ATENEO DE MANILA UNIVERSITY

RELATIONSHIP BETWEEN ATTITUDE TOWARDS TECHNICAL EDUCATION AND ACADEMIC ACHIEVEMENT IN MATHEMATICS AND SCIENCE OF THE FIRST AND SECOND YEAR HIGH SCHOOL STUDENTS, CARITAS DON BOSCO SCHOOL, SY 2002 - 2003

A THESIS SUBMITTED TO

THE FACULTY OF THE EDUCATION DEPARTMENT

IN CANDIDACY FOR THE DEGREE OF

MASTER OF ARTS IN EDUCATION

BY

CARLO MAGNO

QUEZON CITY, PHILIPPINES

MARCH 2003

CONTENTS

TABLES

TABLES

FIGURES

APPENDICES

APPENDICES

CHAPTER I

INTRODUCTION

Background of the Study

It is most common nowadays for schools to administer achievement tests at the end or middle of the school year to determine what students have learned across the different academic areas. This is especially true in Mathematics and Science. Ordinarily, achievement tests are used as assessment tools. Their results are used to improve the curriculum. Studies have investigated the different variables that affect and relate to student achievement. According to Enemarck and Wise (1981), Parsons, Adler and Kaczala (1981), and Ma and Kishor (1997) the variable 'attitude' is one of the most potent factors that relates to achievement.

Despite these studies, the researcher believes that there is still a need to study further factors that relate to achievement. One of these factors is Attitude Towards Technical Education. Technical Education contributes to the exploratory function of the secondary curriculum, helps provide for individual differences, and contributes to worthy home membership, leisure-time activities and command of fundamental processes (Bent and Kronenberg 1980). Determining the students' Attitude Towards

Technical Education enables teachers and curriculum planners to consider and evaluate the Technical Education program and its appropriate structures. Since the variable ‘Attitude Towards Technical Education’ is quite unique in its structure there is a need to provide empirical data about it.

There is also a need to provide explanation on how Mathematics and Science Achievement relate to students’ Attitude Towards Technical Education since achievement in Mathematics and Science are cognitive in nature while attitude is affective. Current literature shows that there is a gap between knowledge in the cognitive domain and knowledge in the affective domain (Maker 1982). This implies that the interplay between the cognitive and affective domain has to be further explained. This interplay is deemed important since it is a process that students undergo most of the time. As Maker (1982) emphasized, it is impossible to separate the cognitive from the affective domain in any activity. Moreover, according to McLeod (1992) attitudes, beliefs, and emotions are the major descriptors of the affective domain in Mathematics and Science Education, whereas knowledge and thinking are considered descriptors of the content and process of the human mind. According to Steinkamp (1982), Cheung (1988), Ma and Kishor (1997), and Middleton and Spanias (1999) Science and Mathematics educators have traditionally accepted the positive relationship between attitude towards Mathematics and Science and achievement in Mathematics and Science.

The area of Technical Education needs to be explored further in terms of its relation to other variables. Technical Education basically needs considerable amount of manual skill which is an attribute of a craftsman (French 1980). A person involved in Technical Education needs a sound background in Mathematics, Science and in the Technology of his work (French 1980). Donald (1985) carefully noted that Practitioners implementing Technology Education for high school should keep several guiding principles in mind:

> Technology education is a vital educational component in a highly technological society. Present and future societies will depend upon the wise use of technology as an important factor in survival and human progress. Technology education must be packed and delivered in keeping with the characteristics and needs of all students in all ability levels. The program should be experientially based and should utilize the base of research findings on how individuals learn. Instruction should take place in the content of a multi- and cross-disciplinary involvement of the learner. Technology education must be extended beyond the craft domination of previous years and most programs, thus making technology education much more broadly conceived than technical education as it is usually understood. The process of technology education must be a holistic one that recognizes the fact that nothing can be studied to any measurable degree within a single discipline. (Donald 1985, 3)

This study investigated the relationship between students' achievement in Mathematics and Science and Attitude Towards Technical Education. The areas of

Mathematics and Science were considered since their principles are the bases of the applications to Technical Education.

The variable Attitude Towards Technical Education was conceptualized to determine primarily whether the High School students of Caritas Don Bosco School have a favorable attitude towards the Technical Education they are taking. Determining the students Attitude towards Technical Education was the initial step done in order to fully develop and implement a more complete Technical Program.

Conceptual Framework

This study made use of the "Model of Academic Choice" by Meece et al. (1982). It is a general model of academic choice, expectation and value of attitude leading to achievement. The model links achievement with constructs of expectation of success on a task and the subjective value of the task influencing the attitude of students.

Attitude

Attitudes are learned predispositions to respond in a consistently favorable or unfavorable manner with respect to a given object (Meece et al. 1982). According to Meece et al. (1982) Attitude is related to academic achievement since attitudes are learned over time by being in contact with the subject area. Information about the subject area is received through instruction and consequently attitude is developed. Moreover, if a person is favorably predisposed toward an academic course, that favorable disposition should lead to favorable behaviors like achievement.

Task Value

Being in favor of a certain academic area is a component "task value" as proposed by Meece et al. (1982) in their Academic Choice Model. Task Value is the perceived difficulty or assumed challenge in a task (Meece et al. 1982). Task Value as determined by students include the need to fulfill goals, to facilitate attainment of goals, or to affirm personal values. Task Value determines the importance a person attaches to engaging in a task (Meece et al. 1982). In the model, Task Value is influenced by students' perceptions of their own ability, personal needs, and future goals and by their perceptions of task characteristics.

Task Value includes attainment value, intrinsic value, and utility value (Meece et al. 1982). Task Value aims to facilitate the attainment of goals and determine the importance of tasks that a person attaches to it. Task Value in the attainment of goals implies the importance of doing well on a task and coincides with the conceptualization of attainment. It includes a variety of task perceptions such as the likelihood that success on the task will confirm salient and valued characteristics of the self and the likelihood that the activity will provide challenge. Intrinsically, task value is seen as the inherent enjoyment one gets from engaging in an activity. Some tasks are undertaken because enjoyment or satisfaction is derived from simply engaging in those tasks. On the pragmatic side, Task Value is undertaken as a means of reaching a variety of goals.

Task value can affect students' achievement in the way they perceive the use of Mathematics and/or Science. It is strongly related to their intentions to continue or discontinue further Mathematical or Science studies.

Expectations

Expectation is the perceived probability for success (Meece et al. 1982). Studies have demonstrated the role of "expectation" on achievement including academic performance, task persistence and task choice. Given that Expectations play a significant role in students' achievement, they are mostly influenced by self-concepts of ability and by estimates of task difficulty. These are the typical differences found in students' expectations in their performances.

Attitude encompasses the constructs of Expectation and Task Value. It was noted by Hatzios (2002) that a person learns an attitude by the "expectations" of people around.

The figure shows the link between Attitude and the the academic achievement of students.

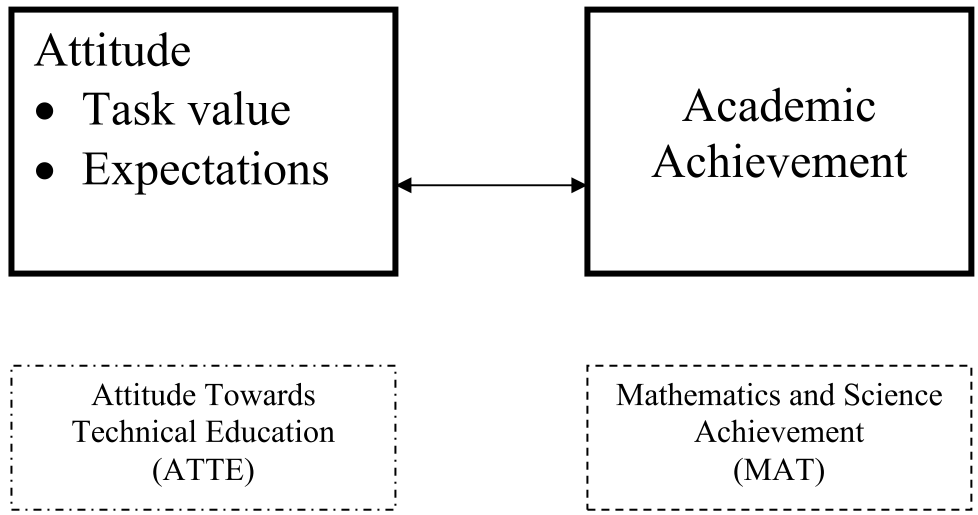

Figure 1. Researcher's Interpretation of the Link between Attitude and Achievement as Derived from Meece et al. (1982).

Achievement

Achievement is a measure of what a person has learned within or up to a given time (Yaremko et al. 1982). It is a measure of the accomplished skills and indicate what a person can do at the present (Atkinson 1995). Kimball (1989) explained the differences between traditional and alternative views in the achievement of students in Mathematics and Science subjects. He noted that the greater number of courses taken by students and their more extensive classroom experience with Mathematics outside the classroom may give them an advantage. The advantage is in the knowledge of Mathematics which give them increased confidence when taking standardized tests. Moreover, extracurricular Mathematics activities may facilitate class learning. Having more Mathematics–related experiences may increase students' performance on standardized tests either directly or indirectly. Greater experience with Mathematics may provide specific knowledge such as algorithms that can be used to solve problems. Indirectly, greater experience may facilitate performance through general familiarity with Mathematical thinking and increased confidence. Another explanation in the achievement of Mathematics is the autonomous approach in learning that facilitates performance on standardized tests, which require one to apply or generalize mathematics knowledge to new or unfamiliar problems. On the other hand, there are students who take a rote learning approach to Mathematics that proves to be advantageous in classroom exams. These differing styles of learning facilitate performance on different kinds of achievement measures. Another way of explaining the performance of students on achievement is connected with the novelty or familiarity of the material. There are students who are motivated to do well and are confident when dealing with familiar material but become less confident when dealing with novel material. Thus they do better on Mathematics examinations that cover relatively more familiar material, but they do less well on standardized tests that are more likely to contain novel material. On the other hand, there are students who are motivated to do well and are more confident when dealing with novel or challenging material or situations but are less motivated to perform well when faced with familiar material. Thus, they do better on standardized tests, which offer more challenges, but do less well on traditional classroom exams. This explanation rests on the assumption that standardized tests are relatively more novel or unfamiliar than classroom examinations. They are more novel in two ways: first, the standardized test is a more novel situation because it occurs less often and sometimes is administered by a stranger. Occasionally the standardized test is given outside of class time and in a strange environment. On the other hand, traditional classroom exams are taken several times within a course with the same group of people, are given by the same person, and occur in the same physical environment. Second, the material or problems on a standardized test are more likely to be novel or unfamiliar to the students taking the test. Standardized exams are not designed to cover what has been learned in class. A "fair test" in the classroom emphasizes what has been taught. In this case, the student may be given hints or information about how to prepare for a traditional classroom exam.

Statement of the Problem

The purpose of this study was to determine the profiles of the Attitude of first and second year high school students of Caritas Don Bosco School SY 2002 - 2003 towards Technical Education and their profiles in Mathematics and Science achievement. It also investigated whether a relationship existed between Attitude Towards Technical Education and Academic Achievement in Mathematics and Science. Specifically it aimed to answer the following questions:

1. What is the profile of Attitude Towards Technical Education of the first year high school students in the following:
   1.1 Task Value?
   1.2 Expectation?
   1.3 general Attitude Towards Technical Education?
2. What is the profile of attitude Towards Technical Education of the second year high school students in the following:
   2.1 Task Value?
   2.2 Expectation?
   2.3 general Attitude Towards Technical Education?
3. What is the profile of achievement of the first year high school students in the following:
   3.1 Mathematics?
   3.2 Science?
4. What is the profile of achievement of the second year high school students in the following:

4.1 Mathematics?

4.2 Science?

5. What, if any, is the relationship between the first year high school Mathematics achievement and the following :

5.1 Task Value?

5.2 Expectation?

5.3 general Attitude Towards Technical Education?

6. What, if any, is the relationship between the first year high school Science achievement and the following:

6.1 Task Value?

6.2 Expectation?

6.3 general Attitude Towards Technical Education?

7. What, if any, is the relationship between the second year high school Mathematics achievement and the following :

7.1 Task Value?

7.2 Expectation?

7.3 general Attitude Towards Technical Education?

8. What, if any, is the relationship between the second year high school Science achievement and the following:

8.1 Task Value?

8.2 Expectation?

8.3 general Attitude Towards Technical Education?

Hypotheses

1. There is no significant relationship between the first year high school Mathematics achievement and the following:

1.1 Task Value

1.2 Expectation

1.3 general Attitude Towards Technical Education

2. There is no significant relationship between the first year high school Science achievement and the following:

2.1 Task Value

2.2 Expectation

2.2 general Attitude Towards Technical Education

3. There is no significant relationship between the second year high school Mathematics achievement and the following:

3.1 Task Value

3.2 Expectation

3.3 general Attitude Towards Technical Education

4. There is no significant relationship between the second year Science achievement and the following:

4.1 Task Value

4.2 Expectation

4.3 general Attitude Towards Technical Education

Assumptions

1. The questionnaire "Attitude Towards Technical Education" (ATTE) was an appropriate instrument to measure first and second year high school students' perceived Attitude Towards Technical Education.

2. The "Metropolitan Achievement Test" (MAT) was a useful and adequate instrument in measuring students' achievement in Mathematics and Science.

3. The respondents cooperated and gave fair answers to the items in the ATTE questionnaire objectively.

Scope and Delimitation

The study only accounted for the relationship between attitude and achievement as variables and other extraneous factors were not considered as units of analysis.

The study was limited to the 191 first and second year high school students of Caritas Don Bosco School. There are no third and fourth year students for this school year.

Other variables were not considered in explaining the relationship between academic achievement and Attitude Towards Technical Education. For achievement, only Mathematics and Science were the areas under investigation. Other subject areas were not covered. For attitude, the variable was limited to measuring "Attitude Towards Technical Education." It merely measured students' perception on how they regard the importance of the technical subject they are taking.

The variable attitude was studied as a perception and did not account for the explanation of attitude and how it developed.

Significance of the Study

Most literature in the areas of Technical Education shows the output of technical training by students. This study may be significant since it provides additional data about the perception of the students taking the course or subject. It determines through the instrument constructed the current status of whether students are receiving the appropriate objectives intended for them in the particular technical training.

The study can be significant in the area of Technical Education since it can provide a guide to curriculum developers for Mathematics, Science and Technical Education on how to focus the curriculum based on the perceptions of students about the course. It is important to determine the perception of students in coming up with a technical curriculum since they are the recipients of the intended curriculum. It can also provide information on whether students are inclined to pursue technical training or not.

The study can be significant for the school in determining the attitude of students taking technical subjects. Determining their attitude enables the teacher to provide more support to the student to improve their work output.

This study may help Caritas Don Bosco School in terms of identifying the kind of students who take Technical Education. Taking into consideration the students' attitude toward the subjects might provide information about the output of their learning such as academic achievement.

Definition of Terms

Achievement – Measure of the effects of a specific program of instruction or training (Anastasi 1997). In this study, achievement was measured by the Metropolitan Achievement Test (MAT).

General Attitude Towards Technical Education – Learned predispositions to respond in a consistently favorable or unfavorable manner with respect to a given object (Fishbein and Adjzen 1981). It represents covert feelings of favorability or unfavorability toward an object, person, issue or behavior (Hatzios 2002). Composed of Task Value and Expectations (Meece et al. 1982). In this study general Attitude was measured by the scale Attitude Towards Technical Education inventory.

Expectation – Refers to the probability of success (Meece et al. 1982). In this study it is a factor of ATTE with nine items measuring the intended objectives of what students will attain in the technical subject.

High School Students – Students who passed all necessary requirements and finished the elementary stages (Hurlock 1990). They are usually under the ages of 12 to 16. They are males and females who are in their first and second year level at Caritas Don Bosco School.

Mathematics Achievement – Measure of the effect of a Mathematics program (Anastasi 1997). In this study it is measured by the Metropolitan Achievement Test Mathematics factor level 8 and 9. The Mathematics items measures Mathematical concepts, arithmetic operations, problem solving and data interpretation, and computation (Harcourt 2001).

Science Achievement – Measure of the effect of a Science program (Anastasi 1997). In this study it is measured by the Metropolitan Achievement Test Science factor level 8 and 9. The Science questions measure students ability use reasoning, apply understanding, interpret data, draw conclusions and predict events. The specialized areas of Physiology, Physics, Chemistry, Biology, Earth and Space Sciences are tested. The nature and processes of Science also are given considerable emphasis (Harcourt 2001).

Task Value – The degree to which a particular task is able to fulfill needs, to facilitate attainment of goals, or to affirm personal values. It determines the importance a person attaches to engaging a task (Meece et al. 1982). A factor of ATTE with eleven items measuring attainment value, interest and utility value in Technical Education.

Technical Education - Manual training "shop" and industrial arts, consists of practical and applied subject matter that reflect the practices of current society (Buck 1997).

At Caritas Don Bosco School, Technical Education refers to the following subjects:

- Drafting for first year

- General Technology and Information Technology for first and second year high school.

CHAPTER II

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents the literature related to the study. It focuses on the context of Technical Education, Achievement in Mathematics and Science and the influences of Attitude on Academic Achievement. It also looks at the trend in different studies in the context of the variables mentioned and the interactions of each.

Related Literature

Technical Education

According to French (1980) that in Technical Education, students need a considerable amount of manual skill which is the main attribute. He also noted that a sound background in Mathematics, in Science and in the technology of education is needed. In practical terms it is meant for laboratory and experimental work to strengthen basic manual skills. Technical Education aims to facilitate student entry into universities and further advancement in technical related courses such as Engineering and Industrial Arts.

According to Settamanit (1984) Technical Education as part of the secondary education curriculum prepares students for entry into those occupations that lie between skilled crafts and the Engineering and Scientific professions. It introduces the students to the work-oriented skills and desirable work habits that can be applied in their daily lives. It prepares students for industrial and commercial occupations that do not require a university degree. It involves the integration of subjects in the academic stream to learn the work-oriented and occupational subjects to develop desirable work habits and apply what they learn in schools in daily living. The general background of mathematics, physics, chemistry, engineering, drawing etc. provides necessary planning.

It can be seen that Technical Education differs from vocational education. Vocational Education was conceived to provide job opportunities for high school graduates who do not want or have no opportunities to further their education in the universities. Students are trained in vocational education to acquire needed skills which they can apply to practical work.

According to Lindbeck (1997) Technical Education programs emphasize the understanding and application of the basic principles of Science and Mathematics and require knowledge of computer applications. The training stresses applications of Science and Mathematics to laboratory operations and processes. Technical Education involves the use of scientific analysis, equipment and mechanical apparatus and machinery often found in laboratories.

According to Garner (1997) Technical Education aims to prepare students for a particular line of study. Technical Education is a formal program that is part of the secondary curriculum academic stream. It concentrates on general skills on the basic industrial processes and focuses on applied Science and Mathematics. Technical Education is concerned primarily with the teaching of proper and safe techniques for handling and applying materials and modern technologies, including the theories behind it. It is different from vocational education which is a non-formal education found in community and junior colleges, industry, labor unions, penal institutions, adult education courses, and the military. These institutions offer vocational education to further equip personnel with additional technical skills. It concentrates on learning occupational related skills like painting, varnishing, repairing furniture, upholstery, making pieces of furniture, simple electric wiring, repairing leaking faucets and other activities and experiences needed by everyone in a home. Vocational education aims to develop manual and technical skills generally related to a single occupation while Technical Education is more broad and comprehensive in scope.

Technical Education is part of the curriculum offered for the secondary education of students in Caritas Don Bosco School. The Technical Education and its integration with other subject areas intend students to be productive, develop life skills, love and discipline for work, technology use in school, and provide options for future career in technical courses (Magno 2002).

Theoretical Component of Technical Education

Technical education is grounded on the theories governing Mathematics, Physics, Chemistry, Engineering, Drawing and other relevant subjects (French 1980). The areas studied in Technical Education are applications of specific skills learned in Science and Mathematics.

This theoretical component constitutes the proper understanding of the concepts, principles, law, and generalizations in Science and Mathematics which the student must acquire with mastery. Moreover, this theoretical basis should be solid enough to enable the students to cope, without too much difficulty with developments that might arise in the field. The student is concerned with the specific techniques that he has to exercise in the use of actual equipment. It is practical to link the laboratory work with these basic theories. This makes it difficult to draw a distinction between theory and practice (French 1980) .

Practical Component of Technical Education

Technical Education combines theory with laboratory and experimental work (French 1980). The lessons are conducted in relation to theory but the laboratory work on structured class is categorized in practical terms. This includes the basic manual skills similar with the skills needed by craftsmen. It involves the making of precise measurements, simple and complicated application of skills. The work in Technical Education usually involves judgment and the intelligent application of theory.

According to French (1980) that the ultimate valuation placed upon a student in Technical Education is in terms of his success in doing a practical job or work. The theory serves as a background to enable him to do practical work with certainty and expedition, and to equip him to continue to do this even if the equipment and methods change.

Models for Technical Education

One model of Technical Education resulted from a study of Technical Education objectives compiled by leaders in the technical field. The model shows a definite effort to meet the needs of the youth in a complex society (US Office of Education 1960). To meet the needs of the youth, the objectives included emphasis on problem solving, design, and experimentation as facets of a more wholesome approach to learning through intelligently organized experiences that help orient the student in the realm of technological subject matter. The stress was placed in the correlation of Science and Mathematics and the relation of various industrial processes to lifelike situations.

The report of the U. S. Office of Education conference in 1960 includes four broad objectives. These objectives were the result of extensive surveying and summarizing of previously established objectives by recognized authorities in the field. The objectives are as follows:

1. To develop in each student an insight and understanding of industry and its place in our culture.
2. To discover and develop talent of students in the technical fields and Applied Sciences.
3. To develop technical problem solving skills relative to materials and processes.
4. To develop in each student a measure of skill in the use of common tools and machines.

The objectives provided the necessary directions for Technical Education as part of the secondary course. It is necessary to look into the components that lead to the effective performance of students in line with Technical Education.

Trump and Miller (1985) proposed another model for Technical Education. The model is called “General Shop Class.” The objectives of the General Shop Class were related to the development of skills in the use of hand tools. Woodworking was the major activity in this class. As increased technological knowledge brought new products and new industrial processes into everyday living, curriculum planners sought to incorporate this information in the shop classes (Trump and Miller 1985). Students needed a wider knowledge about the materials and processes of industry. They also needed information on the use and maintenance of many modern conveniences and labor saving devices coming into the home. Learning activities then included the Graphic Arts such as Drafting and Lettering (Schmitt and Chismore 1987).

The study as contextualized in the Philippines as viewed by the "Technical Education and Skills Development Association" (TESDA) is shown in the development of a world class, technically skilled and educated workers with positive work values, acting as the vital force in building a prosperous country where citizens enjoy a life of greater economic security social well being and personal dignity (TESDA 2002). This statement describes the direction of the "National Technical Education and Skills Development Plan" (NTESDP). According to the NTESDP, Technical Education and skills development in the country will be pursued through three directions:

1. Global Competitiveness - This addresses the skills requirements of export-oriented activities, catalytic industries, industries undergoing adjustments, support industries and overseas employment.

2. Rural Development - This addresses the need to mainstream the countryside in national development through addressing the skills requirements of economic activities in the rural areas, especially in pursuing technology-based agriculture and fishery development.

3. Social Integration - This focuses on the development of para-professional and other social development workers to facilitate the delivery and accessibility of social development services; provision of wider range of economic and social alternatives to poor and other disadvantaged Filipinos; and development of intangible social and personal skills.

The quality assured Philippine Technical Education and Skills Development system is envisioned to be the mechanism towards attaining the vision for the sector. It provides the overall framework on which other Technical Vocational Education Training (TVET) reforms are anchored. It is guided by the following basic principles:

1. It is competency-based where acquisition of qualification by a person is based on his learning a set of competencies rather than the completion of a fixed period of study.

2. It draws standards and priorities from the industry which is the user of the output of the TESD system.

3. It is accessible to all those who wish to pursue higher education learning.

4. It allows a person to enter at any stage in the system and for whatever productive purpose a person might aim for.

5. At allows recognition of prior learning regardless of where they acquired their skills, the equivalency scheme and lifelong learning.

6. It installs quality assurance among training providers.

7. It utilizes certification as an assurance to industry of the quality of the workers who may be their future employees.

8. It dovetails the directions indicated in government plans, policies, priorities and public investments.

9. It installs quality assurance to the management of the TESD system.

To upgrade the quality and raise the productivity of Philippine middle level manpower to be globally competitive, TESDA have set the following:

1. Enriching Science and Mathematics content in the curriculum of TVET programs
2. Integration of work ethics, human relations, communication skills and values of excellence in all TVET programs
3. Physical Facilities Development Program in TESDA schools
4. Training Technology Research Program
5. Monitoring and Documentation of best practices in TVET
6. Establishment of Polytechnic System

7. Distance Learning Program for TVET
8. Establishment of Pilot Virtual Training Center
9. TVET Center of Excellence
10. Establishment of Pre-Service Technician Teacher Education Program
11. Occupational Standards and Training Regulations Development
12. Competency Assessment and Certification Program
13. Establishment of a National Trainer Qualification System
14. Establishment of Equivalency System for middle-level skills

Mathematics and Science Achievement

Research shows that Mathematics and Science achievement is influenced by numerous factors. According to Becher (1984) that in the study of Henderson and Berla in 1994 considers one factor that contributes to Mathematics and Science achievement is the support and participation of families in their children's education in positive ways. Through this support children achieve higher grades and test scores, have better attendance at school, complete more homework, demonstrate more positive attitude, graduate at higher rates and act more likely to enroll in higher education.

Dwek (1986) proposed that learning and performance are two different achievement goals in Mathematics and Science. If performance is the goal, then achievement tasks are approached as a test of one's ability. It was explained that failure reflects negatively one's ability. The goal is to choose tasks to maximize success and minimize failure. If learning is the goal, then achievement tasks are approached as a learning opportunity. Moreover it was explained that a person with a performance goal and high confidence will choose moderately difficult tasks. This will likely demonstrate his or her ability and will respond to a difficult task with mastery orientation. On the other hand, the person with a performance goal and low confidence will be most concerned with avoiding failure. This demonstrates low ability, and the person will avoid confusing, difficult, or novel tasks. The person will respond to a difficult task with negative affect and deterioration of performance. For learning orientation, people with both high and low confidence will choose tasks that are perceived to provide good learning opportunities. Even if mistakes are likely, the person will respond to a difficult task with persistence and mastery behavior.

Ruthvan (1987) noted that Mathematics is seen to be more ability – dependent than English or even than Science subjects. Any Mathematics test may be perceived as more of an ability test than traditional classroom exams in other academic areas. It was argued that the standardized Mathematics test in relation to the traditional classroom exam is more likely to be perceived as a measure of one's ability. The special nature of the standardized test may contribute to the perception that it is an ability measure. Receiving feedback in which one's score is presented in terms of a percentile among all those taking the achievement test would certainly contribute to the perception of an ability measure. On the other hand, traditional classroom exams may be presented by teachers as a measure of how hard one has studied. They can be viewed more easily as a measure of how much one has mastered or learned the material presented in class. To the extent that standardized exams induce relatively more of a performance orientation and traditional classroom exams relatively more of a learning orientation, some students with lower confidence are placed more disadvantage in a standardized exam. On the other hand, to the extent that the traditional classroom exam induces relatively more of a learning orientation, students' assumption is that their effort is primarily responsible for success.

Kimball (1989) noted that Mathematics and Science more than verbal subjects may create difficulties for students with a performance orientation and low confidence. Mathematics, especially in high school and beyond, is more likely than verbal subjects to present students with new concepts and confusing material. Each new area (Algebra, Geometry, Trigonometry, Calculus) begins with the introduction of new concepts. Even the fact that each area has a new name may increase the sense that one is dealing with a new and different learning task. Mathematics as compared to Science is an area with a high probability of error, and one's error is easily determined. Children with a performance orientation and low confidence will tend to avoid Mathematics and Science. On the other hand, students with a performance orientation and high confidence may prefer Mathematics because of the high probability of demonstrating one's ability with clear successful solutions to problems.

In Mathematics achievement, the usual factors measured are Mathematical concepts, problem solving and computation. Mathematical concepts assesses Numeration, Geometry, and Measurement, including numbers beyond thousands, decimals and fractions, shapes, money, time and customary and metric measurement. In problem solving, it assesses response to orally presented verbal problems, some items require solutions of problem and choice of correct answer, some require the choice of correct number sentence. In computation, it requires the fundamental operations with whole numbers, decimals and fractions (Anastasi 1997).

Students efforts in studying Science as reported by Greenfield (1997) appear to be supported by factors such as strong interest in the secondary Science curriculum, a strong extracurricular experiential Science background, or even a high level of teacher recognition for their efforts in Science. Students seriously studies Science subject. Students also seem convinced that they can be good Science students and scientists. Moreover, it was explained that the impact of Science attitudes is the students willingness to enroll and participate actively in a Science class. Even though their attitudes toward the Science curriculum become increasingly negative over the years. The hands-on science lessons can help provide students with some of the manipulative experiences. A small group situation can provide a somewhat sheltered environment more conducive to experimentation and risk taking than many whole class situations. The assignment of specific roles within groups can help accustom students sharing of equipment as well as duties which may be carried over into future years and courses. These types of learning opportunities can contribute to building students self-confidence and attitude for studying Science in subsequent years. The learning opportunities can also provide them with some of the skills they will need in working with Science apparatus. The combination of these factors may then contribute to their willingness to enroll in other successive Science and Mathematics secondary classes.

Rennie and Dunne (1994) reported that students who preferred a Science – related career have more positive attitudes than those who preferred other careers. Students consider Science to be difficult but interesting as compared to other school subjects. They noted that students consider the usefulness of Science in getting a job.

It was noted by Smith and Hausafus (1998) that parents can support Science and Mathematics teachers' efforts. The effort is done by helping their children see the importance of taking advanced Mathematics and Science courses, emphasizing the importance of Mathematics in today's careers, limiting TV watching, and visiting Science/Mathematics – related exhibit and fairs with their children. Family support is a factor in Mathematics and Science academic achievement and in children's expectation of themselves. It was explained further by Smith and Hausafus (1998) that interest in Science and Mathematics careers begins or ends at an early age. Believing that Science and Mathematics are the most important subjects for their children and encouraging their children to take advanced Science and Mathematics courses affect Science and Mathematics scores.

Attitude

According to Bandura (1977), attitude is often used in conjunction with motivation to achieve. It is how capable people judge themselves to perform a task successfully. Moreover extensive evidence and documentation were provided for the conclusion that attitude is a key factor in the extent to which people can bring about significant outcomes in their lives.

The relation between attitude and performance is best summed up by Bandura (1977):

> The evidence is relatively consistent in showing that efficacy beliefs (such as attitude) contribute significantly to level of motivation and performance. They predict not only the behavioral changes accompanying different environmental influences but also differences in behavior between individuals receiving the same environmental influence, and even variation

> within the same individual in the tasks performed and those shunned or attempted but failed.(Bandura 1977, 61)

According to Overmier and Lawry (1979) that in the study of Rotter, Phares and Chance in 1972 that one potential source of the drive to perform is the incentive value of the performance. Incentive theories of motivation suggest that people will perform an act when its performance is likely to result in some outcome they desire, or that is important to them. For example, in anticipation of a situation in which a person is required to perform, that person may expend considerable effort in preparation because of the mediation provided by the desire to achieve success or avoid failure. That desire would be said to provide incentive motivation for the person to expend the effort. Accordingly, a test, as a stimulus situation, may be theorized to provoke students to study as a response, because of the mediation of the desire to achieve success or avoid failure on that test. Studying for the test, therefore, would be the result of incentive motivation.

In more objective terms attitude may be said to connote response consistency with regards to certain categories of stimuli (Anastasi 1990). In actual practice, attitude has been most frequently associated with social stimuli and with emotionally toned responses (Anastasi 1990).

Zimbardo and Leippe (1991) defined attitude as favorable or unfavorable evaluative reactions whether exhibited in beliefs, feelings, or inclinations to act toward something.

According to Myers (1996) Attitude is commonly referred to beliefs and feelings related to a person or event and their resulting behavior. Attitudes are an efficient way to size up the world. This means that when individuals have to respond quickly to something, the feeling can guide the way one reacts. Psychologists agree that knowing people's attitude is to predict their actions. Attitudes involve evaluations. Attitude is an association between an object and our evaluation of it. When this association is strong, the attitude becomes accessible. Encountering the object calls up the associated evaluation towards it. One acquires attitude in a manner that makes them sometimes potent, sometimes not. An extensive series of experiments shows that when attitudes arise from experience, they are far more likely to endure and to guide actions. She concluded that attitudes predict actions if other influences are minimized, if it is specific to the action and it is potent.

Review of Related Foreign Studies

Technical Education

A 1995 review of academic studies concluded that using technology in instruction improved student outcomes in Language Arts, Mathematics, Science, and Social Studies.

Studies on computer-based instruction by Kulik (1997) found that students who used computer-based instruction learn more in less time. Students who used computer-based instruction scored in the 64^{th} percentile on achievement tests while students without computers scored in the 50^{th} percentile. In addition, the study reported that students enjoy classes that include computer-based instruction more than classes that do not.

The Educational Testing Service (ETS) made a national study of technology's impact on Mathematics achievement (1998). It has a national sample of 6,227 fourth graders and 7,146 eighth graders. The report concluded that computers can have a positive impact on student achievement when used selectively by well-trained teachers and that learning is enhanced when computers are used to encourage higher order thinking skills. When looking at National Assessment on Education Progress results, they found that eighth grade students showed fifteen weeks of gains above grade level after using simulation and higher-order thinking software. They also showed thirteen weeks of gains above grade level after having teachers who received professional development on computers. Professional development and higher-order computer use resulted in higher achievement in Mathematics for both fourth and eighth graders.

A review of research studies from 1990 to 1997 by Sivin-Kachala (1999) found that children showed increase in achievement from preschool through higher education when immersed in technology-rich environments. When computers were used for instruction, students' self-concept and attitudes toward learning consistently improved. Positive effects in achievement were found in all major subject areas when students were immersed in technology-rich environments.

The recently released report on the "Effectiveness of Technology in Schools" by the Software Information Industry Association (SIIA) states that educational technology has demonstrated significantly positive effects on achievement. The Illinois State Board of Education recently completed a two-and-a-half-year study commissioned by Westat (1999). They concluded that while Illinois' investment in learning technologies is paying off, poorer schools still lag behind wealthier schools and have less access to computers. In schools where technology usage was the highest, students' scores were higher in certain subjects. In addition, in cases where teachers were effectively using technology to facilitate or enhance classroom instruction, standardized test scores were also high.

The Idaho Technology (2000) initiated “An Accountability Report to the Idaho Legislature on the Effects of Monies Spent through the Idaho Council for Technology in Learning.” They found that the benefits of educational technology in teaching and learning are clearly due to an increase in academic achievement in Reading, Mathematics, Language, and core studies. The benefits also include improved technology literacy, increased communication, well-trained, innovative teaching, positive relationships with the community, more efficient operation of the schools, and technically qualified students ready for the 21st-century workforce.

The West Virginia’s Basic Skills/Computer Education (BS/CE) Statewide Initiative (2000) made a study on the achievement of 950 fifth-grade students in eighteen West Virginia schools. The study found that all students’ test scores rose on the Stanford 9. The more they used BS/CE, the higher their scores. The lower-achieving students showed the greatest improvement. The factors that contributed the most were consistent access, positive teacher and student attitudes, and teacher training.

It was reported by Jordan and Dove (2002) in “A High School That Works” that Technical Studies is one way for improving student achievement. It was explained that more students need access to intellectually challenging careers like Technical Studies that emphasize the high level Mathematics, Science, Language Arts and problem solving skills needed in the modern work-place and in further education.

Mathematics and Science Achievement

Berryman (1983) concluded that students' interest in Mathematics and Science has emerged strongly by grade 9 and is essentially completed by grade 12.

A study by Copa (1985) examined the practice and effects of Technical Education in fourteen classrooms in eight Minnesota Public schools. Technical Education was found to play an important role in helping students build competence, apply basic skills, think through problems, learn technical skills, explore life roles, learn to work together, express themselves, extend themselves to the community, and practice life roles. Within the context of secondary education, Technical Education was found to provide a change of pace from other experiences in high school. Technical Education was found to help students experience cooperation and teamwork, provided learning activities relevant to students lives, gave opportunity for teachers to know their students well, and helped students develop self-esteem. It was concluded that those responsible for planning, administering, and teaching Technical Education should continue to be creative and challenge students beyond their expectations, clarify the purpose of Technical Education, and continue to provide new areas for student exploration without becoming so specialized as to narrow students' opportunities.

Leath (1995) reported in the Department of Education's National Center for Education Statistics annual report the trends related to Mathematics and Science education. Furthermore, students had responded dramatically by advocating tougher course requirements for high school graduation. It was reported that high school graduates were taking more academic courses overall. Likewise, the proportion of students completing the recommended core courses in Mathematics and Science has increased, and a greater percentage were taking advanced placement courses. In addition, more students are taking Algebra, Geometry, Trigonometry, and Calculus as well as Advanced Science courses, including Chemistry and Physics. There were improvements in high school course taking reflected in gains in Mathematics and Science achievement. It was also reported that between 1982 and 1992, the Mathematics and Science proficiency scores of 17-year-olds on the National Assessment of Educational Progress (NAEP) increased. Thus, great value was placed on Mathematics and Science. Although, as noted, the Mathematics and Science scores of United States students had increased since the early 1980s, they remained low compared to their counterparts in many other countries. Other Science trends noted in the report include that in 1992, average Science achievement was higher at all three age levels than in 1982. In addition, the gap between male and female scores at ages 13 and 17 has decreased. The number of bachelor's degrees earned in the Science and engineering fields peaked in the mid-1980s, representing 22 percent of the total number of bachelor's degrees conferred in 1986. Since then, the number of Science and engineering degrees conferred had fallen, reaching 16 percent of total bachelor's degrees conferred in 1992. The number of Science and engineering master's and doctor's degrees conferred grew faster than the total number of master's and doctor's degrees between 1981 and 1992. However, in 1992, Science and engineering master's and doctor's degrees made up approximately the same percentage of total degrees as they did in 1971.

Bottoms and Feagin (1997) reported on the “1996 High Schools That Work Assessment on Science” contain implications for action. The report showed that the achievement of career-bound students improved when (1) Science departments enrolled more of them in college-preparatory Science courses (2) when Science teachers used methods that motivated students to work harder in and out of class (3) when teachers used open-ended, real-world problems in teaching Science and (4) when teachers used writing and oral presentations to get students to reflect on what they have learned. It was reported in the study that students from two vocational programs had average Science scores: Electronics and Drafting and Design. Students graduating from several additional fields of study had average science scores. Students also had significantly higher Science achievement if their technical teachers often stressed Science and if they had to use scientific principles daily or weekly to explain particular systems in their Technical Studies. The average Science scores of students in technical programs that should require in-depth knowledge of Science did not meet the “High School that Work” (HSTW) goal. These programs include Agriculture, Health, Family and Consumer Sciences, Technical, and Trade and Industrial. The report includes that 64 percent of students said they did not remember or their technical teachers never or seldom stressed Science. There was almost no change from 1993 and 1994 to 1996 in the percentage of students who said their technical teachers often stressed Science. It was suggested in the study that state and local leaders need to promote the integration of Science and technical studies through the following:

1. Arrange in-depth Science and Technology workshops for Science and technical teachers to expand the technical teachers’ knowledge of scientific concepts and processes and help the Science teachers discover “real-life” problems and issues that can be used as a vehicle for teaching Science.

2. Support academic and technical teachers in working together to encourage students to take the challenging Science courses that are coherently linked to their career concentrations.
3. Provide time and incentives for academic and technical teachers to plan together.

Moreover, Buttoms and Feagan (1997) said that schools and society have changed. It is no longer enough for students to learn facts in isolation. Rather, teachers must help students understand connections among subject areas and how the knowledge and skills acquired in school would fit the needs and demands of the workplace and postsecondary education. To do this, teachers must plan together to integrate learning. In the 1996 Assessment, 63 percent of students said their technical and Science teachers worked together. It was suggested in the report that Science and technical teachers:

1. Review national standards and select those that overlap to develop joint integrated lessons and projects for achieving the standards.
2. Seek support from school administrators for a common planning time.
3. Develop an end-of-program examination on Science facts, concepts, processes and problems that graduates of a given vocational program should know and understand.

4. Ask groups and/or individual students to design and conduct experiments on problems germane to their technical studies and to report their findings orally and in writing.

The “High Schools That Work” (HSTW) Assessment of students’ Reading, Mathematics and Science achievement demonstrated that schools implementing the HSTW key practices could raise achievement and improve students’ preparation for work and further education. These research briefs were based on findings of and implications from the HSTW Assessment.

In another study by Bottoms et al. (2000), Seventy-six high schools in eight urban districts are using the “High Schools That Work” goals and key practices to raise student achievement. More urban students met the HSTW performance goals for reading, Mathematics and Science in 2000 than in 1998. However, a major gap still exists between the achievement of students at urban high schools and at all HSTW sites. This research brief tells the progress that has been made in raising the achievement of urban students, the strategies that work in urban high schools, the challenges that urban schools face in the future and the actions that states and districts can take to improve urban schools.

The study by Buttons (2000) entitled “Putting Lessons Learned to Work by Improving the Achievement of Technical Students” reported that state and local leaders created the conditions and policies that support schools' actions to improve student achievement. This research brief answered three basic questions to help leaders take action to raise the academic achievement of vocational students: 1) What progress is being made?; 2) What things matter in raising achievement?; and 3) What can states and districts do to improve high schools for vocational students? The report was based on lessons learned in High Schools That Work since its inception in 1987. This was further supported recently that more than two-thirds of the students enrolled in vocational studies achieved the performance goals in Mathematics and Science. The participating schools were within reach of achieving the goal of getting 85 percent of technical students to meet performance goals. Furthermore, according to Bottoms (2000) the achievement goals in Mathematics and Science give schools and states targets in their efforts to prepare vocational students academically and technically for further study and jobs.

Third International Mathematics and Science Study (TIMSS)

The Third International Mathematics and Science Study (TIMSS), conducted in 1995, involved forty-two countries at three grade levels and was the largest, most comprehensive and rigorous assessment of its kind ever undertaken. In 1999, TIMSS-R collected data in thirty-eight countries at the eighth-grade level to provide information about change in the Mathematics and Science achievement of students compared to those in other nations over the last four years.

The TIMSS report provides a preliminary overview of the results for the Benchmarking Study in Mathematics. The real work will take place as each participating entity begins to examine its curriculum, teaching force, instructional approaches, and school environment in an international context. As those working on school improvement know fully well, there is no single factor that is the answer to higher achievement in Mathematics or any other school subject. Making strides in raising student achievement requires tireless diligence, as policy makers, administrators, teachers, and communities work to make improvements in a number of important areas related to educational quality (TIMSS 1999).

In the United States the opportunities to learn Mathematics is derived from an educational system that operates through states and districts, allocating opportunities through schools and then through classrooms. Improving students' opportunities to learn requires examining every step of the educational system, including the curriculum, teacher quality, availability and appropriateness of resources, student motivation, instructional effectiveness, parental support, and school safety (TIMSS 1999).

The data in the TIMSS (1999) result reinforced the point that participants usually did not significantly differ from each other. Although the differences in achievement between the high-performing and low-performing participants were very large.

Singapore, Korea, Chinese Taipei, and Hong Kong had the highest performance, closely followed by Japan, the Naperville School District, the First in the World Consortium, and Belgium. Naperville and First in the World both performed similarly to Hong Kong, Japan, and Belgium (Flemish), but significantly below Singapore, Korea, and Chinese Taipei. The difference in performance from one participant to the next was often negligible. Montgomery County, the Michigan Invitational Group, the Academy School District, the Project Smart Consortium, the Southwest Pennsylvania Mathematics and Science Collaborative, Michigan, Texas, Indiana, Oregon, Guilford County, Massachusetts, Connecticut, and Illinois were outperformed by only the top-performing eight or nine entities. These benchmarking jurisdictions had average achievement most similar to the Netherlands, the Slovak Republic, Hungary, Canada, Slovenia, the Russian Federation, Australia, Finland, the Czech Republic, and Malaysia. Pennsylvania and South Carolina had achievement similar to that of Latvia, the United States, and England, closely followed by North Carolina, Idaho, Maryland, Missouri, and the Fremont/Lincoln/Westside Public

Schools. The Delaware Science Coalition and the Jersey City Public Schools had average achievement similar to that of Italy, out-performing eleven and nine of the TIMSS 1999 countries, respectively. The Chicago Public Schools had average achievement close to that in Moldova, Thailand, and Israel. The Rochester City School District and the Miami-Dade County Public Schools had average eighth-grade mathematics performance lower than most of the TIMSS 1999 countries. Rochester had performance similar to the Republic of Macedonia, but significantly higher than Indonesia and Chile. Miami-Dade had average achievement about the same as the Islamic Republic of Iran, but significantly higher than the three lowest-scoring countries the Philippines, Morocco, and South Africa (TIMSS 1999).

TIMSS Mathematics Achievement

The Benchmarking Study of the TIMSS underscored the extreme importance of looking beyond the Mathematics averages to the range of performance found across the United States. Performance across the participating school districts and consortia reflected nearly the full range of achievement internationally. Although achievement was not as high as Singapore, Korea, and Chinese Taipei, the top-performing Benchmarking jurisdictions of the Naperville School District and the First in the World Consortium (both in Illinois) performed similarly to Hong Kong, Japan, Belgium (Flemish), and the Netherlands. At the other end of the continuum, urban districts with high percentages of students from low-income families, such as the Chicago Public Schools, the Rochester City School District, and the Miami-Dade County Public Schools, performed more similarly to lower-performing countries such as Thailand, Macedonia, and Iran, respectively, but significantly higher than the lowest-scoring countries (TIMSS 1999).

The TIMSS (1999) index of home educational resources (based on books in the home, availability of study aids, and parents' education level) showed that students with more home resources had higher Mathematics achievement. Furthermore, the benchmarking jurisdictions with the greatest percentages of students with high levels of home resources were among the top-performing jurisdictions, and those with the lowest achievement were four urban districts that also had the lowest percentages of students with high levels of home resources. These and other TIMSS 1999 Benchmarking results supported research indicating that students in urban districts with a high proportion of low-income families and minorities often attended schools with fewer resources than in non-urban districts. It also included less experienced teachers, fewer appropriate instructional materials, more emphasis on lower-level content, less access to gifted and talented programs, higher absenteeism, more inadequate buildings, and more discipline problems.

Mathematics at the eighth grade TIMSS 1999 Benchmarking Study showed relatively equivalent average achievement for girls and boys in each of the Benchmarking jurisdictions. This followed the national and international pattern where the United States was one of thirty-four countries in 1999 with girls and boys performing similarly (TIMSS 1999).

Of the five Mathematics content areas assessed by TIMSS, U.S. eighth graders performed higher than the international average in fractions and number; data representation, analysis, and probability; and algebra; measurement and geometry only in an international average. Despite the major differences among the benchmarking participants geographically, economically, and culturally, most to some extent followed the national pattern. It will be important, however, for each participant to determine its specific relative strengths and weaknesses in Mathematics achievement (TIMSS 1999).

The Benchmarking results indicated that students' relatively lower achievement in Geometry was most likely related to less coverage of geometry topics in Mathematics classrooms. Teachers also expressed the least confidence in their preparation to teach geometry (TIMSS 1999).

TIMSS Science Achievement

The top-performing benchmarking participants – the Naperville School District and the First in the World Consortium (both in Illinois), the Michigan Invitational Group, and the Academy School District (in Colorado) – all had average achievement comparable to the world class performance of Chinese Taipei and Singapore (TIMSS 1999). However, the Benchmarking Study underscored the extreme importance of looking beyond the averages to the range of performance found across the U. S., as performance across the participating school districts and consortia reflected nearly the full range of achievement internationally (TIMSS 1999). In contrast to the top performers, urban districts with high percentages of students from low-income families – the Rochester City School District, the Chicago Public Schools, the Jersey City Public Schools, and the Miami-Dade County Public Schools – performed more similarly to lower-performing countries such as Jordan, Iran, Indonesia, Turkey, and Tunisia, but significantly higher than the lowest-scoring countries (TIMSS 1999).

In the same way with the Mathematics achievement, the TIMSS (1999) index of home educational resources (based on books in the home, availability of study aids, and parents' education level) showed that students with more home resources have higher Science achievement. Furthermore, the benchmarking jurisdictions with the greatest percentages of students with high levels of home resources were among the top-performing jurisdictions, and those with the lowest achievement were four urban districts that also had the lowest percentages of students with high levels of home resources. These and other TIMSS 1999 benchmarking results supported research indicating that students in urban districts with a high proportion of low-income families and minorities often attend schools with fewer resources than in non-urban districts. This also included less experienced teachers, fewer appropriate instructional materials, more emphasis on lower-level content, less access to gifted and talented programs, higher absenteeism, more inadequate buildings, and more discipline problems (TIMSS 1999).

The Science at the eighth grade TIMSS 1999 benchmarking study showed relatively unequal average achievement for girls and boys in many of the benchmarking jurisdictions, and in the United States overall. Boys had significantly higher average Science achievement than girls in ten of the thirteen benchmarking states, with Massachusetts, South Carolina, and Texas the exceptions. Gender differences were less prevalent among the Benchmarking districts and consortia, with significant differences in just four jurisdictions: the First in the World Consortium, Guilford County, Naperville, and the Southwest Pennsylvania Mathematics and Science Collaborative. This followed the national and international pattern where the

United States was one of sixteen countries in 1999 where boys significantly outperformed girls (TIMSS 1999).

Of the six Science content areas assessed by TIMSS, U.S. eighth graders performed higher than the international average in Earth Science, Life Science, Chemistry, Environmental and Resource Issues, and Scientific Inquiry and the nature of Science, but only at the international average in Physics. Some of the lowest-performing benchmarking participants had more success in the Life Sciences and Inquiry than in the other content areas. It will be important, however, for each participant to determine its specific relative strengths and weaknesses in Science achievement (TIMSS 1999).

Although many countries teach eighth-grade science as separate subjects (namely, Earth Science, Biology, Physics, and Chemistry), most jurisdictions in the United States teach Science as a single general or integrated subject. It naturally follows, then, that teachers in the U.S. overall and in the majority of the benchmarking entities reported a relatively heavy emphasis given to General/Integrated Science among the Science content areas. In the U.S., teachers of 41 percent of the students reported that General Science was emphasized most in their classes, compared with 28 percent for Earth Science, 21 percent for physical science (chemistry/physics), 5 percent for Biology, 3 percent for Chemistry, and 2 percent for Physics (TIMSS 1999).

The 1999 TIMSS reports concerted effort across the U. S. at the state and local levels in writing and revising academic standards in various academic subjects. In Science, most states were in the process of implementing new content or curriculum standards or revising existing ones. All but four states now have standards in Science. Twenty-nine states also have some type of criterion-referenced Science assessment aligned to state standards. Much of this effort has been based on work done at the national level over the past decade to develop standards aimed at increasing the Science literacy of all students.

Attitude

There is considerable evidence to support the contention that attitude beliefs contribute to academic achievement by enhancing the motivation to achieve (Bandura 1977). For example, Schunk (1980) in a number of studies, had shown that children with the same level of intellectual capability differ in their performance as a function of their level of attitude.

Enemark and Wise (1981) demonstrated that the attitudinal variables were significant indicators of Mathematics achievement, and few of the attitudinal variables also showed strong relationship with Mathematics achievement even after background and academic orientation variables were controlled.

Steinkamp (1982) concluded that primary among the variables that determine achievement in Mathematics is attitude in Mathematics. These conclusions represented the view of a strong relationship between achievement and attitude.

According to Brush (1985) that more girls than boys have lower or less positive attitudes toward Mathematics in the middle grades and these attitudes continue through high school.

Attitude beliefs have also been shown to play a mediational role in academic attainment, especially between instructional or induced-strategy treatments and academic outcomes. Schunk and Gunn (1986) reported that children provided with strategy instruction and training in self-monitoring and self-correcting increased performance both directly and through the enhancement of attitude. In the same way, they also found that training in verbal self-guidance increased both attitude and reading comprehension skill.

According to Kehr (1986), interests, attitude, values and expectancies were associated of such educational outcomes as occupation. It was also noted that many writers currently hold the view that while there are some minor cognitive differences in achievement, attitude play more significant role in the outcome.

Cheung (1988) prepared a study to examine the relationship between Mathematics achievement and attitudes toward Mathematics in junior secondary schools in Hong Kong. It was found that the correlation between the attitude and Mathematics achievement were positive. It showed that the more positive the students attitude towards Mathematics, the higher the achievement. The greatest correlation was associated with self, a measure of the students' own estimation of their abilities in doing Mathematics. Another two larger correlations were associated with students' perceptions of the usefulness of Mathematics in society and Mathematics as a creative subject. The results support that if the student found Mathematics useful in their daily lives through the activity approach that some teachers employ, then the students were more likely to consider Mathematics creative. The more confident a person, the better his/her performance, especially in academic subjects like Mathematics. Surprisingly, there was little research evidence linking favorable attitudes to Mathematics and achieving highly in Mathematics. It had been found to be difficult to determine whether the attitude to Mathematics is affecting the achievement or vice versa, even when a correlation did occur.

Skinner, Wellborn, and Connell (1990) sought to predict achievement. They used "control beliefs," as somewhat more complex construct of beliefs than attitude, one that combined capacity and strategy beliefs with more generalized expectations, They found that elementary school children’s perceived control influenced academic performance by promoting or undermining engagement in learning activities.

Pintrich and De Groot (1990) found a significant negative correlation between test anxiety, often considered a manifestation of attitude, and achievement among seventh graders, while Bandura, Zimmerman, and Martinez-Pons (1992) found a strong relationship between high school students' grade goals, another reflection of value or drive, and their school achievement. Other studies supported the importance of attitude or value, using sources other than incentives, as a factor related to achievement (Pintrich and Schrauben 1992).

In one of Tukmans collaborative studies (Tuckman and Sexton 1991), encouraging feedback was found to increase attitude on the task and subsequent performance on the task. Statistical analyses showed that when performance was held constant, encouragement was seen to affect attitude, but when attitude was held constant, encouragement had no effect on performance. Hence, self-efficacy functioned as a mediator of performance (Tuckman and Sexton, 1991).

Wigfield and Eccles (1992), building on the work of Atkinson in 1966, argued that incentive value of a task was an important determinant of task choice, and that individuals would tend to do tasks that they positively value and avoid those that they negatively value. They cited that the tendency to show enhancing the incentive value of studying, a person's drive to engage in that task increased the level of achievement.

A study made by Ma and Kishor (1997) assessed the magnitude between attitude toward Mathematics and achievement in Mathematics. The researchers conducted a meta-analysis to integrate and summarize the findings from 113 primary studies. The statistical results of these studies were transformed into a common effect size measure, correlation coefficient. This relationship was found to be dependent on a number of variables: grade ethnic background, sample selection, sample size, and date of publication.

The work of Tuckman (1999) compared the task performance of students at high, intermediate, and low levels of attitude with regard to the task. The highest attitude group was found to be twice as productive as the middle group, and ten times as productive as the low group. Moreover, the high group outperformed their own expectations by 22%, the intermediate group equaled their own expectations, and the low group fell below their own expectations by 77%. The results reflect a clear relationship between attitude beliefs and academic productivity.

A review made by Middleton and Spanias (1999) examined recent research in the area of motivation in Mathematics education and discussed findings from research perspectives in this domain. Consistencies across research perspectives were noted suggesting a set of generalizable conclusions about the contextual factors, cognitive processes, and benefits of interventions that affect students' and teachers' motivational attitudes. Criticisms were brought up concerning the lack of theoretical guidance driving the conduct and interpretation of the majority of studies in the field. Few researchers had attempted to extend current theories of motivational attitude in ways that were consistent with the current research on learning and classroom discourse. In particular, researchers interested in studying motivational attitudes in the content domain of school Mathematics needed to examine the relationship that existed between Mathematics as a socially constructed field and students' desire to achieve.

A meta-analysis study by Ma (1999) examined twenty six studies on the relationship between anxiety toward Mathematics and achievement in Mathematics among elementary and secondary students. The common population correlation for the relationship is significant (–0.27). A series of general linear models indicated that the relationship was consistent across gender groups, grade-level groups, ethnic groups, instruments measuring anxiety, and years of publication. The relationship, however, differed significantly among instruments measuring achievement as well as among types of publication. Researchers using standardized achievement tests tended to report a relationship of significantly smaller magnitude than researchers using Mathematics teachers' grades and researcher-made achievement tests. Published studies tend to indicate a significantly smaller magnitude of the relationship than unpublished studies. There were no significant interaction effects among key variables such as gender, grade, and ethnicity.

A study by Koller, Baumert and Schnabel (2001) in a total of 602 students (59.5% female) from academically selected schools in Germany were tested at three time points: end of grade 7, end of grade 10, and middle of grade 12. They investigated the relationships between academic interest and achievement in Mathematics. In addition, sex differences in achievement, interest, and course selection were analyzed. At the end of grade 10, students opted for either a basic or an advanced Mathematics course. Data analyses revealed sex differences in favor of boys in Mathematics achievement, interest, and opting for an advanced Mathematics course. Further analyses by means of structural equation modeling showed that interest had no significant effect on learning from grade 7 to grade 10. But it affected course selection where highly interested students were more likely to choose an advanced course. Furthermore, interest at the end of grade 10 had a direct and an indirect effect (via course selection) on achievement in upper secondary school. In addition, results suggest that, at least from grade 7 to grade 10, achievement affected interest. Achievers expressed more interest than low achievers. The findings underlined the importance of interest for academic choices and for self-regulated learning when the instructional setting is less structured.

Review of Related Local Studies

Technical Education

Dizon (1991) made a comparative study of the performance of Bosconian and Non-Bosconian secondary graduates at Don Bosco Technical College from school year 1985 to 1990. His report emphasized on the nature of vocational education although the technical curriculum he is referring to in a Don Bosco school has a different concept. In the report, he also noted the distinction of the education program of Technical Education of a Don Bosco school from a vocational education. It was emphasized in the report that the Don Bosco Technical Education is both general and specialized. The general education enables a graduate to pursue any postsecondary or tertiary studies. The specialized education aims to prepare the students for Engineering and technical courses. At the same time, the course is designed to equip the students with basic skills and attitudes toward work that may enable a student to land a gainful occupation after graduation. Furthermore, the findings of Dizon's (1991) study indicated that the technical average during high school was significantly related to Workshop and Drafting achievement. It was shown that across the 5 years (1985 – 1990) the registered grades of students in the technical subject and their grade in drafting and workshop consistently correlated. It was concluded in the study that the high school technical program confers on its high school graduates to such skills in drafting enabled them to achieve better grades after graduation in other technical courses.

Junia (1994) made a study to find out the perceptions of the 1980 – 1990 graduates and their present employers/supervisors regarding the adequacy of the chemical technology curriculum to the graduates' present industrial job. A questionnaire was used to assess the graduates in terms of their theoretical knowledge, job practical knowledge, manual job skill, communication skill and personal relation skill. It was found that there was significant difference between the theoretical knowledge of the graduate and employer, no difference in job practical knowledge, a significant difference in manual job skill, no difference in their communication skill and no difference in their personal relation skill. The implications of the study included to raise the competencies of students in Theoretical knowledge, include laboratory or shop work in all subjects, acquire instruments needed, assess the on the job training and additional hours for training.

Miciano (1998) did a similar study and used the same instrument in the study of Junia. However, his study was a comparison between the profiles of Don Bosco Technical School and Vunabosco Agro-Technical School in Papua New Guinea. The instrument was simplified into five categories that included theoretical knowledge, technical skill, communication skills and personal relations skills. Generally there was no significant difference in the profiles of the Technical students but they were adequately prepared for their job.

Achievement

Dalupang (1981) made a study on the relationship between beliefs in locus of control and intellectual-academic achievement. It was reported in the study that there was a significant relationship between beliefs in internal responsibility for failures and achievement. Moreover, there was a significant relationship between belief in internal locus of control and achievement. The study helped explain the nature of achievement and attitude since the beliefs and locus of control are attitudinal variables in nature. It showed that even in a different component of attitude it was still significantly related to achievement.

Enriquez (2001) made a study on Mathematics and Science Education in two public school in Metro Manila. In the study, teacher motivation, and students achievement were correlated. The results indicated a significant relationship between student achievement in Mathematics and Science and students motivational attitude. It was further explained that motivation made a difference in students learning and academic success.

Summary

The literature showed that the major emphasis of Technical Education as part of the secondary curriculum is to enhance students skills in technical areas in preparing them for future Engineering and technically related courses. The literature reviewed showed that Mathematics and Science achievement was a root for Technical Studies. The TIMSS report gave a feedback to educators to examine the curriculum, teaching force, instructional approaches, school environment in an international context base on the performance of each country. Various studies were provided showing factors to improve performance of students in Mathematics and Science (Bottoms and Faegan 1997; Laeth 1995; Xin Ma and Kishor 1997; Middletown and Spanias 1999; Koller, Baumert and Schnabel 2001; Buttoms 2000). Most comprehensively, it was shown across studies that attitude plays an influential factor relating to achievement.

This study was similar with the studies mentioned since the variables attitude and achievement was used. It was indicative that most literature couple achievement in a subject area paralleled with the attitude towards the subject area. This study was unique in a way that it explores Mathematics and Science achievement coupled with the attitude of the areas' application, specifically Technical Education.

This study was different from other studies since other studies related Mathematics and Science achievement with the attitude in the same subject area. In other studies, attitude was viewed with the components of motivation and other social factors as leading to achievement. In this study, Mathematics and Science achievement is correlated with Attitude Towards Technical Education.

CHAPTER III

METHODOLOGY

This chapter presents the research design of the study, a description of the research setting and the research population, the instruments used, and the statistical procedure utilized to analyze collected data.

Research Design

This study made use of the descriptive method of research. This method describes and integrates what exists. It is concerned with constant conditions, opinions that are held, and processes that are going on (Best and Kahn 1998). Descriptive research is used to provide a systematic description that is as factual and accurate as possible (Joppe 2002). Descriptive research provides data about the population being studied. However, it can only describe the "who, what, when, where and how" of a situation, not what caused it. In this study, the relationship among the following variables was studied: Mathematics achievement and attitude towards technical education, and Science achievement and attitude towards technical education.

Research Setting

The research was conducted at Caritas Don Bosco School where Technical Education is part of the curriculum (see APPENDIX 1). The school is located at Laguna Technopark, Binan Laguna.

As a Don Bosco School, Technical Education is provided for the high school students as part of their curriculum. Technical Education is indicated in the vision of the school which states that "Caritas Don Bosco School molds well-rounded individuals into competent leaders of the church and technically capable citizens of the society." The school necessitates the inclusion of Technical Course for students in high school. The school goals for the Technical Education curriculum includes: (1) Knowledge of and skill in the fundamental principles of arithmetic; (2) A knowledge and understanding of laws and principles of elementary science; (3) An understanding and appreciation of the importance and purpose of social and economic institutions; (4) Habits of industry, thrift, promptness and resourcefulness; (5) An ability to adapt oneself to a changing environment; (6) Knowledge of the world of work, its importance, and the economic interdependence of men; (7) A respect for honest work regardless of social and economic level (Magno 2002).

Research Population

The population of this study is composed of all 191 first and second year high school students of Caritas Don Bosco School. There were 107 first year and 84 second year students with 126 males and 65 females ages 11 to 14. All high school students (100% of the population) participated in this study.

Table 1. Distribution of the Population Across Gender and Level

Level	Males	Females	No. of students
First Year	70	37	107
Second Year	56	28	84
Total	126	65	191

Research Instruments

Attitude Towards Technical Education (ATTE)

The ATTE is a scale that measures students' perceived degree of importance of the Technical Education they are taking. This instrument was constructed and developed by the researcher. It is composed of twenty items describing the dispositions towards Technical Education (See APPENDIX 2). The scale has two factors: Task Value and Expectation. There are eleven items measuring task value and nine items measuring expectation. The table of specifications below shows the items under each factor.

Table 2. Table of Specifications for the items of ATTE

	Task Value	**Expectation**
Item Number	3, 4, 6, 7, 8, 9, 13, 15, 17, 18, 19	1, 2, 5, 10, 11, 12, 14, 16, 20

Test Construction Procedure

1. *Search for Content Domain.* The concept of 'Attitude Towards Technical Education' was conceptualized because of a need of Caritas Don Bosco School to survey the general disposition of students towards Technical Education. The concept was operationalized through constructing an inventory that specifically measures students' Attitude Towards Technical Education. Secondary school curriculum references were reviewed to see the direction of Technical Education. The references provided objectives as to what students will attain for a Technical Education class. The school with its technical advisory board formulated objectives for the Technical Education curriculum of Caritas Don Bosco School. The items were then constructed based on these objectives.

Based on the concepts of task value and expectation the items on the inventory was further improved.

Since attitude emphasizes favorability or unfavorability, the response format is numeric. In the numeric scale, the items are judged on a single dimension and arrayed on a scale with equal intervals. The scale label is about the students' perceived degree of importance for each item. The more the respondent judges the items as important, the higher is the numerical value. The scale used is as follows:

5 – Very important
4 – important
3 – Not sure
2 – Unimportant
1 – Very unimportant.

2. Item Review and Content Validation. The items were initially reviewed through e-mail by Dr. Richard J. Riding of the Assessment Research Unit, School of Education at the University of Birmingham in Egbaston (R.J.Riding@bham.ac.uk) and Mr. Jonathan Baclig, the Operations Engineering Head of Intel in California (Jbaclig@intel.edu.ph). A panel of faculty members of the Education Department of Ateneo de Manila University who reviewed this study recommended the items to be fit to the kind of curricular program Caritas Don Bosco School offers. The items were revised making them correspond with the aims of the Technical Education subject offered by Caritas Don Bosco School. The items were then sent for critiquing to the Center for Research and Training at the Don Bosco Technical College in Mandaluyong and the researcher's adviser. Subsequent revisions were done based on these critiques.

3. Scaling Technique. The inventory measures two constructs – Task Value and Expectation. There are eleven items for Task Value and nine items for the

Expectation. The items for Task Value are stated in a specific tasks that students engage in with the subject while the items under Expectations reflect what the students will achieve in the Technical subject.

4. Directions for Responding. The instructions were read by the test administrator. The students were given information about the inventory and how to answer it. The respondents encircled the number corresponding to their own judgment for each item. The items were read to them by the test administrator. The inventory could be answered within ten to fifteen minutes. The instrument was administered within the period of the General Technology Subject since the students were focused on the subject itself and appropriate concentration was established. The students responded using a five-point scale indicating their attitude on how important each item is. The scale was scored as 5 - Very important; 4 – Important; 3 – Not sure; 2 – Unimportant; 1 - Very unimportant. The numbers encircled were tabulated for each factor. The responses for Expectation were summated. The same process was followed for the responses for Task Value scores.

5. Directions for Scoring. The response of the students in the 11 items for Task value will be summated separately with the 9 items in Expectations. The total score for Task Value and Expectation when combined will the score for general ATTE. The table for interpretation is then used.

6. Pilot Testing. After the scale analysis, final draft of the inventory was constructed. The final draft of the ATTE was pilot tested with 100 students studying at Don Bosco High School in Canlubang (see APPENDIX 3). These students were also involved in a Technical Education subject similar to the program offered by Caritas Don Bosco School. A letter was first given to the principal and technical coordinator of Don Bosco High School requesting permission to administer the inventory to their students (see APPENDIX 4). The inventory was administered to fifty first year and fifty second year students. The responses for the inventory was recorded for both Task Value, Expectation, and overall score. The scores for each item were encoded in SPSS. The alpha reliability of the test is 0.86.

Tables for Interpretation

To interpret the scores for Task Value, the scores for item numbers 3, 4, 6, 7, 8, 9, 13, 15, 17, 18, 19 are summated (see APPENDIX 5) and the following table is be used.

Table 3. Interpreting Task Value

Class interval of Scores	Remark	Interpretation
47 and above	Very High Task Value Attitude Towards Technical Education	Tends to affirm greatly the task of performing actual technical work. Tends to create technology that is functional and meaningful. Tends to possess work habits that is expected of a good learner. Tends to be enthusiastic and well-motivated in working and studying in the filed of Technical Education.
38 – 46	High Task Value Attitude Towards Technical Education	Tends to perform task well in Technology related work. Tends to produce quality work given the appropriate time. Tends to develop more skills as one continues to assimilate information during work. Tends to possess good habits needed in the shop class.
29 – 37	Moderate Task Value Attitude Towards Technical Education	Tends to perform necessary task to be done. Tends to work with the given requirements in the shop class. Tends to learn the basic operation of different technologies taught in class. Works and shows good habits when needed.
20 – 28	Low Task Value Attitude Towards Technical Education	Is predisposed to the need to be reminded of the progress and performance in different tasks and activities. Tends to possess some or few habits that need to be practiced in the shop class. Tends to need more training in optimum work performance.
19 and below	Very Low Task Value Attitude Towards Technical Education	Is predisposed to the need to have a big push to perform well on assigned tasks and activities. Tends to need more time to develop important habits in handling technology.

To interpret the score for Expectation, the scores for item numbers 1, 2, 5, 10, 11, 12, 14, 16, 20 are summated (see APPENDIX 6) and the following table is used.

Table 4. Interpreting Expectation

Class interval of scores	Remark	Interpretation
37 and above	Very High Expectation in Attitude Towards Technical Education	Values greatly the training for Technical Education. Appreciates well the quality of one's work. Prepared and ready for more learning in the field of Technical Education.
30 – 36	High Expectation in Attitude Towards Technical Education	Tends to give importance in the need to learn skills necessary for work. Tends to prepare oneself in the field of Technical Education.
23 – 29	Moderate Expectation in Attitude Towards Technical Education	Tends to give regard to the acquisition of knowledge learned in technical education. Tends to see oneself in preparing for courses and work in the field of Technical Education.
16 – 22	Low Expectation in Attitude Towards Technical Education	Is predisposed to the need for guidance in realizing the importance of acquiring and training in Technical Education. Needs to be reminded to prepare oneself for learning.
15 and below	Very Low Expectation in Attitude Towards Technical Education	Is predisposed to the needs to realize more the importance of acquiring knowledge and training in Technical Education. Predisposes the need to prepare work-oriented skills.

To interpret the scores for the ATTE, the following tables are used. The responses of the subjects in all twenty items are summated to arrive with a general ATTE score (see APPENDIX 7).

Table 5. Interpreting General Attitude Technical Education

Class interval of scores	Remark	Interpretation
84 and above	Very High General Attitude Towards Technical Education	Tends to perform well and tendency to be successful in areas concerning technical work and training. Tends to possess good habits and sets a goal leading to quality of work done.
68 – 83	High Attitude Towards Technical Education	Tends to perform well and practices the necessary skills and habits expected.
52 – 67	Moderate Attitude Towards Technical Education	Generally favorable to Technical Education and performs on assigned tasks. Tends to be trainable and can posses habits necessary for technical training.
36 – 51	Low Attitude Towards Technical Education	Is predisposed to the need to focus on one's work and performance. Predisposes the need to be exposed on activities that would enhance once skills and develop ones' habits necessary for attaining quality performance
35 and below	Very Low Attitude Towards Technical Education	Is predisposed to the need for more supervision and guidance from others to perform well. Predisposes the need to improve ones behavior to attain better performance.

Metropolitan Achievement Test (MAT)

The MAT is used to assess student achievement in five disciplines: Reading, Mathematics, Language, Science, and Social Studies. The test is available in fourteen levels covering kindergarten to grade 12. The test also reflects current emphasis on the assessment of critical thinking in a realistic content. It measures content that includes Word Recognition, Vocabulary, Reading Comprehension, Mathematical Concepts and Problem Solving, Mathematical Procedures, Listening, Prewriting, Composing, Editing, Spelling, Science, Social Studies, and Research Skills. It measures thinking skills in all content areas. Specifically in the Mathematics component, tests were constructed to be appropriate for the use of either traditional or progressive Mathematics instruction. The Science test emphasizes process skills and reasoning ability within Life Science, Physical Science, and Earth Science.

Mathematics factor level 8 and 9

Arithmetic Operations. This includes computation. Results from this test may be reported by the operation or by the kind of number used in the operation. Many of these items are presented in context so that the student must select an appropriate operation as well as perform the computation.

Concepts and Problem Solving. Measures a student's facility for applying mathematics to many different kinds of problems and evaluating their results. This area is composed of number operations, patterns, relations, algebra, geometry and measurement, data, statistics and probability.

Testing time for Mathematics level 8 and 9 is sixty minutes with fifty items.

Science factor level 8 and 9

The Science test measures the students understanding of how nature and the processes of Science help them function more effectively in a complex society. High school students are tested on the more specialized Science disciplines like Physiology, Physics, Chemistry, Biology, and Earth and Space Sciences. The items ask students to apply an understanding of a concept to a situation, to interpret data, draw conclusions and predict events.

Testing time for Science level 8 and 9 is sixty minutes with fifty items.

Reliability and Validity Indices

The Kuder–Richardson Formula 20 estimates MAT's internal consistency. The reliability of the test is 0.93. Construct, content, and criterion-related validities have been reported to be adequate.

Scoring

Each form and level of the MAT has a separate set of hand scoring stencil keys. A line is drawn through all the answers on the answer spaces with multiple marks so that no credit will be given for them. The number of answer marks appearing through the holes in the perforated stencil key is counted. The raw scores are recorded for each test in the Score Summary Box. The raw score is obtained as an index of achievement. It is the number of correct answers obtained on a test (see APPENDIX 8). To aid in interpretation, raw scores are converted into other type of scores that are more meaningful (Harcourt 2001).

Table 6. Interpreting Scores in the MAT for Mathematics First Year High School

Raw score	Scaled score	Percentile	Stanine	Remark
41 – 50	766 – 996	77 - 99	7 – 9	Above Average
29 – 40	662 – 763	23 – 76	4 - 6	Average
1 – 28	511 – 659	1 – 22	1 - 3	Below Average

Table 7. Interpreting Scores in the MAT for Mathematics Second Year High School

Raw score	Scaled score	Percentile	Stanine	Remark
44 – 50	797 – 999	77 – 99	7 – 9	Above Average
32 – 43	685 – 794	23 – 76	4 - 6	Average
1 – 31	543 – 683	1 – 22	1 - 3	Below Average

Table 8. Interpreting Scores in the MAT for Science First Year High School

Raw score	Scaled score	Percentile	Stanine	Remark
39 – 50	788 – 999	77 – 99	7 – 9	Above Average
22 – 38	575 – 783	23 – 76	4 - 6	Average
1 – 21	417 – 570	1 – 22	1 - 3	Below Average

Table 9. Interpreting Scores in the MAT for Science Second Year High School

Raw score	Scaled score	Percentile	Stanine	Remark
39 – 50	801 – 999	77 - 99	7 – 9	Above Average
26 – 38	611 – 795	23 – 76	4 - 6	Average
1 – 25	432 – 607	1 – 22	1 - 3	Below Average

Data Gathering Procedure

The researcher made the MAT and ATTE available for the targeted 193 high school students of Caritas Don Bosco School. A letter was drafted and given to the principal and assistant principal of Caritas Don Bosco School informing them of the request to administer the achievement test and the ATTE to the high school students

(See APPENDIX 9). The principal and assistant principal were informed of the nature of the study. Upon approval the researcher coordinated with the guidance office to administer the achievement test on the day scheduled. The students and teachers were then informed about the schedule of the achievement test to be taken.

For the ATTE, the procedure on how to administer, interpret and score the questionnaire were explained to the General Technology teacher. The ATTE was given a week before the MAT was administered. It was administered during the General Technology class by the teacher.

Statistical Treatment

To answer problems 1, 2, 3 and 4 the mean and standard deviation were determined from the raw scores. The mean and the standard deviation were used to get the profile of students' Mathematics achievement, Science achievement and Attitude Towards Technical Education.

The formula for the mean and standard deviation are as follows (Downie and Heath 1984):

$$\overline{X} = \frac{\Sigma X}{N}$$

where:

ΣX = Summation of scores

N= Number of cases

Standard Deviation Formula (Downie and Heath 1984):

$$SD = \sqrt{\frac{\Sigma(X - \bar{X})^2}{n}}$$

where:

SD = standard Deviation

$\Sigma(X - \bar{X})^2$ = summation of squared scores

n = sample

To answer problems 5, 6, 7, and 8, the Pearson Product-Moment Correlation (r) was used to determine whether there is a relationship between Mathematics Achievement and Attitude Towards Technical Education, and Science achievement and attitude towards technical subject. The r values were squared to get the coefficient of determination which is the percent of the variance in X accounted for by Y.

The formula for the Pearson r and coefficient of determination are as follows (Downie and Heath 1984):

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N\Sigma X^2 - (\Sigma X)^2]\,[N\Sigma Y^2 - (\Sigma Y)^2]}}$$

where:

r = correlation coefficient

N = population

$\sum X$ = summation of scores in variable A

$\sum Y$ = summation of scores in variable B

Coefficient of Determination Formula:

$cd = r^2$

where:

cd = coefficient of determination

r = correlation coefficient

To interpret the degree of relationship among the variables the following scale was used (Calderon and Gonzales 1986).

Table 10. Interpreting the Degree of Correlation

Correlation Coefficient Value	**Interpretation**
0.80 – 1.00	Very high relationship
0.6 – 0.79	High relationship
0.40 – 0.59	Substantial/marked relationship
0.2 – 0.39	Low relationship
0.00 – 0.19	Negligible relationship

The Fisher's t-test was used to determine whether the correlations found are significant or not. The significance level was set up at p=0.05

The formula for the Fisher's t-test (Downie and Heath 1984):

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

where:

t – significant test of r

r – correlation coefficient

N – Population

N – 2 – standard error

CHAPTER IV

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This chapter presents, analyzes and interprets the data gathered following the sequence of the specific questions posed by this study.

Question No. 1 What is the profile of Attitude Toward Technical Education of first year high school students in the following:

1.4 Task Value?

1.5 Expectation?

1.6 general Attitude Towards Technical Education?

Table 11 shows the frequency distribution profile of Task Value scores of first year high school students is shown.

Table 11. Task Value Scores Of First Year High School Students

Scores	Frequency	Percentage	Remarks
47 and above	23	21.5%	Very High Task Value
38 – 46	71	65.14%	High Task Value
29 – 37	12	11.21%	Average Task Value
20 – 28	1	0.93%	Low Task Value
19 and below	0	0%	Very Low Task Value
N=	107	100%	

The scores of first year high school students on Task Value show that most of them (65.14%) had scores from 38 to 46. Most of them were in the area of high Task Value. There were 23 students (21.5%) scored very high in Task Value, 71 students (65.14%) scored high in Task Value, 12 students (11.21%) scored low in Task Value, only 1 student (0.93%) scored low in Task Value and no student scored very low in Task Value.

Table 12 shows the frequency distribution profile of expectation scores of first year high school students.

Table 12. Expectation Scores Of First Year High School Students

Scores	frequency	Percentage	Remarks
37 and above	52	48.6%	Very High Expectation
30 – 36	45	42.06%	High Expectation
23 – 29	10	9.35%	Average Expectation
16 – 22	0	0%	Low Expectation
15 and below	0	0%	Very Low Expectation
N=	107	100%	

The scores of first year high school students on Expectation show that most of them (48.6%) had scores from 37 to 45. Most of them were in the area of very high Expectation. Almost half of the students (48.6%) had very high Expectation scores. Only 10 students (9.35%) scored in the average Expectation and 45 students (42.05%) scored High in Expectation. No students scored Low and very low in Expectation.

Table 13 shows the frequency distribution of general ATTE scores of first year high school students.

Table 13. General ATTE Scores Of First Year High School Students

Scores	Frequency	Percentage	Remarks
84 and above	31	28.97%	Very High general ATTE
68 – 83	64	59.81%	High general ATTE
52 – 67	12	11.21%	Average general ATTE
36 – 51	0	0%	Low general ATTE
35 and below	0	0%	Very Low general ATTE
N=	107	100%	

The scores of first year high school students on general ATTE showed that most of them (59.81%) had scores from 68 to 83. Most of them are in the area of high general ATTE. There were 31 students (28.97%) who scored very high in general ATTE and 12 students (11.21%) who scored low in general ATTE. There were no students who scored low and very low in general ATTE.

Table 14 shows the profile of first year high school students in Attitude Towards Technical Education.

Table 14. Attitude Towards Technical Education Of First Year High School Students

	Mean	Standard Deviation	Remark
Task Value	42.63	5.15	High Task Value
Expectation	35.79	4.44	High Expectation
General ATTE	78.42	8.78	High General Attitude

The mean (42.63) for Task Value shows that first year high school students have a high Task Value in Attitude Towards Technical Education. This indicated that the first year students tend to perform tasks well in Technology related work. They tend to produce quality work given the appropriate time. They tend to develop more skills as they continue to assimilate information while working. They tend to possess good habits needed in the shop class. A high value was obtained from the group since most of the scores for Task Value are high. This could be due to the fact that the task done in every class time in Technical Education was task focused and concentrated on the job to be accomplished.

The mean (35.79) for Expectation shows that the first year high school students had a high Expectation in Attitude Towards Technical Education. This indicated that they tend to give importance in the need to learn skills necessary for work. They tend to prepare themselves in the field of Technical Education. The high score in Expectation could be due to the fact that even though more time was spent in doing actual work projects, students were still evaluated and tested on the carpentry class.

The mean (78.42) for general ATTE showed that the first year high school students had a high general Attitude Towards Technical Education. This indicated that they tend to perform well and practices the necessary skills and habits expected. A high value was obtained since they generally enjoyed both actual and theoretical activities done in class.

The reported standard deviations for Task Value (5.15), Expectation (4.44) and general ATTE (8.78) show that the scores were minimally dispersed.

Question No. 2 What is the profile of Attitude Towards Technical Education of second year high school students in the following:

2.1 Task Value?

2.2 Expectation?

2.3 general Attitude Towards Technical Education

Table 15 shows the frequency distribution of Task Value scores of second year high school students.

Table 15. Task Value Scores Of Second Year High School Students

Scores	Frequency	Percentage	Remarks
47 and above	30	35.71%	Very High Task Value
38 – 46	45	53.57%	High Task Value
29 – 37	9	10.71%	Average Task Value
20 – 28	0	0%	Low Task Value
19 and below	0	0%	Very Low Task Value
	84	100%	

The scores of second year high school students on Task Value showed that most of them (53.57) had scores from 38 to 46. Most of them were in the area of high Task value. Half of the students (53.57%) scored very high on Task Value. There were 30 students (35.71%) who scored Very high on Task Value and 9 students (10.71%) scored average on Task Value. There were no students who scored low and very low in Task Value.

Table 16 shows the frequency distribution of Expectation scores of second year high school students

Table 16. Expectation Scores Of Second Year High School Students

Scores	Frequency	Percentage	Remarks
37 and above	51	60.71%	Very High Expectation
30 – 36	33	39.29%	High Expectation
23 – 29	0	0%	Average Expectation
16 – 22	0	0%	Low Expectation
15 and below	0	0%	Very Low Expectation
	107	100%	

The scores of first second high school students on Expectation showed that most of them (60.71%) had scores from 37 to 45. Most of them were in the area of very high Expectation. There were 33 students (39.29%) who scored high in Expectation and no students scored in average, low and very low in Expectation.

Table 17 shows the frequency distribution of general ATTE scores of second year high school students.

Table 17. General ATTE Scores Of Second Year High School Students

Scores	Frequency	Percentage	Remarks
84 and above	35	41.67%	Very High general ATTE
68 – 83	46	54.76%	High general ATTE
52 – 67	3	3.57%	Average general ATTE
36 – 51	0	0%	Low general ATTE
35 and below	0	0%	Very Low general ATTE
	107	100%	

The scores of second year high school students on general ATTE showed that most of them (54.76%) had scores from 68 to 83. Most of them were in the area of high general ATTE. Half of the students (54.76%) scored high in general ATTE, 35 students (41.67%) scored very high in general ATTE and 3 students (3.57%) scored average in general ATTE. No students scored from low to very low general ATTE.

Table 18 shows the profile of second year high school students Attitude Towards Technical Education.

Table 18. Attitude Towards Technical Education Of Second Year High School Students

	Mean	Standard Deviation	Remark
Task Value	44.11	5.12	High Task Value
Expectation	37.43	3.39	Very High Expectation
General ATTE	81.55	8.07	High General Attitude

The mean value (44.11) for Task Value shows that second year students have a high Task Value in Attitude Towards Technical Education. This indicated that the second year students tend to perform tasks well in Technology related work. They tend to produce quality work given the appropriate time. They tend to possess more skills as one continues to assimilate information while working. They tend to possess good habits needed in the shop class. The high value obtained shows that the activities done in Technical Education are appreciated by the students. This could be due to the schools' provision for needed materials like transistors, radio, and PC boards that is functional and meaningful.

The mean (37.43) for Expectation showed that the second year high school students had a very high Expectation in Attitude Towards Technical Education. This indicated that they greatly value the training gained from Technical Education. They appreciate the quality of their own work well. They tend to be prepared and ready for more learning in the field of technical education. The very high value obtained could be due to the fact that they are confident to finish successfully the work provided for them in the activities.

The mean (81.85) for general ATTE showed that the second year high school students had a very high general Attitude Towards Technical Education. This indicated that they tend to perform well and practices the necessary skills and habits expected. The high value obtained could be due to the fact that they perceive both Task Value and Expectation as important.

The standard deviation for Task Value (5.12), Expectations (3.39) and general ATTE (8.07) showed that the scores were minimally dispersed.

Question No. 3 What is the achievement profile of first year high school students in the following:

3.1 Mathematics?

3.2 Science?

Table 19 shows the scores of first year high school students in Mathematics Achievement.

Table 19. Mathematics Achievement Scores Of First Year High School Students

Scores	**Frequency**	**Percentage**	**Remarks**
41 – 50	27	25.23%	Above Average
29 – 40	65	60.75%	Average
1 – 28	15	14.02%	Below Average
	107	100%	

The scores of first year high school students on Mathematics achievement showed that most of them (60.75%) had scores from 29 to 40. Most of them were in the area of average. Most of the students performed from average to above average and few in the below average.

Table 20 shows the scores of first year high school students in Science Achievement.

Table 20. Science Achievement Scores Of First Year High School Students

Scores	Frequency	Percentage	Remarks
39 – 50	24	22.43%	Above Average
22 – 38	76	71.03%	Average
1 – 21	7	6.54%	Below Average
	107	100%	

The scores of first year high school students on Science achievement showed that most of them (71.03%) had scores from 22 to 38. Most of them were in the area of average. There were 24 students (22.43%) who scored above average in the Science achievement and only 7 students scored below average in the Science achievement.

Table 21 shows the profile of first year high school students achievement scores in Mathematics and Science.

Table 21. Achievement Profile Of First Year High School Students In Mathematics And Science

	Mean	Standard Deviation	Scaled score	Percentile	Stanine	Remark
Mathematics Achievement	35.57	6.73	704	44	5	Average
Science Achievement	32.05	7.40	682	50	5	Average

The reported mean (35.57) for the first year Mathematics achievement was within the average region at the 44th percentile rank. This means that most of them had scores higher than 44% of the norm group. In the reported TIMSS (1999), however the Philippines was reported to have a low ranking compared with other countries. In the case of these first year high school students, the mean was higher, this could be due to the fact that they belong to a private school with the necessary home resources and richer background.

The reported mean (32.05) for the first year Science achievement is within the average region at the 50^{th} percentile rank. The coverage of the MAT was the different strands of Science and it was likely that the curriculum for first year high school which is general Science that tackles information across various Science strands and was parallel to what MAT measures. This could have helped in the average performance of the students in the test. It has been shown through the studies of Bottoms and Feagin (1997), and a report on the National Assessment of Educational Progress show that Science Achievement has improved since 1992. The improvement in Science achievement was due to the use of methods that motivated students and teachers using different strategies in oral and writing presentations of Science lessons. The report also noted that students graduating with several additional fields of study in Science had average Science scores.

The standard deviations in Mathematics Achievement (6.73) and Science Achievement (7.40) showed that the scores are minimally dispersed.

Question No. 4 What is the achievement profile of second year high school students in the following:

4.1 Mathematics

4.2 Science

Table 22 shows the scores of Second year high school students in Mathematics Achievement.

Table 22. Second Year High School Students Scores In Mathematics Achievement

Scores	Frequency	Percentage	Remarks
44 – 50	4	4.76%	Above Average
32 – 43	47	55.95%	Average
1 – 31	33	39.29%	Below Average
	84	100%	

The scores of second year high school students on Mathematics achievement showed that most of them (55.95%) had scores from 32 to 43. Most of them were in the area of average. There were only 4 students (4.76%) who scored above average and 33 students (39.29%) who scored below average.

Table 23 shows the scores of Second year high school students in Science Achievement.

Table 23. Second Year High School Students Scores In Science Achievement

Scores	Frequency	Percentage	Remarks
39 – 50	28	33.33%	Above Average
26 – 38	47	55.95%	Average
1 – 25	9	10.71%	Below Average
	84	100%	

The scores of second year high school students on Science achievement showed that most of them (55.95%) had scores from 26 to 38. Most of them are in the area of average. There were 28 students (33.33%) who scored above average in the Science achievement and only 9 students (10.71%) scored in the below average.

Table 24 shows the achievement profile of second year high school students in Mathematics and Science.

Table 24. Achievement Profile Of Second Year High School Students In Mathematics And Science

	Mean	Standard Deviation	Scaled score	Percentile	Stanine	Remark
Mathematics Achievement	33.43	6.06	688	24	4	Average
Science Achievement	35.11	6.74	723	42	5	Average

The reported mean (33.43) for the second year Mathematics achievement was within the average region at the 24th percentile rank. The scores were in the lower part of the average region. The scaled scores were already close to the below average region. The results are contrary to the report of Kimball (1989) who noted that the greater number of Mathematics courses taken by students, the better was their performance in standardized tests. The second year high school students had an additional statistics class for this school year as compared to the first year students who had only one Mathematics class.

The reported mean (35.11) for the second year Science achievement was within the average region at the 50th percentile rank. It means that most of them had scores higher than 50% of the norm group. The scores are in the middle part of the average region. Considering the nature of the standardized test as being more novel which provide a more challenging situation as explained by Kimball (1989) that makes the results most likely to be fair.

The standard deviations in Mathematics Achievement (6.06) and Science Achievement (6.74) showed that the scores were minimally dispersed.

Question No. 5 What, if any, is the relationship between first year high school Mathematics achievement and the following:

5.1 Task Value

5.2 Expectation

5.3 general Attitude Towards Technical Education

Table 25 shows the relationship between first year high school Mathematics achievement and Attitude Towards Technical Education.

Table 25. Relationship Between First Year High School Mathematics Achievement And Attitude Towards Technical Education

Variable	Correlation Coefficient	Remark	r^2	t-computed value	t-critical value	Decision
Task Value	-0.0384	Negligible relationship	0.0015	-0.3975	1.9825	Fail to reject Ho
Expectation	0.0555	Negligible relationship	0.0031	0.5749	1.9825	Fail to reject Ho
general Attitude Towards Technical Education	0.0055	Negligible relationship	0.00003	0.0569	1.9825	Fail to reject Ho

Pearson r was computed to find if there was a relationship between Mathematics Achievement and Task Value. The computation yielded a coefficient of –0.0384 which is a negative and negligible relationship. To find if the coefficient is significant, the Fisher's t-test was computed. Since the t - computed value for Task Value (-0.3975) was less than the t-critical value, the null hypothesis was not rejected. This means that there was no significant relationship between first year high school Mathematics achievement and Task Value. Task value explained only 0.15% of the variability in Mathematics achievement.

Pearson r was computed to find if there was a relationship between Mathematics Achievement and Expectation. The computation yielded a coefficient of 0.0555 which is a positive and negligible relationship. To find if the coefficient is significant, the Fisher's t-test was computed. Since the t–computed value for

Expectation (0.5749) was less than the t-critical value the null hypothesis was not rejected. This means that there was no significant relationship between first year high school Mathematics achievement and Expectation. Expectation explained only 0.31% of the variability in Mathematics achievement.

Pearson r was computed to find if there was a relationship between Mathematics Achievement and general ATTE. The computation yielded a coefficient of 0.0055 which is a positive and negligible relationship. To find if the coefficient is significant, the Fisher's t-test was computed. Since the computed value for the general ATTE (0.0569) was less than the t-critical value, the null hypothesis was not rejected. This means that there was no significant relationship between first year high school Mathematics achievement and general ATTE. General ATTE explained 0.003% of the variability in Mathematics achievement.

Question No. 6 What, if any, is the relationship between first year Science achievement and the following:

6.1 Task Value

6.2 Expectation

6.3 general Attitude Towards Technical Education

Table 26 shows the relationship between First Year high school Science achievement and Attitude Towards Technical Education.

Table 26. Relationship Between First Year High School Science Achievement And Attitude Towards Technical Education

Variable	**Correlation Coefficient**	**Remarks**	**r^2**	**t-computed value**	**t-critical value**	**Decision**
Task Value	-0.4864*	Substantial relationship	0.2366	-5.7584	1.9825	Reject Ho
Expectation	0.0514	Negligible relationship	0.0026	0.5324	1.9825	Fail to reject Ho
General ATTE	-0.0025	Negligible relationship	0.000006	-0.0259	1.9825	Fail to reject Ho

Pearson r was computed to find if there was a relationship between Science Achievement and Task Value. The computation yielded a coefficient of –0.4864 which is a negative and substantial relationship. To find if the coefficient was significant, the Fisher's t-test was computed. Since the t-computed value (-5.7584) was greater than the t–critical value, the null hypothesis was rejected. This means that there was a significant relationship between first year Science achievement and Task Value. A negative correlation occurred and this means the higher the Task Value, the lower the achievement in Science or vice versa. Since some activities and topics in General Science were somewhat parallel to what is taken in the Technical Education classes, both subjects provide on-the-task activities and students see them similarly. However, the more the students engage in rigid tasks, the lower was their achievement in Science. Students might be used to focus their attention on performing for tests rather than spending time to do practical applications in Science. It was also common that students who were good in practical work may perform low in written work and vice versa. This was explained by Kimbal (1989) who said that the standardized test was a more novel situation compared to activity tasks inside the classroom which were done several times within a course of time. Students got used to them over a period of time and did well in these tasks. This result supported the findings of Pintrich and DeGroot (1990) where a negative relationship occurred between attitude and achievement. They further explained in their findings that individuals tend to do tasks that they positively value and avoid those that they negatively value. In this study, students may be provided with sufficient activities but they may or may not value it. Task Value explains 23.6% of the variability in Science achievement.

Pearson r was computed to find if there was a relationship between Science Achievement and Expectation. The computation yielded a coefficient of 0.0514 which is a positive and negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t-computed value for Expectation (0.5324) was less than the t–critical value, the null hypothesis was not rejected. This means that there was no significant relationship between first year high school Science achievement and Expectation. Expectation explained 0.26% of the variability in Science achievement.

Pearson r was computed to find if there was a relationship between Science Achievement and general ATTE. The computation yielded a coefficient of -0.0025 which is a negative and negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t-computed value for general ATTE (-0.0259) was less than the t-critical value, the null hypothesis was not rejected. There was no significant relationship between first year high school Science achievement and general ATTE. General ATTE explained 0.0006% of the variability in Science achievement.

Question No. 7 What, if any, is the relationship between second year high school Mathematics achievement and the following :

7.1 Task Value

7.2 Expectation

7.3 general Attitude Towards Technical Education

Table 27 shows the relationship between second year high school Mathematics Achievement and Attitude Towards Technical Education.

Table 27. Relationship Between Second Year High School Mathematics Achievement And Attitude Towards Technical Education

Variable	**Correlation Coefficient**	**Remarks**	**r^2**	**t-computed value**	**t-critical value**	**Decision**
Task Value	-0.0377	Negligible relationship	0.00142129	-0.3419	1.98925	Fail to reject Ho
Expectation	-0.0618	Negligible relationship	0.00381924	-0.5603	1.98925	Fail to reject Ho
General Attitude Towards Technical Education	-0.05	Negligible relationship	0.0025	-0.4531	1.98925	Fail to reject Ho

Pearson r was computed to find if there was a relationship between Mathematics Achievement and Task Value. The computation yielded a coefficient of -0.0377 which is a negative and a negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t-computed value for Task Value (-0.3419) was less than the t–critical value, the null hypothesis was not rejected. This means that there was no significant relationship between second year high school Mathematics achievement and Task Value. Task Value explained 0.14% of the variability in Mathematics achievement.

Pearson r was computed to find if there was a relationship between Mathematics Achievement and Expectation. The computation yielded a coefficient of -0.0618 which is a negative and negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t–computed value for Expectation (-0.5603) was less than the t–critical value, the null hypothesis was not rejected. This means that there was no significant relationship between second year high school Mathematics achievement and Expectation. Expectation explained 0.38% of the variability in Mathematics achievement.

Pearson r was computed to find if there was a relationship between Mathematics Achievement and general ATTE. The computation yielded a coefficient of -0.05 which is a negative and negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t–computed value for general ATTE (-0.4531) was less than the t-critical value, the null hypothesis was not rejected. This means that there was no significant relationship between second year high school Mathematics achievement general ATTE. General ATTE explained 0.25% of the variability in Mathematics achievement.

Question No. 8 What, if any, is the relationship between second year high school Science achievement and the following:

8.1 Task Value

8.2 Expectation

8.3 general Attitude Towards Technical Education

Table 28 shows the relationship between second year high school Science achievement and Attitude Towards Technical Education and its components.

Table 28. Relationship Between Second Year High School Science Achievement And Attitude Towards Technical Education

Variable	Correlation Coefficient	Remarks	r^2	t-computed value	t-critical value	Decision
Task Value	-0.1045	Negligible relationship	0.0109	-0.9519	1.9925	Fail to reject Ho
Expectation	-0.1657	Negligible relationship	0.0275	-1.5216	1.9925	Fail to reject Ho
general Attitude Towards Technical Education	-0.1362	Negligible relationship	0.0186	-1.2449	1.9925	Fail to reject Ho

Pearson r was computed to find if there was a relationship between Science Achievement and Task Value. The computation yielded a coefficient of -0.1045 which is a negative and negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t-computed value for Task Value (-0.9519) was less than the t–critical value, the null hypothesis was not rejected. This means that there was no significant relationship between second year high school Science achievement and Task Value. Task Value explained 1.09% of the variability in Science achievement.

Pearson r was computed to find if there was a relationship between Science Achievement and Expectation. The computation yielded a coefficient of -0.1657 which is a negative and negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t-computed value for Expectation (-1.5216) was less than the t–critical value, the null hypothesis was not rejected. This means that there was no significant relationship between second year high school Science achievement and Expectation. Expectation explained 2.75% of the variability in Science achievement.

Pearson r was computed to find if there was a relationship between Science Achievement and general ATTE. The computation yielded a coefficient of -0.1362 which is negative and negligible relationship. To find if the coefficient was significant the Fisher's t–test was conducted. Since the t–computed for general ATTE (-1.2449) was less than the t–critical value, the null hypothesis was not rejected. There was no significant relationship between second year high school Science achievement and general ATTE. General ATTE explained 1.86% by the variability in Science achievement.

CHAPTER V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This chapter summarizes the study, presents the findings, conclusions and suggests recommendations.

Summary

The purpose of this study is to determine the relationship between Mathematics and Science Achievement and Attitude Towards Technical Education of First and Second Year high school students of Caritas Don Bosco School. The students Attitude Towards Technical Education was determined with the use of the ATTE inventory as constructed by the researcher. The Mathematics and Science Achievement score were determined using the Metropolitan Achievement Test. In this study the following problems were posed:

1. What is the profile of attitude Towards Technical Education of the first year high school students in the following:

   1.7 Task Value?

   1.8 Expectation?

   1.9 general Attitude Towards Technical Education?

2. What is the profile of attitude Towards Technical Education of the second year high school students in the following:

2.1 Task Value?

2.2 Expectation?

2.3 general Attitude Towards Technical Education?

3. What is the profile of achievement of the first year high school students in the following:

3.1 Mathematics?

3.2 Science?

4. What is the profile of achievement of the second year high school students in the following:

4.1 Mathematics?

4.2 Science?

5. What, if any, is the relationship between the first year high school Mathematics achievement and the following :

5.1 Task Value?

5.2 Expectation?

5.4 general Attitude Towards Technical Education?

6. What, if any, is the relationship between the first year high school Science achievement and the following:

6.1 Task Value?

6.2 Expectation?

6.4 general Attitude Towards Technical Education?

7. What, if any, is the relationship between the second year high school Mathematics achievement and the following :

7.1 Task Value?

7.2 Expectation?

7.3 general Attitude Towards Technical Education?

8. What, if any, is the relationship between the second year high school Science achievement and the following:

8.1 Task Value?

8.2 Expectation?

8.3 general Attitude Towards Technical Education?

Hypotheses

1. There is no significant relationship between first year high school Mathematics achievement and the following:

1.1 Task Value

1.2 Expectation

1.3 general Attitude Towards Technical Education

2. There is no significant relationship between first year high school Science achievement and the following:

2.3 Task Value

2.2 Expectation

2.4 general Attitude Towards Technical Education

3. There is no significant relationship between second year high school Mathematics achievement and the following:

3.1 Task Value

3.2 Expectation

3.3 general Attitude Towards Technical Education

4. There is no significant relationship between second year Science achievement and the following:

4.1 Task Value

4.2 Expectation

Research Method

The descriptive method of research was used in this study.

Research Population

The population of this study were the 191 first and second year high school students of Caritas Don Bosco School. There were 107 first year and 84 second year students composed of 126 males and 65 females ages 11 to 14.

Research Instruments

The study made use of the Attitude Towards Technical Education (ATTE) that measures students' perceived degree of importance of the Technical Education classes they are taking. This instrument was constructed and developed by the researcher. It is composed of twenty items describing the competencies learned in a Technical Education classes. This includes the skills developed, topics learned and outcomes of Technical Education. The scale has two factors: task value with eleven items and expectation with nine items.

The Metropolitan Achievement Test was used to determine the first and second year students achievement in Mathematics and Science. The Kuder-Richardson Formula 20 estimated MAT's internal consistency. The reliability of the test is 0.93. Construct, content and criterion-related validities had been reported to be adequate.

Data Gathering Procedure

The researcher requested the assistance of the General Technology teacher to administer the ATTE for both first and second year high school students in her class.

The purpose of the study was explained to the students what the instrument is measuring. The researcher requested the Guidance Office of Caritas Don Bosco School to administer the MAT for assessing the students standing for different subject areas including Mathematics and Science.

Research Findings

An analysis of the data done revealed the following findings:

1. The profile of the Attitude Towards Technical Education of the first year high school students are as follows:

    1.1 high Task Value scores

    1.2 high Expectation scores

    1.3 high general ATTE score

2. The profile of the Attitude Towards Technical Education of second year high school students are as follows:

    2.1 high Task Value scores

    2.2 very high Expectation scores

    2.3 high general ATTE scores

3. There is no significant relationship between first year Mathematics achievement and

    3.1 Task Value

3.2 Expectation

3.3 general ATTE

4. There is a significant relationship between first year Science achievement and Task Value.

9. There is no significant relationship between first year Science achievement and

    9.1 expectation

    9.2 general ATTE

10. There is no significant relationship between second year Mathematics achievement and

    10.1 Task Value

    10.2 Expectation

    10.3 general ATTE

11. There is no significant relationship between second year Science achievement and

    11.1 Task Value

    11.2 Expectation

    11.3 general ATTE

Conclusion

Based on the findings of the study, it can be concluded that in general, Mathematics achievement and Science achievement and students Attitude Towards Technical Education are not related.

Recommendations

The following recommendations are made based on the findings of the study.

1. Since the students gave the following items a low rating compared to the other items, teachers of Technical Education can provide them with activities that address these concerns:

    1.1 Bringing new products and ways into daily living

    1.2 Acquiring specialized training in woodwork, automotive and electrical

    1.3 Acquaintance with students ability to produce craft materials

2. Further research to determine the correlation between attitude in Mathematics and Science with Attitude in Technical Education to see the interplay of the two variables.

3. Conduct a replication study for the third and fourth year high school students since they have been exposed to more complete Mathematics and Science subjects.

4. Further research to determine the difference in the attitude of males and females towards Technical Education is recommended since a pattern is emerging from the scores obtained and numerous literature reviews are available.

REFERENCES

Books

Anastasi, Anne. 1997. *Psychological testing*. New York: McMillan Pub.

Atkinson, J.W. 1966. *Motivational determinants of risk-taking behavior*. In *A theory of achievement motivation,* ed. Atkinson, J.W.& Feather, J.T., 11-31. New York: Wiley.

Becher, R. 1984. *Parental involvement: A review of research and successful practice*. Washington DC: National Institute of Education.

Bent, Robert and Harold Kronenberg. 1980. *Principles of secondary education*. New York: McGraw Hill.

Best, John W. and James V. Kahn. 1998. *Research in education*. Needham Heights MA: Allyn and Bacon.

Berryman, S. E. 1983. *Who will do science? Minority and female attainment of science and mathematics degree: Trend and causes*. New York: Rockefeller Foundation.

Brush, L. R. 1985. *Cognitive and affective determinants of course preferences and plans*. In *Women and mathematics,*ed. Chipman, S. and Brush, L. New Jersey: Erlabaum.

Calderon and Gonzales. 1986. *Methods of research*. Quezon City

Crandal, V. C. 1969. *Sex differences in expectancy of intellectual and academic reinforcement*. In *Achievement–related behaviors in children,* ed. Smith, C. P. New York: Russel Sage Foundation.

Diggory, J. 1966. *Self-evaluation: Concepts and studies*. New York: Wiley.

Downie and Heath. 1984. *Basic statistics for the social sciences*. New York: McGraw Hill.

Fishbein, M. K and I. Ajzen. 1981. *Belief, attitude, intention and behavior*. Reading Massachusetts: Addison Wesley Pub. Company.

French, William. 1980. *Types, content and organization (including extension and corresponding courses) of technical education and training for men and women and its place in education and employment*. In *Report of an expert conference held at the college of education*, ed. Ford, C. R., 1- 20. London: Her Majesty's Stationery office.

Hahn, Robert and David Bidna. 1980. *Secondary education: Origins and directions*. New York: The McMillan Company.

Henderson, A. T. and N. Berla. 1994. *A new generation of evidence. The family is critical to student achievement*. Washington DC: National Committee for Citizens in Education.

Hurlock, Elizabeth. 1990. *Developmental psychology: A lifespan approach*. New York: McGraw Hill Book Company.

Lindbeck, John. 1997. *Technical education vol. 17*. Grolier Encyclopedia. New York: Bantam Press.

Maker, C. J. 1982. *Teaching models in education of the gifted*. Rockville, MD: Aspen Systems Corp.

McLeod, D. B. 1992. *Research on affect in mathematics education: A reconceptualization*. In *Handbook of research and mathematics teaching and learning*, ed. Grouws D. A. New York: MacMillan.

Myers, Anne. 1996. *Social psychology*. New York: McGraw Hill.

Office of Education. 1960. *Improving industrial arts teaching*. Washington: United States Government Printing Office.

Overmier, J.B.& J. A. Lawry. 1979. *Conditioning and the mediation of behavior*. In *The psychology of learning and motivation*, ed. Bower, G.H., 1- 55. New York: Academic Press.

Pintrich, P. R. & B. Schrauben. 1992. *Students' motivational beliefs and their cognitive engagement in classroom academic task*. In *Students perception in the classroom: Causes and consequences*, ed. D. Schunk & J. Meece, 149 - 183. Hillside, NJ: Erlbaum.

Rotter, J.B., J. E. Chance, & E. J. Phares. 1972. *Applications of a social learning theory of personality*. New York: Holt, Rinehart & Winston.

Schunk, D.H. 1989. *Self-efficacy and cognitive skill learning*. In *Research on motivation in education: Goals and cognitions*, ed. Ames, C.& Ames, R., 13 – 44. San Diego: Academic Press.

Settamanit. 1984. *Models of technical/vocational education*. Bangkok: Office of the National Education Commission.

Trump, John and Douglas Miller. 1981. *Secondary school curriculum improvement, proposals and procedures*. Boston: Allyn and Bacon.

Zimbardo, P. G, and M. R. Leippe. 1991. *The psychology of attitude change and social influence*. New York: McGraw Hill.

Yaremko, R. M., H. Harrari, R. C. Harrison, & E. Lynn. 1982. *Reference handbook of research and statistical methods in psychology*. New York: Harper and Row.

Periodicals and Journals

Bandura, A. 1977. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review* 84 (January): 191-215.

Bandura, A., B. J. Zimmerman. & M. Martinez-Pons. 1992. Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal* 29 (December): 663-676.

Bottoms, Gene and Cairo Feagin. 1997. The 1996 high schools that work assessment: Science good news, bad news and actions. *SREB* 4 (June): 1 – 14.

Bottoms, Gene. 2000. Putting lessons learned to work: Improving the achievement of vocational students. *SREB* 40 (December): 2-6.

Cheung, K. 1988. Mathematics achievement and attitude towards mathematics in secondary schools in Hong Kong. *Journal for Research in Mathematics Teaching* 23 (May): 37 – 43.

Dweck, C. S. 1986. Motivational process affecting learning. *American Psychologist* 41 (Spring): 1040 – 1048.

Feather, N. T. 1966. Effects of prior success and failure on expectations of success and subsequent performance. *Journal of Personality and Social Psychology* 3 (December): 287 – 298.

Greenfield, Teresa. 1997. Gender and grade level difference in science interest and participation. *John Wiley and Sons* 23 (June): 259 – 275.

Hatzios, Maria. 2002. Effective models for measuring students' attitudes toward the marketing education program. *Journal of Vocational and Technical Education* 13 (June): 1-11.

Jordan, Betty and Linda Dove. 2002. Closing the achievement gap: A high schools that work design for challenging schools. *Southern Regional Education Board* 3: 1 – 10.

Industrial Arts and Vocational Education 2 (March): 100 – 119.

Kahle, J. B. and M. K. Lakes. 1983. The myth of equality in a science classroom. *Journal of Research in Science Teaching* 20 (May): 131 – 140.

Kehr, Carol. 1986. Gender research and education. *American Psychologist* 41 (October): 1161 – 1168.

Kimball, Meredith. 1989. A new perspective on women's math achievement. *Psychological Bulletin* 105 (July): 198 – 214.

Koller, Olaf, Jurgen Baumert and Kai Schnabel. 2001. Does interest matter? The relationship between academic interest and achievement in mathematics. *Journal for Research in Mathematics Teaching* 32 (November): 448 – 470.

Leath, Audrey. 1995. Education report reflects gains in science and math achievement. *FYI The American Institute of Physics Bulletin of Science Policy News* 121 (August): 23.

Ma, Xin and Nad Kishor. 1997. Assessing the relationship between attitude towards mathematics and achievement in mathematics: A meta-analysis. *Journal of Research in Mathematics Education* 28: 26 – 47.

Ma, Xin. 1999. A Meta-Analysis of the relationship between anxiety toward mathematics and achievement in mathematics. *Journal of Research in Mathematics* 30 (November): 520 – 540.

Meece, Judith, Jaquelynne Parson, Caroline Kaczala, Susan Goff, and Robert Futerman. 1982. Sex differences in math achievement: Toward a model of academic choice. *Psychological Bulletin* 91 (June): 324 – 348.

Middleton, James A. and Photini A. Spanias. 1999. Motivation for achievement in mathematics: Findings, generalizations, and criticisms of the research. *Journal for Research in Mathematics Education* 30 (January): 65 – 88.

Parson, J., T. F. Adler and C. M. Kaczala. 1981. Socialization of achievement attitudes and beliefs: parental influences. *Child Development* 53: 310- 321.

Pintrich, P. R. and E. De Groot. 1990. Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology* 82 (May): 33 – 40.

Rennie, Leonie and Dunne Mairead. 1987. Gender, ethnicity, and students' perceptions about science and science – related careers in Fiji. *Science Education* 3 (February): 285 – 300.

Ruthvan, K. 1987. Ability stereotyping in mathematics. *Educational Studies in Mathematics* 18 (February): 248 – 253.

Schmitt, Marshall and Dale Chismore. 1987. Definition for industrial arts.

Schunk, D.H. & T. P. Gunn. 1986. Modeled importance of task strategies and achievement beliefs: Effect on self-efficacy and skill development. *Journal of Early Adolescence* 5 (March): 247-258.

Schunk, D.H. & J. M. Rice. 1993. Strategy fading and progress feedback: Effects on self-efficacy and comprehension among students receiving remedial reading services. *Journal of Special Education* 27 (March): 257-276.

Skinner, E.A., J. G. Wellborn, & J. P. Connell. 1990. What it takes to do well in school and whether I've got it: A process model of perceived control and children's engagement and achievement in school. *Journal of Educational Psychology* 82 (April): 22-32.

Smith, Frances and Cheryl Hausafus. 1997. Relationship of family support and ethnic minority students' achievement in science and mathematics. *John Wiley and Sons* 12 (July): 111 - 125

Tuckman, B.W. 1998. Using tests as an incentive to motivate procrastinators to study. *Journal of Experimental Education* 66 (March): 141-147.

Tuckman, B.W. & T. L. Sexton. 1990. The relation between self-beliefs and self-regulated performance. *Journal of Social Behavior and Personality* 5 (May): 465-472.

Tuckman, B.W. & T, L. Sexton. 1991. The effect of teacher encouragement on student self-efficacy and motivation for self-regulated performance. *Journal of Social Behavior and Personality* 6 (June): 137-146.

Wigfield, A. & J. S. Eccles. 1992. The development of achievement task values: A theoretical analysis. *Developmental Review* 12 (July): 265-310.

Worthens, Sanders, & Fitzpatrick. 1997. An evaluation of saxon math at blessed sacrament school. C&I 490 EIT: Individual evaluation project final report. *University of Illinois at Urbana-Campaign CTER Masters Program*. (December).

Third International Mathematics and Science Study. 2001. Science and mathematics benchmarking reports 1999. *International Association for the Evaluation of Educational Achievement*.

Disseration Abstracts

Bottoms, G., Fox Horning and T. New. 2000. *The 2000 high schools that work assessment: Improving urban high schools*. SREB Research Briefs 3 (August): 1.

Copa, George, H. 1985. *An untold story: Purposes of vocational education in secondary schools*. ERIC Abstracts 45 (December): 34.

Donald, Maley. 1985. *Implementing technology education in America's schools*. ERIC Abstracts 13 (December): 6 – 10.

Garner, Henry. 1997. *Vo-tech careers in the 21st century*. Vocational Education 27 (September): 42.

Theses

Dalupang, Aida. 1981. *A study of the relationship between beliefs in internal-external locus of control in intellectual – academic achievement situations and reading achievement of a selected group of intermediate boys in a private school in Metro Manila during the school year 1979 – 80*. Masters Thesis. Ateneo de Manila University.

Dizon, Cesar. 1991. *A comparative study of the performance of bosconian and non-bosconian secondary graduates at Don Bosco Technical College School years 1985 – 1990: Implications for curriculum development*. Masters Thesis. Ateneo de Manila University.

Enriquez, Ma. Christina Salud. 2001. *Mathematics and science education in two public high schools in Metro Manila: The relationship between teacher motivation and achievement*. Masters Thesis. Ateneo de Manila University.

Junia, Belen Sanches. 1994. *The preparation of industrial position of chemical technology graduates of TUP – Taguig SY 1980 – 1990 with implications for curricular development*. Masters Thesis. Ateneo de Manila University.

Miciano, Romeo Agustin. 1998. *The preparation for industrial jobs of the machine technology graduates of two Don Bosco technical high schools in Papua New Guinea, 1994 and 1995 with implications for curriculum revision*. Masters Thesis. Ateneo de Manila University.

Electronic Document

Buck. 1997. Technical Education. E-Library online. http://www. googlesearch. E-library.com

Harcourt. 2001. Metropolitan8. http://www.psychorp.com /sub/ services/ srmain.htm.

Idaho Technology. 2000. An accountability report to the Idaho legislature on the effects of monies spent through the Idaho council for technology learning. Highlights from the software information industry Association (SIIA) Executive summary. http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

Educational Testing Service (1998). Technology's Impact on Mathematics Achievement. Highlights from the software information industry Association (SIIA) Executive summary. http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

Joppe. 2002. Descriptive Research Design. http://www. Researchinfo.com

Kulik. 1997. Computer Based Instruction. Highlights from the software information industry Association (SIIA) Executive summary. http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

Sivin-Kachala (1998). Review of Research studies. Highlights from the software information industry Association (SIIA) Executive summary. http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

Westat. 1999. Effectiveness of technology in schools. Highlights from the software information industry Association (SIIA) Executive summary. http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

West Virginia Basic Skills/Computer Education Statewide Initiative (2000). Achievement of 5th Grade Students in 18 West Virginia Schools. Highlights from the software information industry Association (SIIA) Executive summary. http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

1995. Review of Academic studies. Highlights from the software information industry Association (SIIA) Executive summary. http://www.ed.gov/Technology/TechConf/1999/whitepapers.html

Unpublished Materials

Enemark, P. and L. L. Wise. 1981. *Supplementary mathematics probe study*. Unpublished Manuscript. American Institute for Research in the Behavioral Sciences: Palo Alto CA.

Magno, Carlo. 2002. *Skills and vocational inclinations of students in Caritas Don Bosco school*. Research Center Caritas Don Bosco School.

Steinkamp, M. W. 1982. *Sex-related differences in attitude towards science: A quantitative synthesis of research*.

TESDA. 2000. *National Technical Education and Skills Development Plan 2000 – 2004*. Vision and Framework.

APPENDIX 1
DESCRIPTION OF TECHNICAL EDUCATION OF CARITAS DON BOSCO SCHOOL

The Technical Education of Caritas Don Bosco School is offered from Grade school to High School It is started with the grade 4 to 6 students who take the subjects Work Education, Home Economics and Livelihood Education, Computer and Drafting in Art. It is provided to serve as a preparation for the Technical Education in High School.

Some of the common topics taught in Work Education are the following:

Work Education	Home Economics	Computer
A. Grade 4 • Work Related values • Gardening • Methods of planting • Backyard and animal raising • Buying and Selling • Handicraft	Grade 4 • Personal Qualities • Grooming • Clothing • Basic hand stitches • Family • House and Home • Food and Nutrition • Pleasant Dining and Table Setting	Grade 4 Operating System Windows Accessories
B. Grade 5 • Raising Animals for Food and profit • Handicraft • Retail Merchandising • Basic Electrical	Grade 5 • Taking Care of Oneself • Taking Care of the Family • Taking Care of the Home • Planning Nutritious and Adequate food • Learning to Sew • Food Preservation	Grade 5 Operating System Windows Operating System Microsoft Office Microsoft Word Basic Programming
C. Grade 6 • The World of Work • Gardening • Livestock Rising • Fishery Arts • Handicraft • Establishment of a retail store	Grade 6 • Personality Growth and Development • Physical Influences of Appearance • Clothing and Personal Appearance • Home and Family Living • Food for Good Health	Grade 6 Microsoft Excel Microsoft Powerpoint Virus Basic Programming

The Technical Education for the High School of Caritas Don Bosco School is General Technology and Information Technology for first and Second year and Drafting for first year.

General Technology Curriculum

	First Year	**Second Year**
First Quarter	Work Values and Ethics Kaizen 5S	Basic Electrical
Second Quarter	*Simple House Arrangement *(Housing & Family Economics)*	Basic Electrical
Third Quarter	Introduction to Carpentry	Basic Electronics
Fourth Quarter	Carpentry Works	Basic Electronics

Information Technology Program

Qtr	First Year	Second Year
1	Introduction to IT Introduction to internet	BASIC Programming
2	Maximize internet	BASIC Programming
3	Computer Graphics	BASIC Programming
4	Web Page Development	Basic networking

Students in the second year are given an aptitude test to determine the track of specialization that they will have when they go to third year. The tracks of specialization offered for the third and fourth year students are Technical Engineering, Technical Arts and Technical Business. The following are the tracks for the third and fourth year:

Track 1 – Engineering Technical

Quarter	Third Year		Fourth Year	
	Information Technology	**Technical Subject**	**Information Technology**	**Technical Subject**
1	Advance Basic Programming	Electrical	Networking (Installation)	Electronics
2	Visual Basic Programming	Electrical	Networking Commands and Utilities	Electronics
3	Visual Basic Programming	Electronics	Networking Server Configuration	Electronics
4	Visual Basic Programming	Electronics	Networking System Administration	Electronics

Track 2 – Arts Technical

Quarter	Third Year		Fourth Year	
	Information Technology	**Technical Subject**	**Information Technology**	**Technical Subject**
1	Advance Graphics	Drafting: Isometric & Perspective Drawing	Interactive webpage (Technical)	Introduction to Architecture
2	Advance Graphics	Advance Drafting	Active server programming	Architecture
3	Html programming – developing webpage	Drafting Autocad	Desktop publishing	Architecture
4	Html programming	Drafting Autocad	Desktop Publishing	Architecture

Track 3 – Business Technical

Quarter	Third Year		Fourth Year	
	Information Technology	**General Technology**	**Information Technology**	**General Technology**
1	E – Business	Business Concepts	Marketing using IT	Entrepreneurship
2	Feasibility Study utilizing IT	Business Management	Marketing Using IT	Entrepreneurship
3	Feasibility Study	Business Management	Project Marketing	Accounting
4	Project Feasibility Study	Business Management	Project Marketing	Accounting

APPENDIX 2
ATTITUDE TOWARDS TECHNICAL EDUCATION

Name: ___________________________ Year: _______
Gender: ___ Male ___ Female Section: _____________
Age:____________ School: _______________

This inventory measures students' predisposition on the importance of taking a technical course as part of the subjects taken for high school.

Instruction: Encircle the number that corresponds to how important the following statements are to your education. There are no right or wrong answers.

5 – Very Important 4 – Important 3 – Not sure 2 – Unimportant 1 – Very Unimportant

I feel that my subject in General Technology/Information Technology:	Very Important	Important	Not sure	Unimportant	Very Unimportant
1. makes me ready for engineering and related courses.	5	4	3	2	1
2. enables me to learn more about technology.	5	4	3	2	1
3. enables me to use different equipments and mechanical apparatus.	5	4	3	2	1
4. makes me apply the theories learned in math and science	5	4	3	2	1
5. makes me learn work-oriented skills in school.	5	4	3	2	1
6. enables me to develop desirable work habits.	5	4	3	2	1
7. makes me cope with the developments in technology even if equipments and methods change.	5	4	3	2	1
8. makes me bring new products and ways into everyday living.	5	4	3	2	1
9. enables me to develop habits of industry, thrift, promptness, resourcefulness and ingenuity.	5	4	3	2	1
10. makes me understand necessary information about the world of work.	5	4	3	2	1
11. enables me to acquire basic training in technical work.	5	4	3	2	1
12. enables me to gain experiences in doing technical work.	5	4	3	2	1
13. enables me to develop technical problem solving skills using materials and processes.	5	4	3	2	1
14. enables me to acquire specialized training in woodwork, automotive and electrical.	5	4	3	2	1
15. makes me demonstrate my skill in manipulating materials to be used.	5	4	3	2	1
16. makes me appreciate quality of workmanship.	5	4	3	2	1
17. acquaints me with my ability to produce craft materials.	5	4	3	2	1
18. enables me to make use of my hands in applying the knowledge learned from other subjects.	5	4	3	2	1
19. makes me experience working from raw to usable materials.	5	4	3	2	1
20. enables me to undergo training to produce quality work.	5	4	3	2	1

Thank you

APPENDIX 3
RELIABILITY ANALYSIS – SCALE (A L P H A)

		Mean	Std Dev	Cases
1.	ITEM1	4.1204	.7547	191.0
2.	ITEM2	4.3298	.6578	191.0
3.	ITEM3	4.0628	.7788	191.0
4.	ITEM4	3.8377	.8397	191.0
5.	ITEM5	3.9005	.8179	191.0
6.	ITEM6	3.8953	.8941	191.0
7.	ITEM7	4.0838	.7632	191.0
8.	ITEM8	3.6963	.8347	191.0
9.	ITEM9	4.0995	.8799	191.0
10.	ITEM10	4.1361	.7896	191.0
11.	ITEM11	4.0262	.7775	191.0
12.	ITEM12	4.0576	.8347	191.0
13.	ITEM13	3.9005	.8433	191.0
14.	ITEM14	3.8639	.8475	191.0
15.	ITEM15	3.8848	.7014	191.0
16.	ITEM16	4.0576	.8283	191.0
17.	ITEM17	3.8168	.8784	191.0
18.	ITEM18	4.1571	.8055	191.0
19.	ITEM19	3.8901	.8846	191.0
20.	ITEM20	4.0209	.9231	191.0

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 = 191.0

Statistics for Scale	Mean	Variance	Std Dev	N of Variables
	79.8377	73.7156	8.5858	20

Item Means	Mean	Minimum	Maximum	Range	Max/Min	Variance
	3.9919	3.6963	4.3298	.6335	1.1714	.0221

Item Variances	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.6712	.4327	.8522	.4195	1.9693	.0109

Inter-item Correlations	Mean	Minimum	Maximum	Range	Max/Min	Variance
	.2349	.0013	.4843	.4830	385.9904	.0073

Reliability Coefficients   20 items

Alpha =   .8610   Standardized item alpha =   .8600

APPENDIX 4
LETTER TO THE PRINCIPAL OF DON BOSCO HIGH SCHOOL CANLUBANG

Caritas Don Bosco School
Laguna Technopark, Binan Laguna

January 8, 2003

Fr. Renan Michael La Guardia
Principal
Don Bosco High School
Canlubang Laguna

Dear Fr. Renan,

Greetings!

It has been made known to us that your high school which is exclusive for boys in the secondary education offers a technical curriculum. Our school is currently doing a research on the "Relationship Between Attitude Towards Technical Education and Academic Achievement in Mathematics and Science of The First and Second Year High School Students. Our research center has devised an instrument to specifically measure high school students level of Attitude Towards Technical Education. However, before we can fully use the instrument it needs to be pretested. Your school is a good venue to conduct the pilot study since Technical Education is part of your secondary curriculum. Your students would be an ideal sample to administer the said instrument.

If possible I would like to schedule a date and time when I can administer the instrument preferably to first and second year students. I would like to discuss with you further the purpose pf my study and the mechanics of administering the instrument.

Thank you in advance and hoping for your approval.

Yours in St. John Bosco,

Mr. Carlo Magno
CDBS Research Center - Head

APPENDIX 5
SCORES OF FIRST AND SECOND YEAR HIGH SCHOOL STUDENTS ON TASK VALUE

First Year

40	46	42	38	32	38	47	46
43	48	48	38	40	45	41	46
47	40	45	52	45	47	44	46
38	40	46	43	41	50	44	45
47	46	44	40	43	43	34	
46	48	48	47	47	45	34	
45	50	29	31	46	41	50	
38	55	39	35	50	41	39	
36	37	39	46	41	41	44	
44	45	44	30	39	40	39	
42	44	47	39	52	43	43	
30	42	40	46	43	45	39	
50	40	49	39	45	47	26	
46	39	43	46	45	45	51	
41	37	42	40	42	44	38	
Mean	42.63303						
Sd	5.152598						

Second Year

39	40	41	35	33	38
34	40	38	41	37	44
32	34	38	42	42	35
37	41	36	35	37	39
34	38	35	39	43	34
36	34	34	39	33	37
37	38	38	35	38	42
35	35	36	31	33	39
31	41	35	35	45	36
40	39	37	39	40	
39	35	32	38	39	
43	35	33	33	40	
38	30	42	44	43	
40	33	37	39	37	
40	41	33	41	40	
Mean	37.42857				
Sd	3.394843				

APPENDIX 6
SCORES OF FIRST AND SECOND YEAR HIGH SCHOOL ON EXPECTATION

First Year

38	37	35	35	43	38	30	41	38	34	32
37	36	43	39	31	25	33	39	38	27	41
41	40	45	37	41	37	36	40	35	39	27
31	40	27	39	29	42	38	39	31	39	40
43	36	34	37	34	31	32	31	37	38	25
38	37	40	35	34	34	34	33	37	27	39
37	41	36	23	27	39	38	34	36	40	40
34	33	33	36	36	33	38	42	41	33	40
35	34	33	36	35	38	37	39	38	36	45
34	34	30	38	30	27	37	33	37	36	
Mean	35.78899									
Sd	4.439039									

Second Year

46	47	51	44	43	38
38	48	53	44	43	51
33	43	48	49	50	47
45	47	44	44	45	44
36	38	43	47	46	40
44	39	42	45	37	42
39	43	46	43	48	50
41	40	44	39	37	43
37	51	40	41	54	44
47	43	45	42	48	
40	39	36	49	41	
50	41	46	37	46	
50	29	50	53	48	
45	39	52	49	42	
53	49	34	52	47	
Mean	44.11905				
Sd	5.128246				

APPENDIX 7
SCORES OF FIRST AND SECOND YEAR HIGH SCHOOL STUDENTS ON GENERAL ATTE

First Year

79	83	77	90	85	75	
66	93	87	71	56	80	
90	100	82	90	72	53	
86	64	85	72	88	91	
77	79	81	76	61	63	
83	84	83	72	73	85	
89	78	52	65	85	86	
73	73	75	88	72	86	
74	72	75	78	84	90	
80	67	82	70	67	Mean	78.42202
78	62	93	83	81	sd	8.78898
80	73	82	79	68		
88	81	85	76	83		
69	79	84	72	83		
90	75	73	77	72		
84	81	71	80	61		
82	84	79	81	90		
72	88	89	88	72		
71	78	89	83	80		
78	76	76	81	75		

Second Year

85	93	90	67	76	76	
72	87	92	79	80	95	
65	88	91	85	92	82	
82	77	86	91	82	83	
70	88	80	79	89	74	
80	76	78	86	70	79	
76	73	76	84	86	92	
76	81	84	78	70	82	
68	75	80	70	99	80	
87	92	75	76	88	Mean	81.54762
79	82	82	81	80	sd	8.066597
93	74	68	87	86		
88	76	79	70	91		
85	59	92	97	79		
72	89	93	88	87		

APPENDIX 8
SCORES OF FIRST AND SEOND YEAR STUDENTS ON MATHEMATICS AND SCIENCE ACHIEVEMENT

MAT Mathematics - first year					MAT Science - first year				
29	41	35	44	37	39	34	29	34	41
44	46	35	27	35	41	29	28	20	46
42	44	36	38	36	42	32	24	39	42
32	41	41	27	31	32	49	37	35	42
38	44	35	37	47	20	28	34	22	37
27	39	44	41	45	25	33	40	40	38
26	40	39	24	41	27	19	25	27	38
29	35	47	43	40	22	22	37	22	34
37	24	37	39	37	32	32	24	23	35
35	40	41	38	36	36	28	27	27	mean
39	26	37	40	Mean	35	38	32	29	30.8
31	32	33	33	33.95833	23	15	25	27	Sd
32	16	42	35	Sd	26	29	36	27	7.076958
43	32	26	36	6.2934	32	31	38	34	
36	36	35	35		22	38	28	31	
35	40	46	41		23	26	37	15	
34	25	25	24		32	28	37	45	
34	41	36	14		40	20	25	42	
33	37	37	38		31	39	39	41	
22	31	29	44		24	28	34	41	
38	35	37	44		37	41	31	46	
20	35	21	46		22	25	35	38	
42	35	25	38		42	33	23	39	
37	33	41	39		30	32	42	40	
	33	34	37		35	29	21	40	

MAT-Math - 2nd year						MAT-Science - 2nd year					
42	43	33	38	36	25	44	41	37	32	25	24
42	41	31	39	33	28	43	38	43	46	26	30
31	30	36	37	27	33	41	39	39	36	26	23
42	35	32	31	32	29	45	47	37	30	30	22
39	39	32	34	28	28	42	48	35	41	30	31
39	33	39	27	29	35	38	38	34	34	27	36
41	45	36	27	34	25	43	35	32	33	41	27
43	42	35	32	29	30	44	32	38	31	29	29
44	44	35	28	28	33	42	36	41	30	27	27
41	32	36	36	30	25	49	33	37	43	25	24
36	34	30	32	13	26	39	38	33	44	35	30
40	33	36	20	24	25	41	38	40	35	29	24
45	32	30	30	31	30	45	30	33	37	27	27
40	29	32	27	35	39	41	46	30	32	32	37
				Mean	40.35714						42.64286
				sd	3.521519						2.762584

APPENDIX 9
LETTER OF PERMISSION TO CDBS ADMINISTRATORS

Caritas Don Bosco School
Laguna Technopark, Binan Laguna

September 28, 2002

Sister Monica Hamasaki
Principal
Caritas Don Bosco School
Laguna Technopark, Binan Laguna

Dear Sister,

Every school year we administer achievement tests to determine the standing of our students with regards to different academic areas. For this school year I am requesting for our first and second year students to take the "Iowa Test for Basic Skills" ITBS in Mathematics and in Science. The test can provide us the necessary data in the performance of our students specifically in Mathematics and in Science. In relation to this, the evaluation would be more enriched if we would look into the attitude of our students towards Technical Education by administering the "Attitude Towards Technical Education" (ATTE). This would provide us data about tour students' perception in terms of their favorability upon taking their Technical Subject for this school year. I am requesting that the ITBS and ATTE be administered in the during the month of January 2003. By this time the students have taken up most of their lessons for Mathematics and Science. I will be administering the test for our first and second year students.

The data that will be generated from this study will be part of my thesis in fulfillment of my Masters Degree at the Ateneo de Manila University.

Thank you very much in advance and hoping for your consideration.

Very truly yours,

Carlo Magno

Noted by:

Ms. Josephine Herrera
Mathematics Coordinator

Ms. Annalyn Andres
Science Coordinator

Approved by:

Mrs. Perry Cabo
Vice-Principal

Sister Monica Hamasaki
Principal