2200	.3255	.4421	.1501	.4908
B11	.2065	.1488	.2839	.2589	.4151

	B10	B11
B10	1.0000	
B11	.5665	1.0000

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

N of Cases = 429.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	22.8788	19.0133	4.3604	7

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.2684	2.4615	3.9114	1.4499	1.5890	.2612

Inter-item Correlations	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.2961	-.0708	.6090	.6797	-8.6027	.0410

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
B5	19.0490	15.7756	.3828	.3094	.7236
B6	18.9674	15.2513	.4766	.4250	.7061
B7	19.4476	13.7478	.5964	.5084	.6755
B8	19.9860	17.0185	.0996	.0959	.7884
B9	20.4172	13.7718	.5870	.4632	.6775
B10	19.6643	13.4151	.6051	.4378	.6714
B11	19.7413	13.0474	.5081	.4019	.6966

Reliability Coefficients 7 items

Alpha = .7395 Standardized item alpha = .7465

****** Method 2 (covariance matrix) will be used for this analysis ******

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

		Mean	Std Dev	Cases
1.	B12	3.5845	.9248	426.0
2.	B13	2.6432	1.0887	426.0
3.	B14	3.3169	1.2854	426.0
4.	B15	3.1455	1.0186	426.0
5.	B16	3.8005	.9653	426.0
6.	B17	2.9484	.8770	426.0
7.	B18	2.0446	.8867	426.0
8.	B19	2.7371	.9948	426.0

Correlation Matrix

	B12	B13	B14	B15	B16
B12	1.0000				
B13	.3899	1.0000			
B14	.5505	.3836	1.0000		
B15	.1543	.2718	.1372	1.0000	
B16	.1046	.1851	.0454	.4316	1.0000
B17	.1389	.2641	.1648	.3772	.2852
B18	.2493	.2968	.2105	.3757	.2826
B19	.1623	.2521	.1831	.4628	.3373

	B17	B18	B19
B17	1.0000		
B18	.4992	1.0000	
B19	.4699	.4508	1.0000

R E L I A B I L I T Y A N A L Y S I S - S C A L E (A L P H A)

N of Cases = 426.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	24.2207	24.3371	4.9333	8

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.0276	2.0446	3.8005	1.7559	1.8588	.3157

Inter-item Correlations	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.2899	.0454	.5505	.5051	12.1274	.0174

Item-total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Alpha if Item Deleted
B12	20.6362	19.9779	.4239	.3517	.7373
B13	21.5775	18.6775	.4755	.2592	.7281
B14	20.9038	18.5107	.3774	.3453	.7535
B15	21.0751	18.9073	.4958	.3381	.7243
B16	20.4202	20.2536	.3627	.2261	.7476
B17	21.2723	19.7139	.4949	.3466	.7265
B18	22.1761	19.3548	.5378	.3537	.7194
B19	21.4836	18.8338	.5228	.3619	.7196

Reliability Coefficients 8 items

Alpha = .7575 Standardized item alpha = .7656

Appendix E

Chi Square

	Result		Tutor	
	χ^2	p-value	χ^2	p-value
What program of study did you attend in high school?	2.05	.727	18.57	**.001**
How long did you normally concentrate during the lecture?	.48	.975	28.09	**.000**
What did you do to catch up the missing lesson / unclear lesson?	3.21	.524	12.88	**.012**
How many classes did you miss in Statistics II?	10.52	**.033**	41.10	**.000**
What is the most effective preparation way for Statistics II examinations?	7.42	.115	50.69	**.000**

Appendix F

Correlation Analysis

Overview

Correlation analysis measures the relationship between two items. The resulting value (called the "correlation coefficient") shows if changes in one item will result in changes in the other item.

Interpretation

When comparing the correlation between two items, one item is called the "dependent" item and the other the "independent" item. The goal is to see if a change in the independent item (which is usually an indicator) will result in a change in the dependent item. This information helps to understand an indicator's predictive ability.

The correlation coefficient can range between 1.0 (plus or minus one). A coefficient of +1.0, a "perfect positive correlation", means that changes in the independent item will result in an identical change in the dependent item. A coefficient of –1.0, a "perfect negative correlation", means that change in the independent item will result in an identical change in the dependent item, but the change will be in the opposite direction. A coefficient of zero means there is no relationship between the two items and that a change in the independent item will have no effect in the dependent item.

A low correlation coefficient (e.g. less than 0.10) suggests that the relationship between two items is weak or non-existent. A high correlation (i.e., close to plus or minus one) indicates that the dependent item will usually change when the independent item changes.

The direction of the dependent item changes depend on the sign of the coefficient. If the coefficient is a positive number, then the dependent item will move in the same direction as the independent item; if the coefficient is negative, then the dependent item will move in the opposite direction of the independent item.

Assumption

- Data originated from a random sample.
- Data are interval/ratio.
- Both items (variables) are distributed normally.
- Linear relationship.

Significance

Null hypothesis (Ho): There is no association between two variables in the population.

$\rho = 0$ where ρ is the correlation for the population.

Alternative hypothesis (Ha): There is an association between two variables in the population.

$\rho \neq 0$

Degree of freedom = n-2

Use the critical value from the t-distribution.

Test statistic

Convert r into

$$t = r\sqrt{\frac{n-2}{1-\rho^2}}$$

Decision of null hypothesis

- Reject if t-observed is equal to or greater than the critical values or the p-value of the test is less than the level of significance.

- If the p-value is less than 0.5, the correlation is significant and both variables have significant relationship, whereas, if the p-value is more than 0.5, the correlation is not significant and the two variables have no relationship.

Appendix G

Chi-square test of Independence

Research data analysis

When the data are in nominal levels and the researcher wants to determine whether groups are different, the researcher uses the chi-square statistical test. In other words, chi-square tests for significant differences between observed frequencies in data and the frequencies that were expected in an effort to determine whether the groups are independent or related.

Assumption

- Data are at nominal level.
- Data are categorized into cells and there must be data in each cell.

The use of chi-square

Chi-square analysis can be used to calculate the differences among the subjects in a research study to determine if extraneous variables influenced the outcome.

If the calculated chi-square value is high enough, the researcher can conclude that the frequencies found would not be expected on the basis of chance alone and the null hypothesis would be rejected.

Appendix H

Independent Sample t-test

Over the years, many statistical test procedures have been developed that enable us to make comparisons and examine differences between two groups based on independent samples containing numerical data. Thus, an important issue faced by anyone involved in hypothesis testing is the criteria to be used for selection of a particular statistical procedure from among the many that are available. Part of a good data analysis is to understand the assumptions underlying each of the hypothesis-testing procedures and to select the most appropriate for a given set of conditions.

The following sections will describe the **assumptions** underlying the two procedures of the Independent-samples t test, ***Equal-variance t test*** and ***Unequal-variance t test.***

The Independent-Samples t test

The purpose of the Independent-Samples t test is to determine whether there is a significant difference between the means of two populations. The test to be performed can be either two-tailed or one-tailed, depending on whether we are testing if the means of the two populations are merely different or if one mean is greater than the other mean.

Two-Tailed Test	One-Tailed Test	One-Tailed Test
$H_0 : \mu_1 = \mu_2$ $H_a : \mu_1 \neq \mu_2$	$H_0 : \mu_1 \leq \mu_2$ $H_a : \mu_1 > \mu_2$	$H_0 : \mu_1 \geq \mu_2$ $H_a : \mu_1 < \mu_2$

One version of the Independent-Samples t test, Equal-variance t test, assumes that data in the two groups are random samples from normally distributed populations *with the same variance*. The other version, Unequal-variance t test, assumes only that data in the two groups are random samples from normally distributed populations. The following table shows the computational formulas for the value of the test statistic and the degrees of freedom required for each of the two versions of the t tests.

Equal-variance t test	Unequal-variance t test
The t statistic is: $t=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{(n_1-1)\cdot s_1^2+(n_2-1)\cdot s_2^2}{n_1+n_2-2}}\cdot\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$ The t statistic follows a t distribution with $n_1 + n_2 - 2$ degrees of freedoms.	The t statistic is: $t=\frac{(\bar{X}_1-\bar{X}_2)-(\mu_1-\mu_2)}{\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}}$ The t statistic can be approximated by a t distribution with degrees of freedom ν taken to be integer portion of the computation $\nu=\frac{\left(\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}\right)^2}{\frac{\left(\frac{s_1^2}{n_1}\right)^2}{n_1-1}+\frac{\left(\frac{s_2^2}{n_2}\right)^2}{n_2-1}}$

Both versions of t tests are fairly *robust* (that is, not sensitive) to moderate departures from normality, provided that the *sample sizes are large*. In such situations, these t tests may be used without serious effect on its power.

For situations in which the *sample sizes are small* and we cannot or do not wish to make the assumption that the data in each group are taken from normally distributed

populations, some distribution-free (nonparametric) procedure such as the Mann-Whitney or Wilcoxon rank sum test should be used.

For situations in which we *cannot or do not* wish to make the assumption that the two normally distributed populations from which the sample data are drawn have *equal variance*, the Unequal-variance t test should be used.

Checking Assumptions of Independent-Samples t Test

The normality assumption of the t tests can be evaluated by looking at the distribution of the data (via histograms) or by performing a normality test (Lilliefors test in SPSS Explore Command).

The equality of variance assumption can be verified with the Levene's test. The output of the Independent-Samples t test given by SPSS includes the result of the Levene's test. The following statements are the null and alternative hypotheses of the Levene's test:

$$H_0 : \sigma_1^2 = \sigma_2^2$$
$$H_a : \sigma_1^2 \neq \sigma_2^2$$

If the null hypothesis of the Levene's test is rejected, the Unequal-variance t test will be applied otherwise Equal-variance t test will be used.

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Executive Summary

Factors Relating to Students' Learning Achievement in Statistics at Assumption University

Part I: Thesis Problem

Thesis Problem			
Situation	Research Objective	Research Question	Significance of the Study
While teachers of Statistics are likely to focus on transmitting knowledge, many students are likely to have trouble with Statistics. Many students have difficulties learning statistics effectively. They have negative view about the domain of it. The lesson does not seem to stick and they have an unconstructive belief about the relevant of it in their future career. They prefer to go to private tutorial classes. Most of the time in the class they are only physically present but mentally absent. Some factors are behind these problems and they must not be isolated.	This research was designed with the aim of determining the factors related to students' learning achievement in Statistics II at Assumption University. The objectives of the study were as follows: 1. To determine the relationship between students' learning achievement in Statistics II and the following factors: - students' computational background (by using Mathematics for Business and Statistics I results). - students' attitudes toward Statistics II. - students' perception on teaching Statistics II. - students' strategic practices used in learning Statistics II. 2. To determine the relationship between computational background from high school and tutorial class attended.	The researcher arrived at the following research questions: 1. Does the students' learning achievement in Statistics II have a relationship with the following factors: - students' computational background (by using Mathematics for Business and Statistics I results). - students' attitudes toward Statistics II. - students' perception on teaching statistics II. - students' strategic practices used in learning Statistics II. 2. Is there a relationship between students' tutorial classes attended and their computational background from high school? 3. Is there any difference between students who attended tutorial classes and who did not attend such a class on the following factors:	1. To provide the information to Assumption University on factors influencing students' learning achievement since the University has urged to develop a progressive students' learning achievement. 2. To provide the information to the instructors on factors influencing students' learning achievement so that the instructors can modify and adjust their methods of teaching for ending up with better students' learning achievement. 3. To provide the information to the students on factors influencing their learning achievement so that they will be aware of what they are doing and how to improve their learning achievement.

Thesis Problem			
Situation	Research Objective	Research Question	Significance of the Study
	3. To find out whether there is a difference between students who attended tutorial classes and students who did not attend such a class on the following factors: - learning achievement. - attitudes toward Statistics II. - perception on teaching Statistics II. - strategic practices used in learning Statistics II. 4. To determine the relationships among students' attitudes toward Statistics II, students' perception on teaching Statistics II and students' strategic practices used in learning Statistics II. 5. To determine the important factors relating to students' learning achievement in Statistics II by students' opinion and the survey results.	- learning achievement. - attitudes toward Statistics II. - perception on teaching Statistics II. - strategic practices used in learning Statistics II. 4. Are there relationships among students' attitudes toward Statistics II, students' perception on teaching Statistics II and students' strategic practices used in learning Statistics II? 5. What are the factors relating to students' learning achievement in Statistics II by students' opinion and the survey results.	

Part II: Research Design

Research Design					
Theoretical Framework	Conceptual Framework	Independent Variable	Dependent Variable	Data Collection	Statistical Technique
The theoretical framework was drawn based on different models and theories of learning which were related on factors influencing students' learning achievement depicted in the literature review in Chapter II. The framework covering all the main areas of factors influencing students' learning achievement was from the theories of Wang et al. (1992), Walberg (2000), Hagedorn (1995) and Charles (2000).	The conceptual framework was based on the theoretical framework.	1. Students' computational background 2. Students' attitudes toward Statistics II 3. Students' strategic practices used in learning Statistics II 4. Students' perception on teaching Statistics II 5. Tutorial classes attended	Students' learning achievement in Statistics II measured by • mid-term score • final score • total score	From computer data files • demographic profile of students • computational background of students in Mathematics for business and Statistics I • students' learning achievement regarding mid-term, final and total examination score From questionnaires • computational background in high school • students' attitudes toward statistics II	1. Frequency, percentage, mean and standard deviation 2. Independent sample t-test 3. Chi-square test 4. Correlation analysis

Research Design					
Theoretical Framework	Conceptual Framework	Independent Variable	Dependent Variable	Data Collection	Statistical Technique
				• students' strategic practices used in learning Statistics II • students' perception on teaching Statistics II • tutorial classes attended From Interviewed • students' attitudes toward Statistics II. • students' strategic practices used in learning Statistics II. • students' perception on teaching Statistics II. • tutorial classes attended.	

Part III: Results

Results		
Findings	Conclusions	Recommendations
• Students' computational background in Mathematics for business and Statistics I had relationship with the students' learning achievement • Students' attitudes toward Statistics II had a significance relationship with students' learning achievement in Statistics II. • Students' perception on teaching Statistics II did not have any relationship with students' learning achievement. • Students' strategic practices used have significant relationship with students' learning achievement who got high marks. • There was a difference on learning achievement in Statistics II between students who attended tutorial classes and who did not attend such a class. • There was a significant relationship between students tutorial classes attended and their computational background from high school. • There was a difference on attitudes toward Statistics II between groups of students who attended tutorial classes and who did not attend such a class. • There was a difference on perception on teaching Statistics II between groups of students who attended tutorial classes and	After the findings had been summarized, it was found that there were only three factors influencing students' learning achievement in Statistics II: 1. Students' computational background in Mathematics for Business and Statistics I at Assumption University 2. Students' attitudes toward Statistics II in term of mid-term score. 3. Students' tutorial classes attended	According to the findings, two experimental researches are recommended: 1. Comparative study on students' strategic practices used for studying Statistics 2. Comparative study on teaching techniques in Statistics. The results from the comparative studies would be used in designing the following training programs: 1. Students' training program on learning strategy. 2. Instructors' training program on teaching techniques. The outcomes from the researches and training programs will certainly benefit not only students and instructors but also administrators in making and developing plan and policy, both short term and long term.

who did not attend such a class.
• There was a difference on strategic practices used between groups of students who attended tutorial classes and who did not attend such a class.
• There was a positive relationship between students' attitudes toward Statistics II and students' perception on teaching Statistics II.
• There was a positive relationship between students' attitudes toward Statistics II and students' strategic practices used.
• There was a positive relationship between students' perception on teaching Statistics II and students' strategic practices used. in learning Statistics II
• The factors relating to students' learning achievement in Statistics II by students' opinion:
  • strategic practices used in learning Statistics II
  • computational background in Mathematics for Business and Statistics I
  • tutorial classes attended
  • attitudes toward Statistics II
• The factors relating to students' learning achievement in Statistics II
  • students' attitudes toward Statistics II
  • computational background in Mathematics for Business and Statistics I
  • students' strategic practices used in learning Statistics II.
  • tutorial classes attended.		

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English Language and Format Approval

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