SSPC HIGH SCHOOL STUDENTS' MASTERY LEVEL OF THE BASIC SCIENCE PROCESS SKILLS: BASIS FOR CURRICULUM REDIRECTION

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Master of Arts in Teaching
Major in Chemistry

MA. MARGIE L. PAGLIAWAN
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APPROVAL SHEET

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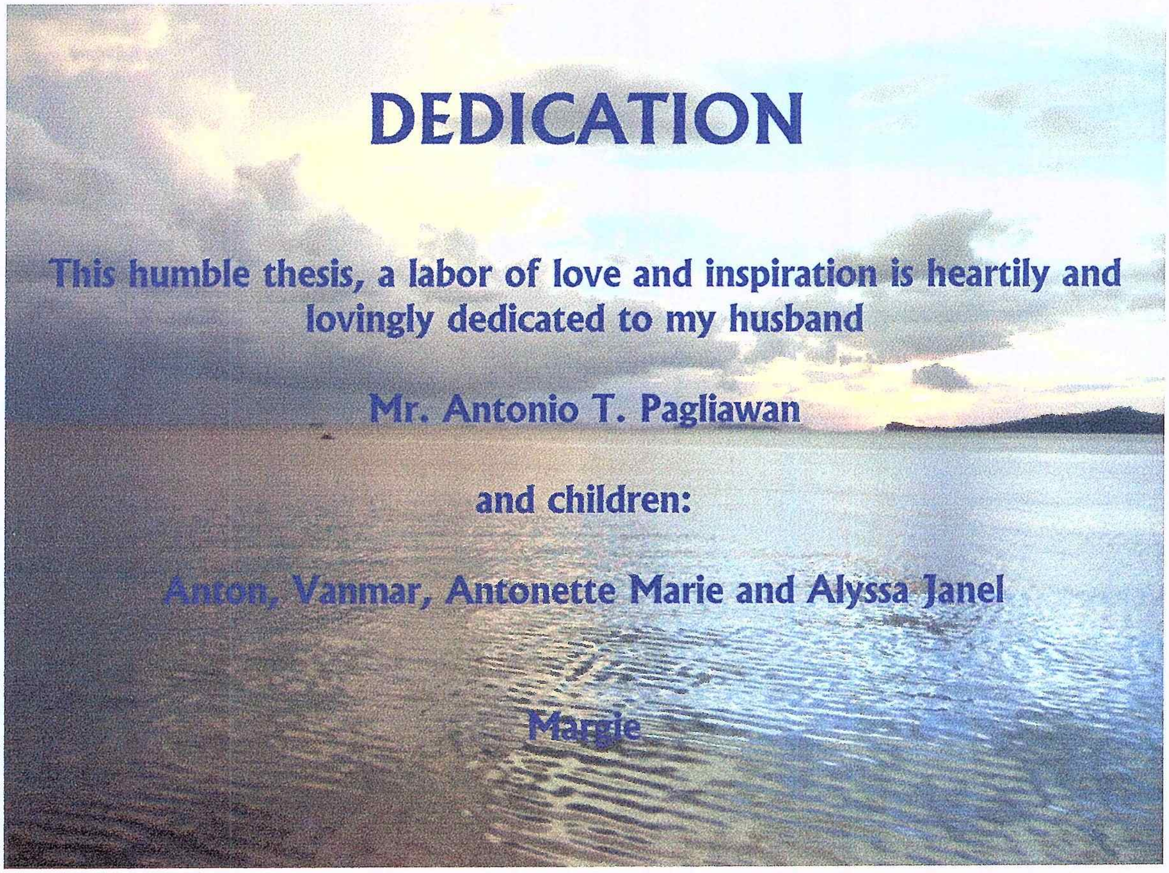

DEDICATION

This humble thesis, a labor of love and inspiration is heartily and lovingly dedicated to my husband

Mr. Antonio T. Pagliawan

and children:

Anton, Vanmar, Antonette Marie and Alyssa Janel

Margie

ABSTRACT

This study determined the SSPC high school students' mastery level in the different basic science process skills. This study utilized a descriptive-normative method of research aimed at determining the mastery level in science process skills of high school students of the Samar State Polytechnic College. The result of the Two-way ANNOVA revealed that "there is no significant effect of year level on the mastery level of the basic science process skills with respect to age and sex". However, there is a significant effect of year level on the mastery level of the basic science process skills with respect to attitude towards science study habits, type of elementary school graduated from and location of elementary school graduated from. The science skills that are difficult in first year, second year, and third year are the following: interring, predicting, and experimenting. However, fourth year respondents do not find difficulties in any of the nine basic science process skills. SSPC high school students' mastery level of the basic science process skills differ by year level as to type and location of elementary school they graduated from. The type and location of elementary school where the high school students graduated from do not affect the mastery level of the basic science process skills in all years level. Inferring, predicting and experimenting, are the basic science process skills that are difficult and need to be developed among the first year, second year, and third year high school students in SSPC, Catbalogan, Samar.

TABLE OF CONTENTS

Chapter | Page

Chapter 1

THE PROBLEM AND ITS SETTING

Introduction

The Filipino youth that will become responsible citizens and decision-makers of the future are in school today. When they leave school, they will face a world made more complex by rapid scientific and technological revolutions. This is the 21st century when the world is rapidly becoming more technologically oriented and to cope with such a world, it is imperative that the population be literate in science.

A basic understanding of science is essential not only for those who will pursue careers in scientific and technical fields but also for all students. The greatest benefit will only be realized from a science education that focuses on producing scientifically and technologically literate citizens. Thus, teachers are called to live and work in a world transformed by rapid growth in new technologies, international competitiveness, and economic globalizations (Uriarte, 1999: 2)

However, there is a problem in teaching science and learning science. In view of the many new discoveries and inventions which have caused the proliferation of knowledge, it is impossible to learn everything in one's field of specialization. This knowledge explosion poses the problem of what and how science teachers should teach effectively scientific concepts. This dilemma can be avoided if teaching and learning will focus on the development of science process skills – how scientific knowledge is arrived at because science is not just the collection of knowledge by memorizing facts but it is also a process of collecting these facts.

Curricula in science for the elementary and secondary levels developed in recent years reveal attempts to present science concepts in the same manner that scientist studied and discovered them (Salandanan, et. al., 1999: 17-18). In contrast to the traditional science programs that treat the different areas of science as a mere collection of facts and concepts, the new curricula revolve around the processes of science. The child learns to understand his environment and simultaneously develops scientific thinking skill through personal experience with materials and phenomena.

For instance, the Department of Education Culture and Sports (DECS), through the Bureau of Secondary Education, comes out with improved secondary Science Education Program (PSSLC, 1998). Found in its opening pages is the objective/goal of the program which states:

> The secondary science education program aims to develop understanding of concepts and key principles of science, science process skills, and desirable values to make students scientifically literate, productive and effective citizens.

Under this objective is the optimism that after undergoing four years of the science and technology program, students are expected to develop the following integrated science process skills: 1) identifying and formulating hypothesis, 2) designing simple experiments or investigations, 3) performing simple experiments or investigations with care and precision, 4) modifying the design of a simple experiment or investigation in as many ways as possible, 5) making and recording observations, 6) organizing data and indicating sources of errors, and 7) inferring from a set of data and drawing conclusions.

The importance of students acquiring competency in the different science process skills is subsumed in a well-known Chinese proverb, which says: "Give a man a fish and he eats for a day. Teach him to catch fish and he eats for a lifetime."

Along this line, Schwarts et. al. (1997: 24-25) called the science process skills as "life long learning skills," as they can be used for daily living and for learning in school in any subject be it in Filipino, English, Chemistry, Biology, Physics, Mathematics, etc.

Inspired by the above observations and opinions, specifically in its goal to emphasize the development of science process skills, the researcher was inspired to undergo this study to find out from SSPC high school students their mastery level of the basic science process skills. The findings of this study can be used as bases for recommendations and suggestions in improving science teaching in the said laboratory high school.

Statement of the Problem

This study determined the SSPC high school students' mastery level in the different basic science process skills. Specifically, it sought answers to the following questions:

1. What is the profile of the first year, second year, third year and fourth year high school students in terms of:

1.1 age;

1.2 sex;

1.3 attitudes toward science;

1.4 study habits;

1.5 type of elementary school graduated from; and

1.6 location of elementary school graduated from?

2. What is the level of facility of each science process skill of students at the end of Grade VI, first year high school, second year high school, and third year high school as well as their mastery level as revealed by the Perez Test 2000?

3. Are there significant differences in the four groups of respondents' mastery level of the basic science process skills according to:

3.1 age;

3.2 sex;

3.3 attitudes toward science;

3.4 study habits;

3.5 type of elementary school graduated from; and

3.6 location of elementary school graduated from?

4. What science process skills are difficult in the first year, second year, third year, and fourth year?

5. What science process skills need to be developed in each year level?

6. What implications in terms of teaching science and curricular redirections maybe derived based on the findings of the study?

Hypothesis

The following hypothesis was tested in order to answer the questions raised in this study:

1. There are no significant differences in the four groups of respondents' mastery level of the basic science process skills according to:

1.1 age;

1.2 sex;

1.3 attitudes toward science;

1.4 study habits;

1.5 type of elementary school graduated from; and

1.6 location of elementary school graduated from.

Theoretical Framework

This study on the SSPC high school students' mastery level of the basic science process skills is supported by the Gestalt Theory. According to this theory cited by William A. Kelly (1965: 218), learning is a process involving both the whole being of the child and the total situation. It is usually defined as the organization and reorganization of behavior which arises from the dynamic interaction of a maturing organism and environment, involving the activities of differentiation and integration, that is, the recognition of significant difference between and among experience and the understanding of the situation or problem in all its relations.

This theory acknowledges the relationship between the learners' experiences and how they use these experiences in perceiving the total situation or problem. As espoused by Lardizabal, et. al. (1991: 19), the learner must put together the parts of a task and perceive it as a meaningful whole. The authors place emphasis upon the concept that learning is interpreted as the organization or reorganization of the subjects as perceptual system into meaningful patterns. A learner will arrive at the solution to the problem when he becomes aware of the important relationships involved in it.

In this case, profile variables such as age, sex, year level, attitude towards science, study habits, type and location of elementary school graduated from will be correlate to the mastery level of the basic science process skills of each high school student.

Further, according to Lardizabal, et. al., (1991: 19), the learner must see the significance, meanings, implications, and applications that will make a given experience understandable. Important to an educative experience are the background and previous experiences of the learner.

In the words of our Filipino authors, Lardizabal, et. al. (1991: 19), as derived from foreign psychologists Magoon and Garrson, the process of problem solving and learning are highly unique and specific. Each individual has his own unique style of learning and solving problems... Thus, learning is facilitated in an atmosphere that promotes and facilitates the individual's discovery of personal objectives and personal meanings in a situation.

This study also rests on the theory of Piaget. Piaget pointed out that mental development is due to different factors. These factors come from experience, social interaction or transmission and equilibrium (Copland, 1979: 29) as the child proceeds through the stages of development and maturation.

Piaget pointed out that a child must experience things for himself. Learning according to Piaget is a situation of experiences where data are stored, correlated, and given continuity. Students are given the opportunity and occasion to test ideas by application.

The research is anchored on Maslow's Hierarchy of Needs Theory. This is one of the most popular attempts to deal with the complexity of human motivation. Maslow theorized that all human motivation could be described in terms of satisfying a hierarchy of needs. This hierarchy, presented symbolically in a pyramid, is composed of a number of different types of needs arranged in such manner that each need becomes dominant when lower level needs have been gratified.

Physiological needs are basic. They must first be gratified before any higher need can become dominant. If a man's physiological needs are not met, his survival is threatened and all behaviors will be directed toward satisfying these needs. The significance of this basic need pervades all learners and whatever their age, the only difference maybe is that the older the learner, the more he can disguise his real motivations and the longer he can postpone their gratification. Thus, a problematic BSIE student will have difficulty in learning and this will result in poor achievement.

Next in the hierarchy are safety needs. To the young learner, these needs are clearly expressed by the learners in their fear of the school environment, the first time they leave home for school. Until such time that the students realized that it is secure, they will be likely preoccupied with proving that this is a safe one, too. As Maslow puts it "growth forward" customarily takes place in little steps and each step forward is made possible by the feeling of being safe from home because retreat is possible.

Then, there are love and belongingness needs. Once a student feels safe in his environment, he will turn toward others to achieve fulfillment. Friendship, love, relationship, group acceptance emerge as the dominant concerns. Nowhere is this more real as in the adolescent learner whose existence is centered in his peer group, their acceptance or rejection of him.

After belongingness and love needs, are the needs for self-respect and recognition. If these needs are not satisfied, a sense of inferiority will emerge.

The individual will constantly be concerned with his inadequacies and at the same time will fear the condemnation of others. Although this stage begins early in a persons' life, its peak, however, from adolescence arrives to adulthood.

The penultimate is the need for self-actualization. It is the desire for self-fulfillment, that is, to become everything that one is capable of becoming. Now here is this tendency as strong in the learners.

According to this theory, motivation in the classroom is largely a process of helping the learner perceive that certain learning experiences can help him be what he wants to be or become what he wants to become. It is not a matter of creating or developing motive or needs to learn. It is rather a case of building or utilizing motives that are already there; that are existent. If the need that is dominant is the need for love and belongingness, of being accepted, of receiving the attention and affection he deserves or needs. The need to know and understand supposedly emanates from the need for self-actualization. In this case, a learner is inherently motivated to learn, provided he sees the learning task as something that will help him become what he wants to become. If he fails to recognize the value of a task in this light, difficult problems in learning will arise.

In addition to Maslow's hierarchy of needs, the study relied on the theory that individual can be developed to his optimum. In the case of students, they must be helped towards maximizing their achievement in the classroom. This can be accomplished if the teacher appreciates potential capabilities of the students. This would mean that the teacher should consider students' strengths and weaknesses, their background, their skills and abilities and their performance in their chosen career

With the aforecited theories it may be inferred that the SSPC high school students' mastery level of the basic science process skills is highly dependent on themselves, their attitude towards science, their study habits, their environment, which include the type and location of elementary school graduated from, etc. The teacher's knowledge of the learner, the learning situation and his pedagogical experience count a lot in successful learning.

Another theory, which will be useful in this problem, is based on the nature that sets the limits of human capabilities. It basically determines how far a person can go insofar as biology is concerned. On the one hand, it is the environment or nurture that harnesses the capabilities of human beings. As such, the individual is a product of the interaction between these two forces. In the family, human beings get so much of biology. In the different social institutions, except the family, human beings harness their full potentials by going out to the greater world, the society. In a way, the nature of the individual's environment plays a significant role in explaining the capability of every individual.

Conceptual Framework

The schema shown in Figure 1 illustrated the totality of the research study

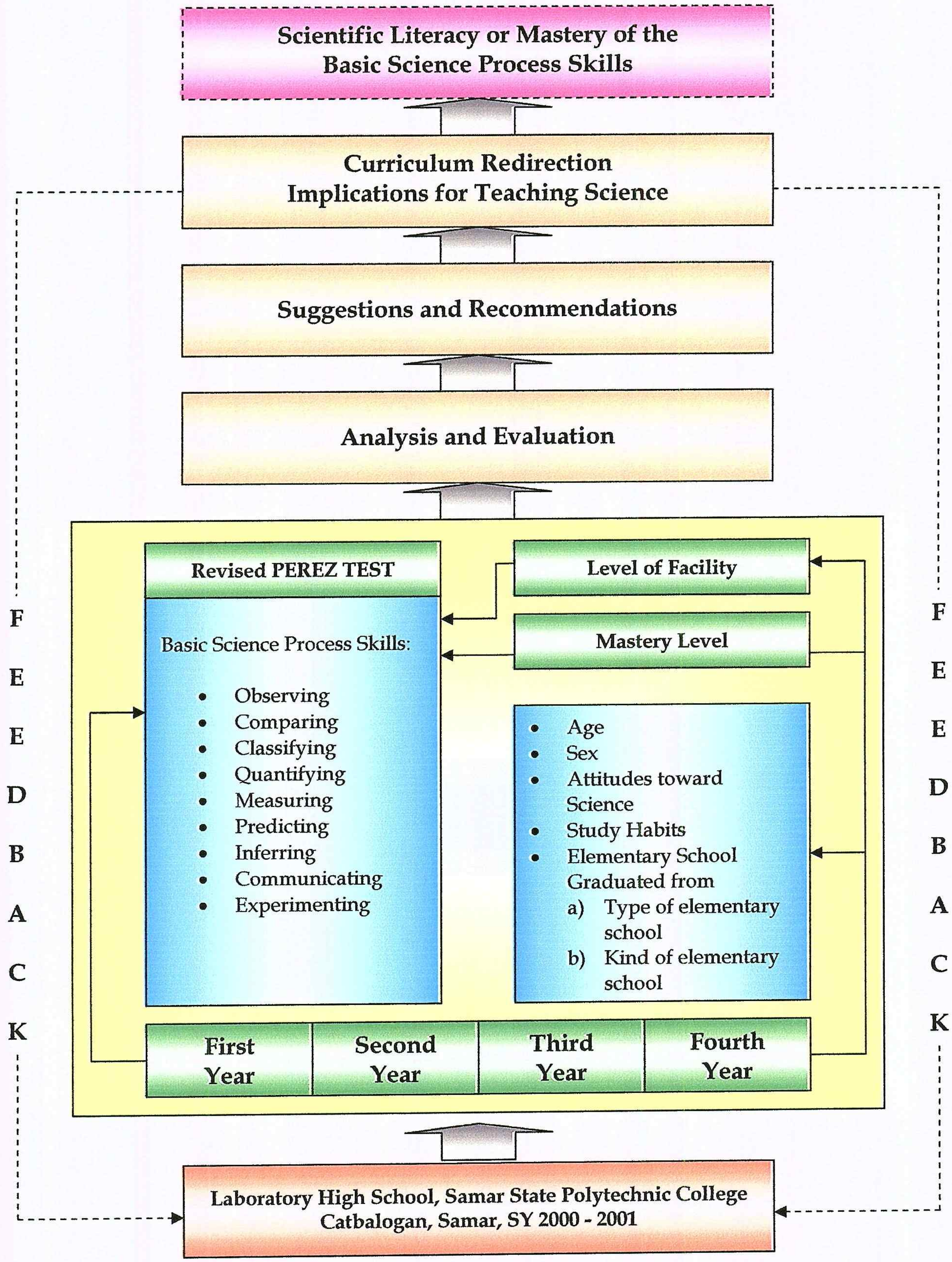

Figure 1. The Conceptual Framework of the Study

The bottom frame of the schema contains the research environment of the study, which is Samar State Polytechnic College, Laboratory High School. It also included the time frame of the study, which is SY 2000-2001. It is then connected with the feedback arrows to the second frame from the topmost part of the schema, the Curriculum Redirection Implication for Teaching Science, since it is expected that curriculum revision should be done first upon knowing the result, findings and recommendations from the environment.

The second frame from the base is the biggest frame. It contains smaller frames inside that illustrate the process as well as the order to attain the research objectives. The grade/year level of the respondents such as first year, second year, third year and fourth year are included to know the mastery level of the basic science process skills using the Revised Perez Test. Mastery levels of the basic science process skills for the four groups of respondents were compared considering the following students related variables – age, sex, attitudes towards science, study habits, type of elementary school graduated from, and location of elementary school graduated from. In addition, the level of facility of the basic science process skills was determined considering the subjects. The facility level of the basic science process skills at the end of each grade/year level was computed and determined.

The third frame of the base is the frame analysis and evaluation. This means that the result was analyzed statistically and interpreted to obtain high school students' mastery level of the science process skills and to know if this process skills are being developed as specified by the whole of Philippine Secondary School Learning Competencies (PSSLC) specifically, to manifest scientific thinking skills among students.

The suggestions and recommendations will lead to the curriculum redirection in the next frame. The direction is upward since it is expected that curriculum revision should be done first and changes on the research environment follows after suggestions and recommendations of any research findings. The second frame from the topmost part of the schema is the frame for curriculum redirections and implications of teaching science. This means that the ultimate aim can be achieved by making some curriculum redirections based on some implications as a result of the study. The topmost frame is the scientific literacy or mastery of the basic science process skills. The aim of science education of any educational system is the attainment of scientific literacy. This is the ultimate aim of this study.

Significance of the Study

This study was conducted to gain information regarding the actual mastery level of high school students in the different science process skills. This would serve as a guide for science teachers in attaining the desired learning competence in science as spelled out in the PSLLC.

To the students. The students, as the focus and subject of this work, are the expected beneficiaries. They will know the mastery level of their science process skills and this will serve as a motivation for them in order to work better in the science subject especially in laboratory activities.

To the science teachers. This study is expected to provide valuable information to teachers, science educators and science education specialists on the science process skills of Filipino learners and their implications to curriculum development and instruction.

By knowing the mastery level of high school students in the science process skills, science teachers would have the knowledge on how to improve the teaching learning situation in the classroom. They would be very careful in planning and selecting activities to be done by students in science classes in order that the students would use the basic skills in science, which are science process skills

To the school administrators. The results would also serve as a valid basis for our educators and administrators in the formulation of policies and guidelines towards the achievement of science education goals. Findings of this study would also give insights, information, direction of guidance to curriculum planners whoa re responsible in preparing science programs. By knowing the SSPC high school mastery level of the basic science process skills, they would be able to conceive better teaching materials, better teaching strategies/techniques that would contribute in raising the mastery level of every secondary students towards science processes which are the basic skills that every science student must possess in order to appreciate science and become in the future a literate citizen of this country

To the parents. Parents would be aware on how their children perform in science, as well as the mastery level of their science process skills. Parents would be guided on how they would motivate their children to engage in science activities and use the process skills even outside the classroom.

To the future researchers. Other researchers who are interested in undertaking similar research problems would find this study a rich material that would serve as a guide in their endeavor.

Scope and Delimitation

This study focused on the high school students' mastery level of the basic science process skills which includes observing, comparing, classifying, quantifying, measuring, predicting, inferring, communicating, and experimenting.

A total of 95 – first year, 72 – second year, 54 – third year, and 84 - fourth year students participated in the survey conducted. The respondents of this study comprised a total of 305 high school students of Samar State Polytechnic College, Catbalogan, Samar Laboratory High School during school year 2000-2001.

The research instruments used were the Perez Test developed by the Institute of Science and Mathematics Education of the University of the

Philippines, Diliman, Quezon City. Attitude Scale developed and validated by Pascua (1900). Study Habits Scale adapted from Bejar (2001) which was validated at Lawaan National High School, Lawaan, Paranas, Samar.

Definition of Terms

Some terms that constantly appear in the write-up are given conceptual and operational meanings to help the readers understand better.

Basic science process skills. This term refers to the processes of observing, comparing, classifying, quantifying, measuring, predicting, inferring, communicating, and experimenting (Religioso, 1996: 34-35).

Classifying. This term refers to a scientific process of arranging objects or events according to some properties (Webster, 1976: 122).

Communicating. This term refers to a scientific thinking process that conveys idea through social interchanges (Webster, 1976: 129).

Comparing. This term refers to a scientific process that deals with concepts of similarities and differences (Webster, 1976: 136).

Curriculum redirection. This term refers to a regular or particular course of study that needs to enrich, modify, abolish or maintain, as the case maybe, towards achieving a common goal (Chappel, 2000: 234)

Difficult skills. This term refers to the quality or state of being hard to do, make or carry out in dealing with understanding, reaching and the like (Webster, 1976: 150). In this study, it refers to the process skill measured by items correctly answered by the students at 49 percent and below by each group of respondents.

Experimenting. This term refers to a scientific process which uses practical test designed with the intention that its results will be relevant to a particular theory or set of theories (Webster, 1976: 279).

Facility level. This term refers to the skills mastered or not mastered by a group of respondents (Baker, 1990: 47).

Inferring. This term refers to a scientific process of making conclusion based on reasoning (Webster, 1976: 290).

Mastery level. This term refers to a condition which identifies aptitudes in terms of measuring the amount of time to learn a task at a performance level: achieved when 100 percent of the pupils master a basic skill at 75 percent level of performance (Padilla, 2000: 437).

Measuring. This term refers to a scientific process of making quantitative observations by comparing to a conventional (or non-conventional) standard (Webster, 1976: 307).

Predicting. This term refers to a scientific process of making a forecast of future events or conditions expected to exist (Webster, 1976: 994).

PSSLC. This is an acronym for Philippine Secondary School learning competencies spelled out by the Department of Education, Culture and Sports. It enumerates the expected competencies at the end of each year level for all subjects.

Quantifying. This term refers to a scientific process to determine the quantity (Webster, 1976: 412).

Reinforced skill. This term refers to the developed knowledge of the means or abilities. In this study, it refers to the process skill that is developed in each year level but shows more improvement in the next year level (Driscoll, 2000: 65).

Revised Perez Test 2000. This is the research instrument borrowed from the UP-NSMED. In this study, it refers to the test instrument that measures the mastery level of the basic science process skills of the students. The test is composed of Part A consisting of 54 multiple choice items that measures lower level of basic science process skills and Part B consisting of 30 items that measures higher level of basic science process skills (Perez, 2000).

Science. This term refers to the knowledge as of facts, phenomena, laws, and proximate causes, gained and verified by exact observation, organized experiment, and correct thinking. In this study, it refers to one of the eight learning areas in the New Secondary Education Curriculum (NSEC) of the Secondary Education Development Program (Villamil, 1998: 1)

Chapter 2

REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents the review of related literature, related studies and the relationship with the present study which give emphasis on the importance of science process skills as a tool for gaining and absorbing knowledge or leading them to science concepts.

Related Literature

The current cybernetic revolution is going to be the biggest technological revolution men have ever know, far more intimately affecting men's daily lives, and of course far quicker, than either the agricultural transformation in Neolithic times or the early industrial revolution which made the present shape of the Asian country. To understand the actual technique of this cybernetic jump, people shall need deep and original conceptual minds. Much of the nations' future depends upon the talent of children not yet in their teens. The type of education needed to bring about the requred talent must be developed in terms of creative skills (Talisayon, 2000: 28).

Santrock and Santrock (1996) believed that all normal, healthy individuals acquire during development a wide range of skills: motor skills, including gross bodily movements, such as walking, and fine manipulations, such as writing, speech production; problem solving skills; and social skills. Skilled behavior is characterized by attributes such as efficiency, purposiveness, and precision. An important feature of all skills is the behavioral flexibility associated with them. For example, the person who has mastered writing can perform that skill with any instrument. Skills enable a person to plan and execute an action designed to achieve a goal, compare results with intentions, and make adjustment in the plan of action. Skill learning usually takes place by small, instrumental steps, gradually improving performance; practice is therefore important. An individual's capacity to adapt to environmental conditions is closely tied to competence in number skills.

Erickson (1993) stated that development needs the intimate and extensive personal acquaintance of a small number of situations with a view of mastering them, not the piling up of information. It is not the naming of facts that is useful but the ability to see their relation and application. Always thinking of social uses of skills, skills are apart from realization of the social use to which they may be futile. A good foundation of education is to build technical skills.

The skills of science have been variously defined and perhaps the most widely accepted definitions are those given by the Commission on science Education of the American Association for the Advancement of Science (AAAS). This system provides the basis for the Science – A Process Approach (SAPA) for the elementary science process program. The primary objective of the SAPA is to have children acquire the skills of doing science. The skills for doing science are categorized into eight primary processes to wit: a) observing; b) classifying; c) measuring; d) communicating; e) inferring; f) predicting; g) using time/space relationships; and h) using numbers.

Mastery of these basic science process skills is required if the students are to learn the integrated science process skills such as: a) formulating hypothesis; b) controlling variables; c) interpreting data; d) defining operationally; and e) experimenting (Walsh, 1996)

Science process skills as defined by Morrison (1998) are the skills that scientist use to study and investigate the world. They are the vehicles for generating content and a means by which concepts are formed.

Processes in learning are worth pursuing to a greater extent as argued by Orton (1990) because it should be emphasized that the understanding of the world around us depends on the development of concepts but his development depends on the use of process skills. Concepts and processes are equally important and are interdependent with one another. As concepts gradually become more sophisticated, process skills need to be refined and extended.

Orton (1990) opined that the development of both must go hand in hand. She explained this development by linking various existing ideas to new experience. One of the existing ideas is linked to the new experience in preference to other possibilities because of some perceived similarities. The processes involved may include observing, hypothesizing and communicating. If the idea that has been linked helps in making sense of the new experience then it will emerge reinforced as a useful idea. Alternatively, it may be that the idea is in need of modification or should be rejected; in which case a different initial ideas will have to be tried. In using ideas and modifying them as experience grows, there is an important role for the process skills – observing, hypothesizing, predicting, investigating, interpreting, and drawing conclusions. These skills are used in linking existing ideas to a new experience, forming hypotheses and testing prediction against new evidence. But if they are not carried out in a rigorous and scientific manner, then the emerging ideas will not necessarily fit the evidence. Thus the development of ideas depends crucially on the process used.

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Schwartz (1997) states that it would be a great mistake to believe that thinking is all there is to the problem solving method. It is important also, that there be other experience as well. The learner must not only be skillful in manipulation of the symbol of thought, but he must be directly exposed to the sorts of experience, which they denote. Language is only a pointer; it takes firsthand experience to clinch its meaning. But one must take care not to confuse thus intuitive learning with the raw empiricism of sense impressions that had been gathered together. And the thinking, which did follow later, was merely a matter of separating and arranging sensory units of experience. Or, if thinking did proceed, sense impressions were employed merely to lend interest to learning its bare symbols.

Bower (1995) in his study of adult education claimed that experiences in adult education show that training courses are most effective if they are closely geared towards training needs identified beforehand in a problem - oriented way. One should build on the experiences of trainees and their self-reflection abilities when addressing their deficits. Using participatory work forms like group work, exercises, role-plays, etc. has proved to be more suitable for learning.

According to Cabag (1999), experiential learning is based upon three assumptions namely: 1) One learn best when one is personally involved in the experience; 2) Knowledge has to be discovered by himself if it is to mean anything to him or make difference in his behavior; and 3) A commitment to learning is highest when one is free to set his own learning goals and actively pursue them within a given framework.

This type of learning utilizes the individual as well as the collective experience of the group as resources for learning new concepts, enhancing skills and developing new orientation

According to Carin (1990), learning experience in science should stimulate and sustain a continuing interest in science undertakings. This may take the form of active involvement in activities that are considerably science – based not only in school but extended to their own homes and the community. Hobbies and leisure time activities such as photography, rearing animals, growing plants, making collections, and reading science materials are worthy off shoots of daily science lesson. Their interest should grow even after leaving school and must be carried into adult life, thus making them more creative and productive. Their interest in any of the science areas may also help them in making future decisions to pursue science careers

Do it! To learn, students must act. They must taste, touch, feel, see, and hear – in short, they must experience. To have a better and more successful tomorrow, student must first fully experience today. Similarly, if teachers expect children to learn, they must expect them to do. Certainly, they must read, think and discuss, but sooner or later, they must act. So, activities and demonstrations are important in and of themselves but they perform other very important functions: they can tangibly help children prepare for life itself. Science experiences enable children to acquire skills that are transferable to their present and future life experiences. These easily transferable components of the experiences are the science process skills (Coga, 1994). Skills involved are observing, classifying communicating, inferring, and predicting.

Ebenezer and Connor (1998) stated that identifying scientific problems, framing questions, seeking and providing evidences, and making knowledge claims are all determined by the social, political, and economic climates of a culture. Scientist's thoughts language and actions are governed by the multiple worlds in which they live. These worlds include scientific network, family, and community.

The authors further said that collecting evidence, generating questions, and proposing and discussing explanations play major roles in scientific inquiry. These intellectual and communicative processes are integral to constructing and negotiating scientific knowledge. They create opportunities for critical thinking. And, although, process skills should not really be an end in them or taught in isolation, they are the basic in conducting scientific inquiry.

Broadly defined, scientific inquiry is a search for truth and knowledge. If you are scientific, you are able to identify problems, make educated guesses of hypotheses, and investigate them. These attitudes influence scientist's discovery behaviors. The discovery behaviors of scientists in turn result in scientific methods, which are referred to in science elementary school children as the process of science. These are: 1) observing; 2) classifying; 3) measuring; 4) hypothesizing or predicting; 5) inferring or making conclusions from data; 6) making insightful questions about nature; 7) forming problems; 8) designing investigations including experiments; 9) carrying out experiments; and 10) constructing principles, laws, and theories from data. Acting like a scientist means using these processes (Carin, 1990).

According to Salandanan et. al. (1996), the greatest value of experimenting as a method of study is the chance afforded to children to experience what scientists went through in their eager search for information. The young are exposed to the ways of the scientists – particularly the systematic procedure they follow in gathering evidences. The children also realize the risks, frustrations, and uncertainties experienced by scientists in their relentless probes, and the children become more appreciative of the discoveries and advances in technology they are enjoying at present.

Moreover, the authors further explained that through experimenting, the pupils get direct contact with the materials needed and they personally gather the data which they analyze in order to arrive at a conclusion. They learn by actually "doing things" themselves. Hopefully, they will develop the habit of finding answers to questions through self-activity.

According to Washton (1997), students are encouraged to investigate problems, perform open-ended experiments when precise answers cannot be obtained from a book but rather by performance of the experiment. They are compelled to think and reason. Some students are forced to become creative by designing and performing their own experiments to test hypotheses, some of which may have been self formulated.

Moreover, the author said that there is also a need for the students to learn basic skills through the manipulation of apparatus. This type of learning activity lends itself more appropriately to the individual laboratory exercise. In the process of concept formation, meaningful learning as opposed to rote learning makes for a greater retention of the fact and an understanding of the concept. Learning can be made more meaningful by the manipulation of objects such as are in the laboratory and through the use of pupil's experiences and interests.

Further, the author said that as science teachers, they should involve their students in helping to design the nature of the laboratory problem or exercise. The students should do some planning of the experiment which will lead to thinking an analytical reasoning. The experiments to be performed by the students should be checked by the teacher.

Finally, the author said that the first exploration conducted by a young child in his immediate surroundings could be paralleled to the sophisticated experimentation performed by scientists in search of new and scientific information. Both can be broken down into a number of simple but developed in order to achieve the goals of science education: 1) observing; 2) comparing; 3) classifying; 4) measuring; 5) inferring; 6) predicting; and 7) controlling variables.

Dawson (1995) stated that competence in using process skills children with the ability to apply knowledge, not only to science and other subjects in the classroom, but outside the classroom in their everyday lives as well. They are the same skills that will serve them as adults, when they measure their floor for a carpet, try to figure out why their automobile didn't start, or decide which presidential candidate to vote for. These are the thinking skills they will use when separating evidence from opinion while listening to someone's side of a story, or when looking for evidence and contradictions in written or spoken opinions. They are the science processes children will use as adults.

A form of problem solving which draws on many skills and employs the higher cognitive activities of interpretation, analysis and synthesis is modeling. Johnson and Johnson (1994) enumerate the significance of making students work collaboratively through models. They can 1) observe, imitate and build upon each other strategies, thereby increasing their mastery of higher level reasoning processes; 2) experience the encouragement, support, warmth and approval of a number of classmates; 3) have peers evaluate, diagnose, correct and give feedback on their conceptual understanding; 4) be exposed to a greater diversity of ideas and procedures, and 5) apply critical thinking and give more creative responses. It is very clear that modeling involves using the basic science process skills.

According to Nuñez (1993) the public school students' problem lies in their inability to comprehend the theories, concepts and mathematical problems in science. The students; inability to define terms, theories and concepts could be due to poor vocabulary, inadequate foundation in the concepts, principles and theories in science. Such situation could be due also to insufficient communication in English. The students are not confident in solving problems in science. It reveals that the students have poor foundation in the four fundamentals of mathematics, maybe they do not possess mathematical skills needed for solving science problems.

The private school students are uncertain in memorizing the symbols of elements and chemical formulas of compounds. Scientists share common language. In science, particularly chemistry, standard ways are used to express the composition of substances, the number of particles and chemical reactions and other quantities. Symbols of elements and chemical formulas of compounds are involved in these processes, and they are considered the language of chemistry. Because of the complex task of memorizing the symbols of elements and formulas of compounds, the students resent memorizing them. The teacher should explain the importance of the subject matter to the students in the study of science. The importance also of problem solving should be emphasized to the students in order to arouse their interest and enthusiasm.

According to Cinco (1990) good study habits are generally not acquired by merely reading the book on the subject; they are developed by definitely planned directive procedures. They enable the students to make the most of complex ideas in their lessons. The scarcity of present literature on how to study is not due to the suggestions and tips offered to students but due to lack of understanding on the part of the teachers on how to apply the suggestions in concrete situations.

Since early childhood, students have developed attitudes towards work and studies. Some of these attitudes are good, others are not. For example, when one student comes across a new word, new words should be added to a list, find its meaning in a dictionary, and uses it in writing and speech. Another student skips over new words and quickly loses interest in reading, and finally quits. Students obviously exhibit different talents and abilities in school. This is a psychological principle which makes it impossible for teachers to transform all individuals in a class into equally good students. This situation is a challenge to those who are responsible for the development of student's potentials.

Related Studies

Several research studies had been undertaken on how to measure science process skills learned specifically using the pencil paper type of assessment of written task.

Arana (1990) studied the competencies in science processes of freshmen students in South Cotabato. She utilized the Perez Test of Science Processes (PTSP) as instrument. Her findings revealed that students possess the skills in observing, quantifying, classifying and measuring as shown by the mean scores obtained in these processes. Difficulty in comparing was exhibited by the first year students. They also found it very difficult to experiment, infer and predict. One of her recommendations it for more intensive elementary science program, which emphasizes the development of competencies in science processes.

In the case of Asensi (1990), her study involved the science competencies of first year high school students, the present study is also involved in competencies in process skills but the researcher investigated not only first year high school students but also all year levels in high school. The studies also differed in terms of research environment. Also, both studies used the Perez test instrument but the latter used the revised one.

Berzabal (1995) attempted to find out the performance of grade six pupils of the four classes and to account for the process skill profile of the Filipino pupils and their school. He used the Science Process Skills Test Instrument (SPSTI) developed by course participants in SEAMEO RECSAM. The findings of the study revealed that the process skill profile of the grade six pupils in the four classes showed that the better scoring pupils came from the higher sections and also from the high achievers. The level of difficulty as shown by both groups found "devising investigation skills" to be easy, followed by "interpreting information skills" and "hypothesizing skills". The skills being the most difficult is "communicating".

Berzabal's (1995) study is similar to the present study in terms of the science process skills but his study focused in grade six pupils and the instrument used by him was the Science Process Skills Test whereas in this study, the researcher focused on all year levels in the laboratory high school of Samar State Polytechnic College and the instrument used in assessing the level of mastery of the students was the Revised Perez Test.

Lerit (1992) conducted another study to develop a diagnostic test on the processes of science for high school physics. The findings showed that the process skills indispensable to the senior students as perceived by the physics teachers are: observing, comparing, classifying, quantifying, measuring, predicting, inferring, communicating and experimenting. The students got the highest mean score in quantifying. Communicating, classifying, observing, predicting, and experimenting followed this.

The study of Lerit (1992) was a diagnostic test on the science process skills. The science process skills for High School Physics. The Present study and his study have similarity in the sense that both were studies in science process skills. However, the present study differed in the sense that his study concentrated on physics while the current investigation dealt on process skills used in all science subjects. Also, the research environment and respondents were different from his study. The present study involved all year levels in the high school and the research concentrated in Samar State Polytechnic College, Catbalogan, Samar.

The study of Sotto (1995) assessed the integrated science process skills and cognitive abilities of 605 Education students from four state universities in Metro Manila.

The participants were grouped according to their courses: Science, non-science, and vocational-technical students. According to year levels, the samples were classified as freshmen, sophomores, juniors, and seniors.

Four instruments were administered to the participants. An adaptation of Hiura's Integrated Science Process Skills Test (ISPST) was used to determine the performance of the participants in the different integrated science process skill categories. The cognitive level of the participants was measured using the Piagetian Test of Cognitive Development. The unusual uses of a ball pen, task in the verbal form of the Creative Thinking Test, were used to find out the participants' creative ability. The researcher developed a questionnaire that provided the personal profile of the participants.

The following conclusions were drawn: 1) Education students were most competent in graphing and interpreting data. They were least competent in identifying and operationally defining variables; 2) Majority of the education students were in their early formal stage of cognitive development; 3) The science major students had the highest competency in the integrated science process skills, cognitive development, and creative thinking ability; 4) Process skills were significantly correlated with (a) cognitive level, (b) course, (c) creative thinking, (d) grade point average, and (e) number of units earned in Science.

However, the process skills were not significantly related with (a) SES and (b) year level.

This study bore similarity to the study of Sotto since both studies assessed the science process skills of the students. Both studies used four levels of respondents, first year, second year, third year and fourth year. Sotto used college students while this study used high school students. Sotto's study, however, tried to correlate science process skills to the cognitive level, course, creative thinking, grade point average, and number of units earned in science whereas, the present study did not. However, the present study tried to determine the mastery level of the science process skills of each year level.

Van den Berg (1993) conducted a research that develops a module entitled "The Teaching of Scientific Investigation Skills in the Secondary School." Moreover, this study aimed at developing a means to acquaint junior and senior high school students with various aspects of scientific investigation and to exercise skills like formulating hypotheses, controlling variables, and drawing conclusions from experimental data. The module sought to investigate factors, which could influence the period of a pendulum and in the process of investigation to experience the systematic way in which scientists and engineers try to solve problems and answer questions through experiments.

This study found out that scientific investigative skills could be taught using this module. These skills include the following: 1) Formulating the problem to be investigated; 2) Designing experiments to test these hypotheses or predictions; 3) Observing and measuring results of the experiment. 4) Trying alternative arrangements of equipment to improve the validity and accuracy of measurement; 5) defining variables operationally such as the variables time, length of the pendulum, shape of the bob, amplitude of the swing; and 6) Thinking about weaknesses in the design of the experiment and consequences for generalization of the conclusions.

One of the suggestions in the module was for students with little or no prior experience in scientific problem solving to emphasize skills, a) and b) only through experimentation.

The study of Van den Berg is similar to the present study in trying to investigate the performance of students in the basic science process skills. The two studies differ in the sense that the study of Van Den Berg developed a module and through this module students' process skills were assessed. The present study used the Perez Test on basic science process skills to determine the students' mastery level of these skills. Also, the module developed was on a particular topic in science and it was for junior and senior high school students only. This study involved high school students from all year levels and the topic covers not only about the pendulum but almost all aspects of science.

Somerset and Van den Berg's (2001) study on the basic number skills of high school students aimed at gaining understanding of the current problems in science and mathematics education and the needs of teachers. Fifteen high schools in Region VII were chosen to represent the government and private, rural and urban, elite and poor sectors.

The following were the findings of the study and suggested actions to be taken: 1) Second year and fourth year high school students do not master essential basic number skills taught at the elementary and first year secondary level. 2) Typical errors are well known, such as alignment errors in addition and subtraction, smaller - larger error in subtraction, and errors in ordering decimal numbers according to size. However, there does not seem to be systematic effort of teachers to diagnose errors and do something about them. 3) The errors reveal a lack of insight in the magnitude of numbers and the concepts behind basic mathematical operations and procedures.

Observations revealed mathematics lessons, which were mainly formula substitution and drills in carrying out operations with little attention for concepts and context. Opportunities for student guided practice in the classroom were not used sufficiently and teachers do not make use of opportunities to look at individual work during seatwork.

The results supported our belief that skills in solving applied number problems cannot be acquired through drills in formula substitution. Understanding of concepts and contexts is necessary to judge whether outcomes of mechanical arithmetic are sensible. The view of mathematics and mathematics teaching held by many teachers seems to be that mathematics is what the calculator does. In other words, computation and applying rules only. This in turn results in an ineffective teaching methodology. Unfortunately the process of reorienting university/TEI faculty and high school teachers will require many years and long and intensive guidance. It may be more effective to concentrate on teacher education at a few good universities rather than let any college have its own program.

The study is similar to the present study in that they both involved assessing process skills. However, the present study is different in that it focuses on all basic science process skills. While that of the previous study only included the basic number skills.

Nuñez (1996) study assessed the competency of high school Physics teachers in the Science and Technology Coordinating Council (STCC) network schools in Region V. The assessment was based on the principle that the teacher is the most important factor that contributes to efficiency of learning.

The research combined a descriptive survey technique through a researcher - made questionnaire, classroom observation, tests, and existing records. Both qualitative and quantitative analyses were made. The five instruments used were: 1) content knowledge test for Physics teachers, 2) Integrated Science Process Skill Test, 3) teacher questionnaire, 4) student assessment done by the teacher, and 5) classroom observation guide. The statistical techniques used were: descriptive statistics, Pearson r, stepwise multiple regression, item analysis using discrimination and difficulty indices, Kuder Richardson formula 20, and Kendall Tau correlation.

This study showed that the high school Physics teachers were rated competent in all the four measures of competency. The four measures were knowledge of Physics, Science process skills, job performance in the classroom for both method and laboratory, and teacher related variables. These measures did not include the Physics units earned at the graduate school level.

The teachers' job performance in the classroom was positively correlated with the science process skills possessed by the secondary Physics teachers. However, they were found to be negatively related to the content knowledge competency of the teachers. It was significantly related only to the number of years in teaching Physics

The undergraduate Mathematics units earned by the teacher revealed a significantly negative correlation with their competency in Physics. The Physics teachers were related very well in their overall method of teaching.

The study is similar to the present study in the sense that both studies tried to assess science process skills. In the study of Nuñez, the respondents were the Physics teachers of Region V while in this study, the high school students of SSPC. While this study tried to determine the mastery level of the high school students in the science process skills that of Nuñez tried to correlate the science process skills to job performance in the classroom.

Smith and Welliver's (1990) study entitled "The Development of a Science Process Assessment for Fourth Grade Students" used a multi-choice test entitled "A Science Process Assessment." This was developed to measure the science process skills of students in grade four. Students were given a copy of the test booklet; teachers read each test aloud to the students. Upon completion of the first administration, data from the item analysis yielded a reliability coefficient. Subsequently, 40 test items were identified for the Science Process Assessment, Pilot 2. Using the test-retest method, the Science Research Assessment, Pilot 2 (Test 1 and Test 2) was administered to 113 fourth grade students. Reliability coefficients were ascertained. This study is similar to the present study since both utilized science process skills. The latter was used to measure the high school students' cognitive knowledge in science process skills. The study of Smith and Welliver tried to make test questions on the science process skills.

Segumpan (2001) studied the Bruneian Education Students Science Process Skills: Implications to Curriculum and Management. This descriptive-correlational study assessed the science process skills among the 100 final year pre-service teachers of the Sultan Hassanal Bolkiah Institute of Education, University Brunei Darussalam. Data were gathered using the researcher-made Science Inquiry Skills Test (SIST), Science Learning Attitudes Skills (SLAS), Science Teaching Orientation Questionnaire (STOQ), through a non-structured interview, and data from university handbooks and records. Data were analyzed utilizing the SPSS software.

Findings show that mean scores of the pre-service teachers in all the science inquiry processes had an overall competency level that could be described as "average". When categorized into basic and integrated skills, a subject showed average competency level in the basic science process skills and poor competency in the integrated science inquiry skills.

Across the basic science inquiry skills, the subjects displayed above average performance in observing, and quantifying, while they showed an average performance in comparing, recognizing/using space/time relation, and classifying. With respect to the integrated science inquiry skills, it was found that they had average competency level in formulating hypotheses, interpreting data, and inferring while their competency level in experimenting controlling variables, and predicting was poor.

The relatively large standard deviation in the subjects' overall mean scores indicated heterogeneity as regards to their performance in the SIST. This maybe rationalized in terms of the diverse abilities of the subjects as well as the varying science courses provided in the different teacher education programmes in the University Brunei Darussalam. The subjects' school science background might have accounted also for this performance gap.

The findings of this study suggest that the subject are relatively proficient in the overall basic science process skills, especially in observing, measuring, and quantifying where the subjects obtained a rating of above average. This performance could be attributed to, among other factors, the teaching learning experiences provided in the teacher education curricula. For instance, it was established during the interview with the science lecturers involved in the teacher education programme that instructional activities like handling and using laboratory equipment and carrying out simple investigations have been provided to the student teachers. These activities are aimed not only at equipping them with the basic science inquiry skills but also at developing their manipulative or psychomotor skills.

Segumpan (2001) study is similar to the present study in terms of the basic science skills but his study focused on the 100 final year pre-service teachers at the Sultan Hassanal Bolkiah Institute of education, University Brunei Darussalam. The instrument used by him was the Science Inquiry Skills Test (SIST) Science Learning Attitudes Scale (SLAS) Science Teacher Orientation Questionnaire (STOQ), whereas in this study, the researcher focused on all year levels of the Laboratory High School of Samar State Polytechnic College. The instrument used in assessing the level of mastery of the students was the Revised Perez Test.

Lim (1998) studied the measurable effect of a process lead approach on achievement, science process skills and task content among students of chemistry. Her study probes the comparative effects of two contrasting approaches using the process-led and content-led approaches in developing students' science process skills in school and everyday contexts, and in understanding chemistry concepts. Some important findings of her study were the following: 1) Experimental group perceived the process-led approach to be different from the usual laboratory procedure in that doing the investigations engaged them in more higher order process skills about the task on hand made them understand the chemistry concepts linked to the task; 2) The respondents from the control group perceived the traditional laboratory helped them to get the right answers as outlined in the manual and confirmed chemistry concepts learned in lecture; and 3) The laboratory report showed pattern of skill development for the experimental group, while the control group appeared to have benefited little from their laboratory in the acquisition of science process skills.

In the case of Lim (1998), her study involved science competencies of industrial and mathematical engineering classes. The present study is also involved with competencies in science process skills but the researcher investigated not on engineering students but on the high school students from first year to fourth year level. The studies also differed in terms of research environment.

Vargas (1995) attempted to find out the effects of controlled and free grouping schemes on the achievement of the basic science process skills in senior high school physics laboratory activities. Two intact classes that were randomly selected were given the science process skills test that were developed and validated by the researcher. Her study reveals the following: 1) There is no significant difference in the overall performance in basic science process skills between the control and experimental groups; 2) The control group achieves better in the observation skills than does the experimental group; 3) Both groups achieve best in the communicating skills; and 4) The experimental group achieves least in the observation skill while the control group achieves least in the problem solving skills.

The study of Vargas is similar to the present study in that they both involve science process skills. The two studies differ in the sense that Vargas study focused on senior high school physics laboratory activities using the Test Science Process Skills (TSPS) while the present study used the Perez Test on the basic science process skills to determine the students' mastery level of these skills. Also, her study focused only on senior students of Dela Salle University while the present study involved high school students from all year levels of Laboratory High School, SSPC, Catbalogan, Samar.

Cabunoc (1999) attempted to find out the students' skills in the basic science process and their effect on science learning among freshmen at St. Mary's Academy, Palo, Leyte. The following are the important findings of her study: 1) The respondents performance on the skills tested is barely "Fair". The respondents obtain higher scores in observation while they perform lowest in the classification and comparison. 2) There is a highly significant effect of the basic science skills on science learning. The low performance in almost all skills can be traced to their low science related activities.

In the case of Cabunoc (1999), her study involved the science competencies of first year high school students. The present study is also involved in competencies on process skills but the researcher investigated not only first year high school students but also all year levels in high school students but also all year levels in high school. The studies also differed in terms of research environment in the sense that her study was conducted at St. Mary's Academy, Palo, Leyte while the present study was conducted at Laboratory High School, SSPC, Catbalogan, Samar.

Mallorca (1997) attempted to investigate the Grade VI pupil's skills in the basic science processes in representative schools of West District I in the Schools Division of Cagayan de Oro City, for school year 1997-1998. She found out from her study that the respondents' performance varies from "fair" to "good" in the six process skills: for comparison, classification, measurement, and making inference on the other hand, a "fair" performance is observed. A close look at the mean reveals that the respondents perform lowest in comparison and highest in observation. Respondents are also observed to be capable of making estimates with the use of legends and symbols. Similarly they are found to have a good grasp of the concept of time. They are found to need more improvement in the ability to read thermometers. They are also observed to be capable of making inferences in areas where health is concerned. A need to further develop their ability to relate effects to cause is observed.

Mallorca's study is similar to the present study in terms of the science process skills but her study focused on grade six pupils and the instrument used by her was the Science Process Skills Test (SPST) whereas in this study, the researcher focused on all year levels in the laboratory high school of Samar State

Polytechnic College and the instrument used in assessing the level of mastery of the students was the Revised Perez Test 2000.

Cortez (1994) conducted a research on pupil's mastery of the science process skills in Grades III and VII. The results of the International Association for the Evaluation of Educational Achievement - Third International Mathematics and Science Study (IEA-TIMSS) Trial Phase in Science for Grades III and VII in ten elementary schools and 12 secondary schools in four regions were analyzed. The findings show that the science process skills learned well by the respondents are inferring, classifying, and predicting in Grade III; and observing and classifying in Grade VII. As a group, Grade III pupils have not mastered each process skills. The level of competency of Grade VII pupils of each skill reaches only up to near mastery. The skills in Grade III considered difficult and below average levels are observing, comparing, classifying, quantifying, measuring, predicting, inferring, communicating, and predicting. Those in Grade VII are comparing, classifying, quantifying, measuring, predicting, inferring, communicating, and experimenting. It is generalized that not a single skill is mastered by pupils at Grades III and VII in all the schools and regions; skill development is not sustained; and there is no neutral sequential order in the development of the process skills in Grades III and VII.

The present study and her study have similarity in the sense that both are studies in science process skills. However, the present study differs in the sense that her study concentrated on Grades III and VII in ten elementary schools and

12 secondary schools in four regions (Regions II, III, IV, and National Capital Region), while the current investigation focused on high school students only of SSPC, Catbalogan, Samar.

Magno (2000) study on the development and validation of integrated science process skills test in high school chemistry. Result of his study revealed that those students under science-oriented curriculum obtained significantly higher score those under the general curriculum. Further analysis showed that a positive and significant correlation existed between the integrated science process skills test scores and the following student variables: grade in chemistry, school curriculum type and attendance in preschool.

The study of Magno is similar to the present study in that they both involve science process skills. The two studies differ in the sense that his descriptive correlational study used a researcher's validated forty-item, four option multiple choice type of test known as Integrated Science Process Skills Test (ISPST) in high school chemistry. There are only four skills tested in his study. These skills include identifying variables, operationally defining variables, inferring and formulating hypothesis as well as graphing and interpreting data. The respondents of his study were 370 third year high school students enrolled in ten different schools in Iloilo City during the school year 1999-2000. While the present study used the Revised Perez Test 2000 of the Basic Science Process Skills composed of Part A and Part B that focused on the nine basic science process skills and the respondents composed of four year levels of high school students of SSPC, Cathalogan, Samar.

Visitacion (1998) attempted to find out the competencies in science process skills of BEED student teachers and selected Grade VI pupils of Teacher Institutions of Nueva Vizcaya. The finding of his study reveals that the student teachers are found to be significantly superior to the Grade VI pupils in all science skills. His study also reveals that students teacher's performance in the process skill of observing, is significantly better than in predicting, inferring and experimenting, better in comparing than in inferring, better in classifying than in predicting and experimenting, better in quantifying than in comparing, classifying, measuring and predicting, inferring and experimenting; better in predicting than in experimenting than in experimenting; and better in inferring than in experimenting. On the other hand, the Grade VI pupil's performance on the process skill of observing is significantly better than in predicting, inferring, and experimenting, better in comparing than in experimenting, better in classifying than in observing and quantifying; and better in quantifying than in comparing, measuring, predicting, inferring and experimenting. The study reveals that student teachers and Grade VI pupil's needs are in the process skills of experimenting, predicting, inferring, measuring, classifying, comparing, and observing.

His study and the present study are about science process skills. However, Visitacion's study aimed to compare the science process skills competencies of BEED student teachers and Grade VI pupils and relate them to their average grades in Basic English, Mathematics and Science. Whereas the present study aimed to find out the level of mastery of science process skills of all year levels of high school students of SSPC, Catbalogan, Samar in order to improve the teaching of science subjects.

The above related literature and studies were taken into consideration for a better conceptualization of the study.

Chapter 3

METHODOLOGY

This chapter discusses the research methodology which includes the research design, sources of data, instrumentation, validation of the instruments, data gathering procedure and statistical treatment of data

Research Design

This study utilized the descriptive-normative method of research aimed at determining the mastery level in science process skills of high school students of the Samar State Polytechnic College (SSPC).

The main instrument used in gathering the data was the Revised Perez Test 2000. The test consisted of two parts. Part A contained 54 multiple choice items, which aimed to measure the following lower level of science process skills - observing, comparing, classifying, measuring, communicating, and quantifying. Part B contained 30 multiple choice items aimed at measuring the following science process skills - planning and understanding experiments, inferring and predicting. This Revised Perez Test 2000 was developed by the University of the Philippines - Institute of Science and Mathematics Education (UP-NISMED).

Other instruments used were the "Attitude Toward Science Scale" and "Study Habits Scale". The "Attitude Toward Science Scale" was adopted from Medina (1995) and "Study Habits Scale" from Bejar (2000).

A total of 305 respondents were involved in this study taken from the four year levels. There were 95 first year high school students. 72 second year high school students, 54 third year high school students and 84 fourth year high school students. All of these student-respondents were enrolled in the laboratory high school of Samar State Polytechnic College during the school year 2000-2001.

Instrumentation

The following research instruments were used in this study:

Perez Test of Science Processes (Revised 2000). This instrument was used to assess the high school students' science process skills. The researcher wrote a letter addressed to the Director of the UP-Institute of Science and Mathematics Education (UP-NISMED), Diliman, Quezon City to ask for a copy of the Perez Test for Science Process Skills. At the same time, permission to use the said instrument was sought.

The Revised Perez Test consisted of two parts. Part A contained 54 multiple choice item that measured science process skills in observing, comparing, classifying, measuring, quantifying, and communicating. Part B contained 30 multiple choice items that measured planning and understanding of experiments, inferring, and predicting.

Attitude toward science scale. This was a questionnaire-checklists, which was adopted from Medina (1995). It contained 20 positive science attitude statements. The attitude rating scale was used to measure students' manifestation of attitudes toward science. They were given five alternatives indicating their reactions to each statement in the scale. The Likert type of summated rating was adopted. The following point assignments to five different types of responses were used for the attitude rating scale, to wit: (5) strongly agree; (4) agree; (3) neutral; (2) disagree; and (1) strongly disagree.

Study habits scale. This instrument was used to measure students' practice or usual routine in learning or understanding science. This rating scale consisted of 20 positive statements. The students were given five alternatives indicating their reactions to each statement in the scale. The Likert type of summated rating was adapted. The following point assignments to five different types of responses were used: (5) always; (4) often; (3) frequently; (2) sometimes; and (1) not at all.

Validation of the Instrument

The study did not validate the Revised Perez Test of Science Processes since this research instrument was already validated by UP-NISMED.

The "Study Habits Scale" and "Attitudes Toward Science Scale" were validated using the "Test-Retest Method" at Lawaan National High School, Lawaan, Paranas, Samar. Five teachers and a total of 40 high school students were used to validate the above mentioned instruments – Study Habits Scale and the Attitudes Towards Science Scale. They were given to the respondents during the first regular meeting in January 2001. A week after they were given to the same group of respondents. In this method, the researcher computed the correlation coefficient between the two administrators of the test instrument. If r were high the measurement would be consistent and itself reliable. The computed correlation were 0.89 for attitude toward science and 0.91 for study habits, which indicated a high reliability according to Ebel's interpretation.

The degree of relationships was determined by the size of the obtained r. Interpretations of the obtained r were as follows (Ebel, 1965: 202):

r from ± .01 to ± .19	negligible correlation
r from ± .20 to ± .39	low correlation
r from ± .40 to ± .59	moderate correlation
r from ± .60 to ± .79	moderately higher correlation
r from ± .8- to ± 1.0	high correlation

The reliability of computed correlation was interpreted using the following scale:

Reliability	Degree of Reliability
0.95 – 0.99	Very high, rarely found among teacher's made test.
0.90 – 0.94	Highly equaled by few test.
0.80 – 0.89	Fairly high, adequate for individual measurement.

0.70 - 0.79 Rather low, adequate for group measurement but not very satisfactory for individual measurement.

Below 0.70 Low, entirely inadequate for individual measurement although useful for group average and school survey.

Also, five teachers of Lawaan National High School accomplished an evaluation sheet with ten criteria. Using a rating scale of 1 to 5, with 1 as strongly disagree and 5 as strongly agree, an average weighted mean of 4.37 was obtained for attitudes toward science and 4.21 for study habits. Thus, the respondents collectively agreed that the adapted attitudes and study habits instruments had conformed with the criteria of validity.

Sampling Procedure

The respondents of the study were all students of the Laboratory High School of the Samar State Polytechnic College, Catbalogan, Samar during the school year 2000-2001. The researcher wanted to include the total population but during the test administration some students were absent so only 305 high school students became respondents of the study. The researcher believed that with 305 respondents she already got the real picture in science learning of the high school students of SSPC by measuring their science process skills.

The Sloven's formula (1960) was used to determine the sample size adequate for a research study. The total number of respondents needed for the formula was 198. Three hundred-five is more than adequate.

$$n = \frac{N}{1 + Ne^2}$$

where:

n - the sample size;

N - population size; and

e - desired margin of error.

<u>Data Gathering Procedure</u>

The researcher asked permission from the College President and from the Dean of the College of Education of SSPC to conduct the Revised Perez Test 2000 to the high school students.

Test administration was conducted during the actual science class schedule. Other factors such as lighting, duration of the test (1 hour), and test administration were controlled.

The profile of the respondents which is found on the upper portion of the answer sheet of the Perez Test contains data of students such as: age, sex, year and section, type and location of elementary school graduated from.

After collecting the questionnaire, it was immediately scored and analyzed.

The researcher distributed the study habits and attitude towards science questionnaire-checklists after the respondents had finished the test. Upon accomplishment of the questionnaire – checklist on study habits in science and attitudes toward science, the researcher collated the data.

<u>Statistical Treatment of Data</u>

The following statistical tools were used in this study:

To compute for the level of facility of the science process skills the scale formulated by Alindada (1991) was adapted to determine the skills mastered or not mastered by each groups of respondents in this study. The guide for judging the difficulty or ease of item is shown below:

Correct Answers	Interpretation
45 – 100%	Very easy; at mastery level
50 – 74%	Easy; nearing mastery
25 – 49%	Average difficulty; not yet mastered
0 – 24%	Very difficult; far from mastery

Item analysis was done to obtain the facility index of each item. The index of difficulty was used in identifying the level of facility for each item. The process of item analysis was undertaken separately fro each of the four groups of respondents: first year, second year, third year, and fourth year. Below is the formula for computing the difficulty index (Kerlinger & Lee, 2000).

$$\text{Facility index} = \frac{\text{No. of student answering item correctly}}{\text{Total number of students in one year level}}$$

To interpret the collected data, descriptive statistics much as frequency counts, mean, weighted mean, standard deviation, and percentage were computed, and inferential statistics such as the Two-way ANOVA was used.

Frequency counts. This statistical tool was resorted to determine the number of respondents who have the same age, sex, educational qualification, units earned in chemistry, teaching experience, etc.

Ranking. This statistical measure was used to arrange the given data in their order of magnitude. The teaching strategies commonly used by the teachers were ranked.

Mean. This statistical measure was used to determine the collective attitude of high school students toward science.

Standard Deviation (SD). This statistical measure was used to determine the variation in the ages of each group.

Percentage. This statistical tool was used in the analysis and interpretation of data on age, sex, educational qualification, units earned in chemistry, teaching experience, etc.

Weighted mean. This was used to describe the respondents' attitude towards science and the extent to which the method was used by the high school students

The respondents' score level percentages representing the correct answer of each item identifying the behavior of each process skill were computed to get the mean score. The mean score was used to statistically test whether there was a significant difference in the mastery of the science process skills among the four (4) groups of respondents

Two-way ANOVA. The two-way ANOVA was used since there were four groups involved and there were two dependent variables in the study. The formula used for the computation of the Two-way ANOVA as adopted from Bartz (1981) is shown in Table 1.

Table 1

Computation Formula for Two-Way ANOVA

Sources of Variation (S.V.)	Degrees of Freedom (df)	Sum of Squares (SS)	Mean Square (MS)	Computed F
Row Means	$r - 1$	SS_r	$S_1^2 = \frac{SS_r}{r - 1}$	$F_1 = \frac{S_1^2}{S_3^2}$
Column Means	$c - 1$	SS_c	$S_2^2 = \frac{SS_c}{c - 1}$	$F_2 = \frac{S_2^2}{S_3^2}$
Error	$(r-1)(c-1)$	SS_e	$S_3^2 = \frac{SS_e}{(r-1)(c-1)}$	
Total	$rc - 1$	SS_t		

Scheffe's test. When the hypothesis tested for the ANOVA was rejected, it necessarily meant further tests to find exactly where the significant difference lies when comparing the means of the two groups – first year and second year high school students. The Scheffe's method of multiple comparisons (Downie & Heath, 1994: 206) was used with the following formula:

$$F = \frac{(\bar{X}_i - \bar{X}_j)^2}{\left(\frac{MS_w (n_i + n_j)}{(n_i\, n_j)} \right)}$$

where:

F	-	Scheffe's test ratio;
MS_w	-	within group sum of squares;
$\bar{X}_i$	-	mean of the i group;
$\bar{X}_j$	-	mean of the j group;
n_i	-	number of cases of the i group; and
n_j	-	number of cases of the j group.

Chapter 4

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

The chapter presents the collected data, the corresponding results of the analysis made as well as the interpretation of the findings.

Profile of the Respondents

The profile of the high school respondents included their age, sex, year level, attitudes toward science, and study habits. It also included the type of the elementary school graduated from, that is, whether public or private, and the location of the elementary school, that is, whether the school is in the urban or in the rural area.

Age. Table 2 shows the distribution and percentage of the age of high school students of SSPC. As can be gleaned from the table, majority of the first year respondents belong to age level of 13 where there are 71 or 74.74 percent, and the lowest number on one hand is age 12 where there are only 10 or 10.52 percent. Speaking of the first year respondents, their average age was pegged at 13.04, and their standard deviation was equal to 0.02.

For the second year students, most of them belong to age level of 14 where there are 51 or 70.83 percent. The lowest number of them belongs to 16 where there is only one or 1.39 percent. The average age of the second year respondents

Table 2

Age Distribution of Respondents

Age	Year Level								Total	Percent
	I		II		III		IV			
	f	%	f	%	f	%	f	%		
12.00	10	10.52							10	10.52
13.00	71	74.74	8	11.11					79	85.85
14.00	14	14.74	51	70.83	15	27.78			80	113.35
15.00			12	16.67	32	59.26	12	14.29	56	90.22
16.00			1	1.39	7	12.96	63	75.00	71	89.35
17.00							9	10.71	9	10.71
Total	95	100.00	72	100.00	54	100.00	84	100.00	305	400.00
Percent	31.15		23.61		17.70		27.54		100.00	
Mean	13.04		14.02		14.85		15.96		14.47	
SD	0.02		0.08		0.04		0.02		0.04	

was pegged at 14.02 with the standard deviation of 0.08. Out of 54 third year respondents, 32 or 59.26 percent of them belong to age level of 15, and it was the age level where the third year has the highest number belong. The lowest number of them belongs to age level of 16 where there are seven or 12.96 percent. The average of the third year respondents was pegged at 14.85, and the standard deviation was equal to 0.04. Also the table shows the ages of the fourth year high school respondents. Majority of the fourth year respondents belong to age level of 16 where there are 63 or 75 percent, and the lowest number on the other hand belong to age level of 17 where there are nine or 10.71 percent only. Their average age was pegged at 15.96 with the standard deviation equal to 0.02.

Sex. The distribution of the SSPC high school respondents according to sex is shown in Table 3. It can be gleaned from the table that 34 or 35.79 percent of the first year respondents are males and 61 or 64.21 percent are female. 41 or 56.94 percent of the second year respondents are male and 31 or 43.06 percent are female.

It is also shown in the table that 19 or 35.19 percent of the third year respondents are male and 35 or 64.81 percent are female. 34 or 40.48 percent of the fourth year respondents are male and 50 or 59.52 percent are female.

Table 3

Sex Distribution of Respondents

Sex	Year Level								Total	Percent
	I		II		III		IV			
	f	%	f	%	f	%	f	%		
Male	34	35.79	41	56.94	19	35.19	34	40.48	128	168.40
Female	61	64.21	31	43.06	35	64.81	50	59.52	177	231.60
Total	95	100.00	72	100.00	54	100.00	84	100.00	305	400.00

Attitude towards science. Table 4 presents the high school students' attitude toward science expressed in terms of weighted mean. The students' responses were interpreted as follows: strongly agree (5), agree (4), Undecided (3), disagree (2), and strongly disagree (1).

Table 4

High School Students' Attitudes Toward Science

Attitude Statements	Year Level								Grand Mean	Interpretation
	1st		2nd		3rd		4th			
	A	I	A	I	A	I	A	I		
1. I find science an interesting subject.	3.16	U	3.25	U	3.35	U	3.45	U	3.30	U
2. Science is stimulating and challenging subject	2.93	U	3.43	U	3.52	A	3.49	U	3.34	U
3. I enjoy my Science class so I attend my class regularly.	2.88	U	2.67	U	2.74	U	3.00	U	2.82	U
4. I don't get bored in a science class.	3.01	U	3.04	U	2.81	U	2.83	U	2.92	U
5. Science develops my ability to think critically and reason out correctly.	2.63	U	2.51	U	2.52	U	2.87	U	3.63	U
6. I feel relaxed and comfortable when reading my science lessons.	2.57	U	2.60	U	2.81	U	2.73	U	2.68	U
7. I feel happier in my science class than in any other class.	3.13	U	2.94	U	3.13	U	3.08	U	3.07	U
8. I wish I could take more science subjects other than those offered in my course.	3.62	A	3.56	A	3.63	A	3.56	A	3.48	U
9. I find that the allotted time is just enough for studying science	3.27	U	3.56	A	3.48	U	3.75	A	3.52	A
10. I understand science very well of I study it.	3.00	U	3.03	U	3.28	U	3.05	U	3.09	U
11. Science develops in me a feeling of superiority and self importance.	3.03	U	3.14	U	3.06	U	2.68	U	2.98	U
12. I believe that science is the easiest to learn	3.00	U	2.99	U	3.13	U	3.12	U	3.06	U
13 Science is my most important subject.	2.51	U	3.32	U	2.63	U	2.53	U	2.75	U

Table 4 Continued

Attitude Statements	Year Level								Grand Mean	Interpre-tation
	1st		2nd		3rd		4th			
	x	I	x	I	x	I	x	I		
14. I can solve science problem even without the help of somebody.	3.55	A	3.43	U	3.17	U	3.56	A	3.43	U
15. I study my science lesson regularly.	3.44	U	3.65	A	3.22	U	3.57	A	3.47	U
16. Science makes me feel relaxed, happy, and very comfortable.	1.57	U	2.35	D	2.50	D	2.51	U	2.48	D
17. I find textbooks in science interesting.	3.96	A	3.66	A	3.56	A	3.51	A	3.68	A
18. I believe that science is needed in my daily life.	3.72	A	3.69	A	3.57	A	3.55	A	3.63	A
19. I feel alive and alert in my science class.	2.26	D	2.36	D	2.70	U	2.61	U	2.48	D
20. Science is one of my favorite subject.	3.45	U	3.43	U	3.11	U	3.31	U	3.33	U
Total	61.69		62.67		61.92		62.76		62.14	
Mean	3.08		3.13		3.10		3.14		3.11	
Interpretation	U		U		U		U		U	

LEGEND:
4.51 – 5.00 Strongly Agree (SA)
3.51 – 4.50 Agree (A)
2.51 – 3.50 Undecided/Neutral (U)
1.51 – 2.50 Disagree (D)
1.00 – 1.51 Strongly Disagree (SD)

For the first year respondents, the 20 attitude statement were rated in the following manner: four attitude statements were rated "agree", fifteen attitude statements were rated "undecided" and one attitude statement was rated "disagree". No attitude statement was rated "strongly agree" and "strongly disagree".

The data obtained clearly revealed that there were three attitude statements each rated with a mean equal to 3.96, 3.72, and 3.62 respectively. The statements were as follows: 1) I find textbook in science interesting, 2) I believe that science is needed in my daily life; and 3) I wish I could take more science subjects other than those offered in my course.

It also showed that the lowest mean rating of 2.26 was given to the statement "I feel alert and alive in my science class". The grand mean of the first year respondents was 3.08 which is interpreted as "undecided to what the statement says. This means that the first year respondents generally were not partial to any attitude statements.

For the second year respondents, the distribution of ratings for the 20 attitude statements were as follows: two attitude statements were rated "disagree", five attitude statements were rated "agree", thirteen attitude statements were rated "undecided" No attitude statement was rated "strongly agree" and "strongly disagree".

The data obtained clearly revealed that these three attitude statements were given the top highest rating of mean equal to 3.69, 3.68, and 3.65 respectively. The statements were as follows: 1) I believe that science is needed in my daily life, 2) I find the textbook in science interesting; and 3) I study my science lesson regularly.

There were two attitude statements given the lowest rating of mean equal to 2.35, and 2.36 respectively. The statements were the following: 1) Science makes me feel relaxed, happy, and very comfortable, 2) I feel alive and alert in any science class.

The grand mean was 3.33 which are interpreted as "undecided". This means that the second year students were not partial to any of the twenty attitude statements.

For the third year respondents, the distribution of the ratings for the 20 attitude statements was as follows: four attitude statements were rated "agree", 15 attitude statements were rated "undecided", and one attitude statement was rated "disagree"

The data clearly revealed that the highest rating of mean equal to 3.63, 3.57, 3.56, and 3.52 was given to the following statements: 1) I wish I could take more science subjects than those offered in my course, 2) I believe that science is needed in my daily life, 3) I find textbooks in science very interesting, and 4) Science is stimulating and challenging subject. The lowest mean rating of 2.50 was given to the statement "Science makes me feel relaxed, happy and very comfortable

The grand mean s 3.10 which is interpreted as "undecided". This only shows that the third year respondents were not partial to any attitude statements.

For the fourth year respondents, the distribution of the 20 attitude statements was as follows: six attitude statements were rate "agree", 14 attitude statements were rated "undecided". No attitude statement was rated as "strongly agree" and "strongly disagree".

The data obtained clearly revealed that the highest rating of 3.75 interpreted as "agree" to what the statement says was given to "I find that the allotted time is just enough for studying science. The lowest rating of 2.51 interpreted as "undecided" to what the statement says was given to "Science makes me feel relaxed, happy, and very comfortable".

The grand mean of the attitude of the fourth year respondents was pegged at 3.14 interpreted as "undecided". This implies that the fourth year respondents were not partial to any attitude statements. For the overall attitude of the high school respondents, the distributions of the rating of the 20 attitude statements based on the grand mean was as follows: three attitude statements were rated "agree", 15 were rated "undecided". Only two attitude statement was rated "disagree". It is important to note that "none of the attitude statements was rated either "strongly disagree" and/or "strongly agree" as to what the statement says.

The table revealed that the highest rating of 3.68 interpreted as "agree" as to what the statement says was given to the statement "I find textbooks in science interesting". And the lowest rating of 2.48 was given to the following: 1) Science makes me feel relaxed, happy, and comfortable. 2) I feel alive and alert in my science class.

The grand mean of the attitude of the high school respondents was pegged at 3.33 interpreted as "undecided". This implies that the high school respondents were not partial to any attitude statements such as Science is my favorite subject; I believe that science is the easiest to learn, and I find science an interesting subject.

It is evident from the data gathered that SSPC high school students do not feel relaxed, happy and comfortable during science classes. Maybe, it could be the reason also why they are not alive and alert during science class discussion. It can be inferred from the result then that some students regard science a very difficult and boring subject, since it is a combination of numbers and language. So it is part of a teacher's effort to make some remedy in making students understand that science is an enjoyable subject.

The classroom should be a natural environment where living and learning occur together. Even if they're just inside the classroom, let them explore and discover the world around them. If VCD is available in the classroom, film viewing regarding the topic is very helpful for them to awaken their mind and become alert. If the classroom provides necessary materials that the students can manipulate and give them a feeling that they're just playing, they will not notice that learning occurs while they are enjoying the process.

Teachers should develop their willingness to accept responsibility for the learning of their students. They should be competent in teaching students to become alert and alive in science classes. They should engage students in active hands on learning. They should work hard to come up with unique activities that will make students excited about science, until the moment teachers see the enthusiasm in their eyes-students is having fun and learning. In other words they will now start developing favorable attitude towards the subject.

Study habits. The mean weighted ratings of students' perceptions on their study habits in science are presented in Table 5. The mean weighted point of students' responses to their study habits was interpreted as follows: 1.00 to 1.50 not at all; 1.51 – 2.50 sometimes; 2.51 to 3.50 frequently; 3.51 – 4.50 often; and 4.51 – 5.00 always.

For the first year respondents, the data obtained clearly revealed that the highest rating of 3.93 interpreted as "often" practiced was given to the statement "I prefer to study my science lesson alone rather than with others". The lowest rating was 2.76 interpreted as "sometimes" practiced was given to the statement "when tests are returned, I find my grades raised by my careful solutions on problems"

For the second year respondents, the data obtained clearly revealed that the first three highest rating of 3.68, 3.67, and 3.64 interpreted as "often" practiced was given to three statements: 1) If time is available, I take few minutes to check over my answers before turning in my examination papers, 2) I study three or more hours per day outside the class, 3) I give special attention to accuracy and neatness of solutions to exercises, activities, laboratory results and other books to be returned in. The lowest rating of 2.36 interpreted as

Table 5

Respondents' Study Habits

Study Habits Statements	Year Level								Grand Mean	Interpretation
	1st		2nd		3rd		4th			
	$\bar{x}$	I	$\bar{x}$	I	$\bar{x}$	I	$\bar{x}$	I		
1. I really appreciate when my teacher criticizes my solutions to problem as briefly or hastily written or poorly organized.	3.41	F	3.25	F	3.69	O	3.07	F	3.38	F
2. I give special attention to accuracy and neatness of solutions to exercises, activities, laboratory results and other works to be turned in.	3.19	F	3.64	O	3.74	O	3.35	F	3.48	F
3. I memorized rules, definitions of technical terms, symbols, formulas, etc. with understanding	2.78	F	3.11	F	2.85	F	2.96	F	2.93	F
4. I ask my teacher for further explanation of an assignment that is not clear to me.	2.77	F	2.71	F	2.91	F	3.17	F	2.89	F
5. I give attention to returned examinations, reports, experiment papers, and homework / assignments in order to correct errors noted by the teacher.	3.00	F	3.22	F	3.33	F	2.92	F	3.14	F
6. I have clear understanding with the application of mathematical and science formulas.	3.15	F	3.25	F	3.06	F	2.36	S	2.96	F

Table 5 Continued

Study Habits Statements	Year Level								Grand Mean	Interpretation
	1st		2nd		3rd		4th			
	x	I	x	I	x	I	x	I		
7. I put on solving science problems and doing drill exercises.	2.76	F	3.05	F	2.76	F	2.44	S	2.75	F
8. I have no difficulty in picking out important points in my science lessons.	3.75	O	3.50	F	3.69	O	3.11	F	3.51	O
9. When I doubt about the correct solution for a problem I refer to a book to provide a guide to follow	3.44	F	3.58	O	3.48	F	3.24	F	3.44	F
10. I utilized the vacant hours between classes for studying so as to reduce the evening's work.	3.13	F	3.04	F	3.13	F	3.19	F	3.12	F
11. I copy the diagrams, drawings, tables and other illustration that the teacher put on the board.	3.06	F	3.15	F	2.89	F	3.40	F	3.13	F
12. I complete my homework/assignment on time	3.19	F	3.08	F	3.67	O	3.61	O	3.23	F
13. With me, studying my Science lesson regularly can make me feel science as enjoyable subject.	3.17	F	2.63	F	3.02	F	2.49	S	2.75	F
14. I am very careful of the solution when answering examination questions	3.23	F	2.39	S	2.70	F	2.65	F	2.8	F
15. I keep my assignments up to date by doing my work regularly from day to day.	3.52	O	3.57	O	2.93	F	3.29	F	3.43	F
16. I keep my assignments up to date by doing my work regularly from day to day	3.52	O	3.57	O	2.94	F	3.29	F	3.43	F

Table 5 Continued

Study Habits Statements	Year Level								Grand Mean	Interpretation
	1st		2nd		3rd		4th			
	x̄	I	x̄	I	x̄	I	x̄	I		
17. If time is available, I take few minutes to check over my answers before turning in my examination papers.	3.61	O	3.66	O	3.35	F	3.40	F	3.55	O
18. I prefer to study my lessons alone rather than with others.	3.93	O	3.57	O	3.52	O	3.49	F	3.68	O
19. I study three or more hours per day outside the class.	3.84	O	3.67	O	3.72	O	3.30	F	3.63	O
20. When tests are returned, I find my grades have been increased by my careful solution on problems.	2.16	S	2.36	S	3.70	O	2.62	F	2.99	S
21. During examinations, I bear in my mind the concepts, formulas, and other details that I study.	2.22	S	2.36	S	2.39	S	2.96	F	2.48	S
Total	63.61		62.99		63.27		61.02		62.67	
Mean	3.17		3.15		3.16		3.05		3.13	
Interpretation	F		F		F		F		F	

LEGEND:
4.51 – 5.00 Always (A)
3.51 – 4.50 Often (O)
2.51 – 3.50 Frequently (F)
1.51 – 2.50 Sometimes (S)
1.00 – 1.51 Not at All (NA)

"sometimes" practiced were given to the following statements: 1) When tests are returned, I find my grades have been raised by my careful solutions on problems, 2) During examinations, I bear in my mind the concepts, formulas, and other details that I study.

For the third year high school respondents, the data obtained clearly revealed that there were three statements were given the highest rating of mean equal to 3.72 and 3.70 interpreted as "often" practiced. The statements were the following: 1) I prefer to study my science lesson alone rather than with others; and 2) I study three or more hours per day outside the class. There were two study habits given the lowest rating of mean equal to 2.41 and 2.39 interpreted as "sometimes" practiced. The two statements were the following: 1) When tests are returned, I find my grades have been raised by my careful solutions on problems; and 2) During examinations, I hear in my mind the concepts, formulas, and other details that I study.

For the fourth year high school respondents, the data obtained revealed that the highest rating of 3.61 interpreted as "often" practiced was given to the statement "I complete my homework/assignment on time". The lowest rating of 2.49, 2.44, and 2.36 interpreted as "sometimes" practiced were given to the following statements, namely: 1) With me studying science lesson regularly can make me feel science is enjoyable subject, 2) I put on solving science problems and doing drill exercises, 3) I have clear understanding with the application of mathematical and science formulas. On the whole, the study habits of the high school respondents of SSPC were described in terms of the grand mean. No study habits statements were perceived to be "always" practiced. The statement which was perceived to be "often" practiced was "I prefer to study my science lesson alone rather than with others. This statement had the highest mean rating

3.68. There statements followed the preceding statement with the mean ratings of 3.63, 3.55, and 3.51 interpreted also as "often" practiced. These statements were the following: 1) I study three or more hours per day outside the class, 2) If time is available, I take few minutes to check over my answers before turning in my examination papers, 3) I have no difficulty in picking out important points in my science lessons. Fourteen study habits statements were perceived by the high school students to be "frequently" practiced with a mean rating between 2.51 – 3.50. These statements were as follows: 1) I really appreciate when my teacher criticized my solutions to problems as briefly or hastily written or poorly organized, 2) I give special attention to accuracy and neatness of solutions to exercises, activities, laboratory results, and other work to be turned in, 3) I memorized rules, definitions of technical terms, symbols, formulas etc. with readily understanding, 4) I ask my teacher for further explanation of an assignment that is not clear to me, 5) I give attention to returned examinations, reports, experiment papers, and assignments in order to correct errors noted by my teachers, 6) I have clear understanding wit the application of mathematical and science formulas, 7) I prefer to study my lessons alone rather than with others, 8) When I doubt about the correct solution for a problem, I prefer to a book to provide a guide to follow, 9) I utilized the vacant hours between classes for studying so as to reduce the evening's work, 10) I copy the diagrams, tables and other illustration, that the teacher put on the blackboard, 11) I complete my assignment/homework on time, 12) With me, studying science lesson regularly can make me feel science is enjoyable subject, 13) I am very careful of the solution when answering examination question, 14) I keep my assignments up to date by doing my work regularly from day to day.

Two statements which were perceived to be "sometimes" practiced with a lowest mean rating equal to 2.39 and 2.48. These statements were the following: 1) When tests are returned, I find my grades have been raised by my careful solutions on problems, 2) During examinations, I bear in my mind the concepts, formulas, and other details that I study.

The different year levels agree with each other for the following five study habits statements. These statements were the following: 1) I memorized rules, definitions of technical terms, symbols, formulas, etc. with understanding, 2) I ask my teacher for further explanation of an assignment that is not clear to me, 3) I give attention to returned examinations, reports, experiment papers, homework and assignments in order to correct errors noted by the teachers, 4) I utilize the vacant hours between classes for studying so as to reduce the evening's work, 5) I copy the diagrams, drawings, tables, and other illustrations that the teacher put on the blackboard.

It is evident from the gathered data that SSPC high school students are not very careful in solving problems, that's why when tests are returned they found out that their grades have been lowered. It also showed from the gathered data that during examinations, they forgot the concepts, formulas, and other details that they studied.

Mathematics is a language of science, that's why mathematical skill should be developed in the students so that it will be easy for them to solve problems. The students should be aware of the importance of problem-solving in the study of science. They should practiced and used different formulas to different problems. They should not stop until they will arrive at the correct solutions to the problem by understanding numbers and formulas. If they are very much involved in problem solving, they will be more interested and enthusiastic in it.

If the students has the aptitude in problem solving and involve a much different pattern of abilities than those required for understanding and abstract ideas then he is able to solve problems for quality, flexibility, resourcefulness, improving skill, originality, and problem sensitivity as well as venturesomeness.

Also, students should prepare a systematic schedule of studying in studying science lessons. They should have a proper set of mind, so that if examination comes, students will not forget the concepts, formulas, and other details in science that they studied.

For the teachers, if the test papers are returned to the students after checking, it is the best way to have a discussions regarding the test, show them the right way on how to arrive at the correct solutions to the problems so that student can realize and think why they do not arrive the correct answers. Appropriate pedagogic procedures can improve problem solving ability.

Teachers should encourage students develop wholesome study, strive to gain interest of the students in doing the problem solving, make the classroom discussion pleasant, meaningtful and stimulating, and provide learning facilities in the classroom. They should use and provide opportunities for practice in the various learning activities those study habits least or not practiced by the students. They should diagnose cases of inefficient study and provide remedial measures.

Type of elementary school graduated from. The frequency distribution of the SSPC high school respondents according to type of elementary school graduate from are shown in Table 6. Out of 95 first year respondents, 86 or 90.53 percent graduated from public elementary school and nine or 9.47 percent of them graduated from private school. Majority of the second year respondents graduated from public elementary school where there are 62 or 86.11 percent. Ten or 13.89 percent of them graduated from private elementary school.

Table 6

Type of Elementary School Graduated From

Type of School	Year Level								Total	Percent
	I		II		III		IV			
	f	%	f	%	f	%	f	%		
Public	86	90.53	62	86.11	49	90.74	78	92.86	275	360.849
Private	9	9.47	10	13.89	5	9.26	6	7.14	30	39.76
Total	95	100.00	72	100.00	54	100.00	84	100.00	305	400.00

It can be gleaned also from the table that 49 or 90.74 percent of the third year respondents were graduated from public elementary school and five or 9.26 percent of them graduated from private elementary school. For the fourth year, 78 or 92.86 percent of them graduated from public elementary schools and six or 7.14 percent of them graduated private elementary school.

<u>Location of elementary school graduated from</u>. The frequency distribution of the SSPC high school respondents according to location of elementary school graduated from are shown in Table 7. It can be gleaned from the table that out of 95 first year respondents, 60 or 63.16 percent of them graduated from urban elementary school and 35 or 36.84 percent graduated from rural elementary school. For the second year respondents, out of 72 total number of respondents, 62 or 86.11 percent of them graduated from urban elementary school and ten or 13.89 percent graduated from rural elementary school.

Table 7

Location of Elementary School Graduated From

Location of School	Year Level								Total	Percent
	I		II		III		IV			
	f	%	f	%	f	%	f	%		
Urban	60	63.16	62	86.11	46	85.19	62	73.81	230	308.27
Rural	35	36.84	10	13.89	8	14.81	22	26.19	75	91.73
Total	95	100.00	72	100.00	54	100.00	84	100.00	305	400.00

It is also shows in the table that out of 54 total number of third year respondents, 46 or 85.19 percent of them graduated from urban elementary school and only eight and 14.81 percent of them graduated from rural elementary school. For the fourth year, out of 84 total number of respondents, majority of them graduated from urban elementary with a total number of 62 or 73.81 percent, and 22 or 26.19 percent of them graduated from rural elementary school.

Level of Difficulty on the Basic Science Process Skills of the Respondents

The respondents' facility level of the basic science process skills is depicted in Table 8. Item analysis was done to determine the index of difficulty of each item. The difficulty index was expressed in percent and become the level of facility of the item. Items measuring and testing the same basic process skills were grouped together. The mean rating of these items was taken to represent the facility of a respondent of the science process skill. The interpretation of the facility level of the respondents on the basic science process skills was based on the scale formulated by Alindada (1991). If out of the 84 items, a respondent correctly answered 63 items or more, the respondent found the test very easy. If a respondent has correctly answered 42 – 62 items he/she found the test on the science process skills easy enough. If the score of a respondent in the science process skills test is between 21 – 41 the test is average difficult to him/her. If the respondent was not able to answer any item correctly or his score in the test will

Table 8

Respondents' Facility Level of the Basic Science Process Skills Based on Revised Perez Test 2000

Basic Science Process Skills	Faculty Level				Mean	Score	Interpretation
	1st	2nd	3rd	4th			
1. Observing	60 Easy	62 Easy	66 Easy	59 Easy	62	52	Easy
2. Comparing	58 Easy	67 Easy	72 Easy	66 Easy	65	55	Easy
3. Classifying	65 Easy	70 Easy	76 VE	70 Easy	70	60	Easy
4. Quantifying	56 Easy	55 Easy	69 Easy	66 Easy	62	52	Easy
5. Measuring	63 Easy	67 Easy	72 Easy	73 Easy	69	59	Easy
6. Communicating	79 Easy	76 VE	73 Easy	74 Easy	76	62	VE
7. Inferring	28 AD	35 AD	45 AD	52 Easy	40	34	AD
8. Predicting	25 AD	34 AD	35 AD	51 Easy	36	30	AD
9. Experimenting	37 AD	39 AD	39 AD	51 Easy	42	36	AD
Mean	52	56	61	62	58		
Score	42	46	51	52	48		
Interpretation	Easy	Easy	Easy	Easy	Easy		

LEGEND:

75% - 100% Very Easy (VE)
50% - 74% Easy (E)
25% - 49% Average Difficulty (AD)
0% - 24% Very Difficult (VD)

be 20 below the test was very difficult for him/her.

As reflected in the table, for the level of facility of the first year respondents of the basic science process skills, the first year respondent considered six skills easy. These skills are observing, comparing, classifying, quantifying, measuring, and communicating. Three skills were of average difficulty. These are inferring, predicting, and experimenting. The first year respondents rated no science process skill "very difficult" or "very easy".

The second year high school respondents rated communicating as "very easy". Five skills were rated easy. These skills are observing, comparing, classifying, quantifying, and measuring. Three skills were of average difficulty. These are inferring, predicting, and experimenting. The second year high school students rated no science process skills "very difficult".

The third year high school respondents rated classifying as "very easy". Five skills were rated easy. These skills are observing, comparing, quantifying, measuring, and communicating. Three skills were of average difficulty. These are inferring, predicting, and experimenting. The third year high school students rated no science process skills "very difficult".

Implications: This implies that the respondents of all year levels of SSPC Laboratory High School are very much exposed to the following science process skills: observing, comparing, quantifying, and measuring. The four levels of SSPC high school students have different levels of facility to the different science process skills. Most of the science process skills are always used or practiced by them so, they found it easy.

During science classes especially laboratory workshop, teachers should see to it that the activities of the students they are conducting must awaken the students' interests especially those which focus more on the basic science process skills where they found it average difficult for them such as: inferring, predicting, and communicating.

Science Process Skills that Need to be Developed by Year level

The respondents' mastery level of the basic science process skills based on the "Revised Perez Test" is reported in Table 9. The following scale was used as guide in the interpretation: 75 – 100 percent very easy; at mastery level, 50 – 74 percent easy; or nearing mastery, 25 – 49 percent average difficulty; far from mastery; 0 – 24 percent very difficult; very far from mastery. Thus, if the respondent correctly answered 75 – 100 percent of the items in the test, the respondent mastery level of the basic science process skills is deemed "at mastery level" or the test is "very easy" for the respondent. In the same vein, if the correct answer of the respondents has reached around 50 – 74 percent, his mastery level is considered as "nearing mastery". The test is "easy". On the other hand if only 25 – 49 percent of the test items were correctly answered by the respondents his/her mastery level is "far from mastery" or he/she considered the test difficult. If 24 or less of the items in the test were correctly

Table 9

Mastery Level of the Basic Science Process Skills (Using the Revised Perez Test 2000)

Level of Mastery	Year Level								Total	Percent
	I		II		III		IV			
	f	%	f	%	f	%	f	%		
At mastery level	0	-	0	-	0	-	0	-	-	-
Nearing mastery	16	16.84	13	18.06	21	38.89	50	59.52	100	32.79
Far from mastery	78	82.11	59	81.94	33	61.11	34	0.48	204	66.89
Very far from mastery	1	1.05	0	-	0	-	0	-	1	0.33
Total	95	100.00	72	100.00	54	100.00	84	100.00	305	400.00

answered by the respondent his or her mastery level is very far from mastery or he/she considered the test as "very difficult".

As reflected in the table, for the mastery level of the first year respondent of the basic science process skills, 16.84 percent were "nearing mastery", 78 or 82.11 percent were "far from mastery", and one or 1.05 percent is "very far from mastery"

The second year respondents' mastery level of the basic science process skills can be summarized as 13 or 18.06 percent were nearing mastery, and 59 or 81.94 percent were far from mastery.

On the other hand, 21 or 38.89 percent of the third year respondents were considered "easy" or nearing mastery of the basic science process skills and 33 or 61.11 percent were of "average difficulty" or they have not mastered the basic science process skills.

The fourth year respondents' mastery levels, 50 or 59.52 percent were "nearing mastery", and 34 or 40.48 percent were "not yet mastered".

The high school respondents' of SSPC have not yet mastered or they are far from mastery of the basic science process skills. More than 50 percent of the respondents (205) were on the level of "average difficulty" and "very difficult" compared to only 100 which is evaluated as "nearing mastery level" or considered the test "easy"

Comparison of the Mastery Level of the Basic Science Process Skills

The two-way analysis of variance (Two-Way ANOVA) was employed to test the hypothesis of the research problem. The two-way ANOVA was used to determine the differences in mastery level of the basic science process skills due to the simultaneous effect of two factors. These factors are the following: 1) age and year level, 2) sex and year level, 3) attitude towards science and year level, 4) study habits and year level, 5) type of elementary school graduated from and year level and 6) location of elementary school graduated from and year level. The two-way ANOVA had the added advantage over running two single ANOVA in that it enabled the determination of the main effect as well as the simultaneous effect of the two factors on the variables tested. In the formula used for the computation of the two-way ANOVA the sum of squares related to interaction and to error effect are not separated or partitioned. In this research, the first factor, year level has four levels – first, second, third, and fourth. Sex has two levels – male and female. Attitude toward science has five levels – strongly agree, agree, undecided, disagree, and strongly disagree to what the statement says. Study habits have five levels – almost always, often times, frequently, sometimes and rarely practiced. Elementary school graduated from was further grouped into a) type of elementary school – public and private and b) location of elementary school – rural and urban.

By age. Table 10 shows the summary of the year level and age on the mastery level of the basic science process skills. The row factor were the ages of the respondents (12, 13, 14, 15, 16, 17 years old) and the column factor – the year level (first, second, third, fourth).

For the row factor, the mean scores were 11.05, 21.4125, 33.325, 35.6145, 35.876, and 11.9445 respectively for students aged 12, 13, 14, 15, 16, and 17 years old. Using the mastery level scale formulated by Alindada (1991), it was very clear from the result covered two ranges, interpreted as "very difficult" to "average difficulty" irrespective of their ages.

For the column factor, the mean scores were 20.467, 29.988, 23.9175, and 25.1092 for the mastery level for each year level. Using the mastery level scale formulated by Alindada (1991) it was very clear from the result covered two

Table 10

Respondents Mastery Level of the Basic Science Process Skills with Respect to Age

Age	Year Level				Total	Percent
	I	II	III	IV		
12	44.2	0	0	0	44.20	11.05
13	40.4	45.25	0	0	85.65	21.41
14	38.2	44.43	50.67	0	133.30	33.32
15	0	42.25	48.12	52.08	142.46	35.61
16	0	48	44.71	50.79	143.50	35.88
17	0	0	0	47.78	47.78	11.94
Total	**122.8**	**179.93**	**143.50**	**150.66**	**596.89**	**149.21**
Mean	**20.47**	**29.99**	**23.92**	**25.11**	**99.48**	**24.87**

ranges, interpreted as "very difficult" to "average difficulty".

Table 11 shows the result of the two-way ANOVA for making comparison of the effect of the two factors (year level and age) on the students' mastery level of the basic science process skills. Two hypotheses were tested, namely: 1) There is no significant effect of age on the mastery level of the basic science process skills with respect to year level, 2) There is no significant effect of year level on the mastery level of the basic science process skills with respect to age. IN the light of the above result for the two-way ANOVA, the computed F = 0.8323 for the effect of the ages (row factor", which is very much less than the F critical = 2.9013 the hypothesis which states that "There is no significant effect of age on

Table 11

Two-way ANOVA for the Effect of Year Level and Age on the Mastery Level of the Basic Science Process Skills

Sources of Variation	SS	df	MS	F comp.	F crit	Interpretation
Between						
Rows	2712.30	5	542.46	0.8323	2.9013	NS
Columns	279.31	3	93.10	0.1428	3.2874	NS
Error	9777.00	15	651.80			
Total	**12769.00**	**23**				

NS = Not Significant
S = Significant

the mastery level of the basic science process skills with respect to year level" is accepted.

The second hypothesis tested the main effect of the other factor, year level (column factor) on the students' mastery level of the basic science process skills. The computed F = 0.1428 is less than the critical F = 3.2874. This means that the respondents' mastery level of the basic science process skills did not differ when they were grouped by year level if they are of the same age. The mastery levels of the basic science process skills of first, second, and third year high school students, who are of the same age, say 14 years old did not differ. It was clear from the mean score obtained for the mastery level of the basic science process skills for each year level which are 40.930, 44.983, 47.835, and 50.218 that the first three are of "average difficulty" and the last one is under category "easy". Although, the last is interpreted as easy in the scale formulated it is not significant. Based on the ANOVA result, "There was no significant effect of year level on the mastery level of the basic science process skills with respect to age" is accepted.

Table 12 shows the summary of mean scores of the year level and sex on the mastery level of the basic science process skills. The row factor were the sex of the respondents (male and female) and the column factor – the year level (first, second, third, fourth).

For the row factor, it is clear from the means score of the mastery level of the basic science process skills for sex, that the mean score for the male was 46.12 and the female was 45.705 which is very close and belong to the same level in the mastery level scale which is interpreted as "average difficulty"

Table 12

Respondents' Mastery Level of the Basic Science Process Skills with Respect to Sex

Sex	Year Level				Total	Grand Mean
	I	II	III	IV		
Female	42.69	44.03	48.11	49.66	184.49	46.1225
Male	37.47	44.34	48.89	52.12	182.82	45.7050
Total	**80.16**	**88.37**	**97.00**	**101.78**	**367.31**	**91.8270**
Grand Mean	**40.08**	**44.185**	**48.5**	**50.89**	**183.705**	**45.9138**

For the column factor, the mean obtained for first year is 40.08, 44.185 for second year, 48.5 for third year, and 50.89 for fourth year. Using the mastery level scale formulated by Alindada (1991), it was very clear from the result that the respondents' mastery level of the basic science process skills was almost the same interpreted as "average difficulty" and the last one is under category "easy". Although, the last one is interpreted as easy in the scale formulated, it is not significant based on the ANOVA result.

The means obtained are 46.1225 and 45.705 respectively for male and female students. Using the mastery level scale formulated by Alindada (1991), it was very clear from the result that the respondents' mastery level of the basic science process skills was almost the same interpreted as "average difficulty" and the last one is under category "easy". Although, the last one is interpreted as easy in the scale formulated, it is not significant based on the ANOVA result.

Table 13 shows the result of the two-way ANOVA for making comparison of the mastery level of the basic science process skills of row factor as the sex (male and female) and the column factor the year level (first, second, third, fourth). Two hypotheses were tested, namely: 1) There is no significant effect of sex on the mastery level of the basic science process skills with respect to year level. 2) There is no significant effect of year level on the mastery level of the basic science process skills with respect to sex. To test hypotheses 1, whether the sex, male of high school students differ in their mastery level of the basic science process skills with respect to year level.

Table 13

Two-way ANOVA for the Effect of Year Level and Sex on the Mastery Level of the Basic Science Process Skills

Sources of Variation	SS	df	MS	F comp.	F crit	Interpretation
Between						
Rows	0.35	1	0.35	0.0628	10.1280	NS
Columns	136.95	3	45.65	8.2232	9.2766	NS
Error	16.65	3	5.55			
Total	**153.95**	7				

NS – Not Significant

In the light of the above result for the two-way ANOVA, the hypothesis regarding the mastery level of the basic science process skills considering the effect of the row factor (sex) on the year level is accepted. "There is no significant effect of sex on the mastery level of the basic science process skills with respect to year level" is accepted.

For the row factor (sex), the computed F = 0.0627993 is less than the critical F = 10.12796. This means that the respondents' mastery level of the basic science process skills do not differ with sex of the respondents. The mastery level of the male and female on basic science process skills do not differ if they are of the same year level.

For the effect of the other factor, (column) the computed F = 8.2231 for the effect of the year level (row factor), which is very much less than the F critical = 9.2766 the hypothesis which states that "There is no significant effect of year level on the mastery level of the basic science process skills with respect to sex" is accepted. This means that no differences exist in the mean scores by year level of their mastery level on the basic science process skills.

Basic science process skills with respect to attitudes of respondents. Table 14, shows the four groups of respondents mastery level of the basic science process skills with respect to attitude towards science. The row factor are the attitudes toward science such as "strongly disagree", "agree", "undecided", "disagree", and "strongly disagree". The column factor were the year level of the respondents (first year, second year, third year, and fourth year).

For the row factor, the mean scores obtained were different, for the mastery level of the basic science process skills for every level of attitude of the respondents in the fourth year level. It is very clear based on the data that the four groups of students have different mastery level based on the level of attitudes toward science. The mean score obtained was 40.62 for "agree", 46.025 for "undecided", 46.55 for "disagree" and zero for "strongly agree" and "strongly disagree". The values cover two ranges in the mastery level scale, from "far from mastery to "very fair from mastery". This account for the differences in the mastery level by all year levels based on the levels of attitude.

Table 14

Respondents' Mastery Level of the Basic Science Process Skills
with Respect to Attitude Toward Science

Attitude Toward Science	Year Level				Total	Grand Mean
	I	II	III	IV		
SA	0	0	0	0	0	0
A	0	53.00	57.57	51.91	162.48	40.6200
U	43.50	42.21	48.07	50.32	184.10	46.0250
D	40.69	44.00	46.00	55.50	186.19	46.5475
SD	0	0	0	0	0	0
Total	**84.19**	**139.21**	**151.64**	**157.73**	**532.77**	**133.1925**
Grand Mean	**16.84**	**27.84**	**30.33**	**31.55**	**106.55**	**26.64**

For the column factor, the means scores obtained were 16.84, 27.84, 30.33, and 31.55 respectively. It is clear that the mean scores obtained were different for the mastery level of the basic science process skills with respect to the year levels. The values covered two ranges in the mastery level scale from "far from mastery" to "very far from mastery".

Basic science process skills with respect to study habits of respondents. Table 15 shows the four groups of respondents mastery level of the basic science process skills with respect of two factors, study habits and year level of the respondents. The row factor are the extent of practice of the study habits (always, often, frequently, sometimes, and not at all) and the column factor, year level of the respondents (first year, second year, third year, and fourth year) were tested.

Table 15

Respondents' Mastery Level of the Basic Science Process Skills with Respect to Study Habits Toward Science

Study Habits	Year Level				Total	Grand Mean
	I	II	III	IV		
Always	0	0	0	0	0	0
Often	43.13	48.50	41.00	51.75	184.38	46.0950
Frequently	40.06	43.96	48.64	50.53	183.19	45.7975
Sometimes	35.50	0	0	5.35	40.85	10.2125
Not at All	0	0	0	0	0	0
Total	**118.69**	**92.46**	**89.64**	**107.63**	**408.42**	**102.1050**
Grand Mean	**23.74**	**18.49**	**17.93**	**21.53**	**81.69**	**20.4200**

For the row factor, the mean scores obtained were different, for the mastery level of the basic science process skills for every level of study habits of the respondents in four-year level. It is very clear based on the data that the four groups of students have different mastery level based on the level of study habits. The mean scores obtained were 46.095 for "often", 45.7975 for "frequently", 10.2125 for "sometimes' and zero for "always" and "not at all". The values cover three ranges in the mastery level scale, from "far from mastery" to "very far from mastery". This account for the differences in the mastery level by all year levels based on the levels of practiced of the study habits.

The mean scores obtained for the mastery level of the basic science process skills for the four-year levels with respect to study habits were the following:

23.738, 18.492, 17.928, and 21.526 respectively. The mean scores covered only one range in the scale of Alindada (1991) which is interpreted as "very difficult" in the mastery level of the different year levels considering all the levels for the study habits, A, O, F, S, and NA.

Comparison of study habits and year level. Table 16 shows the result of the two-way ANOVA for the mastery level of the basic science process skills with respect to the effect of two factors, study habits and year level of the respondents. The main effect of the row factor the extent of practice of the study habits (always, often, frequently, sometimes and not at all practiced), and the column factor the year level (first, second, third, and fourth) were tested. The hypotheses were tested, namely: 1) There is no significant effect of study habits on the mastery level of the basic science process skills with respect to year level, 2) There is no significant effect of year level on the mastery level of the basic science process skills with respect to the study habits of the high school students. The result of the two-way ANOVA reveal the computed F = 29.87898 is greater than the tabular F = 3.2592, hypothesis 2 was rejected. "There is no significant effect of study habits on the mastery level of the basic science process skills with respect to year level" was rejected. This means that the level of practiced of the study habits affect their mastery level of the basic science process skills in all the year level.

The computed F = 0.4923, for the effect of the other factor, year level (column factor) on the mastery level of the basic science process skills which is

Table 16

Two-way ANOVA for Mastery Level of the Four Groups of Respondents with Respect to Study Habits

Sources of Variation	SS	df	MS	F comp.	F crit	Interpre-tation
Between						
Rows	8965.476	4	2241.369	29.879	3.2592	S
Columns	10.798	3	36.933	0.492	3.4903	NS
Error	147.190	12	12.27			
Total	9976.453	19				

NS = Not Significant
S = Significant

very much less than the critical F = 3.1903, the hypothesis that "There is no significant effect of year level on the mastery level of the basic science process skills with respect to study habits" is accepted. This means that students' mastery level of the basic science process skills do not differ by year level in the practiced of any level of the study habits.

Basic science process skills with respect to type of elementary school graduated from. Table 17 shows the four groups of respondents mastery level of the basic science process skills with respect of two factors, type of elementary school they graduated from and year level. The row factor are the type of elementary school they graduated from (public or private) and the column factor were the year level of the respondents (first year, second year, third year, and

Table 17

Respondents' Mastery Level of the Basic Science Process Skills with Respect to Type of Elementary School Graduated From

Type of School	Year Level				Total	Grand Mean
	I	II	III	IV		
Public	40.0	44.08	48.67	50.56	183.31	45.8275
Private	42.2	45.00	46.75	50.91	184.86	46.2150
Total	**82.2**	**89.08**	**95.42**	**101.47**	**368.17**	**92.0425**
Grand Mean	**41.1**	**44.54**	**47.71**	**50.735**	**184.08**	**46.0212**

fourth year).

The mean scores obtained are 45.8275 and 46.215 respectively. The mean scores covered only one range in the scale of Alindada (1991) which is interpreted as "average difficulty" in the mastery level of the different year levels considering the type of elementary schools graduated from.

For the column factor, the mean score values are increasing, starting with a smaller value for the first year, 41.1 followed by a much high value of 44.54 for the second year, 47.71 for the third year and 50.735 for the fourth year respectively. It is clear that the mean scores obtained were different for the mastery level of the basic science process skills for the four-year levels with respect to type of elementary school graduated from. There is a difference in the mean scores for the different year level.

<u>Comparison of type of elementary school graduated from and year level.</u> Table 18 shows the result of the two-way ANOVA for the mastery level of the basic science process skills with respect to the effect of two factors, type of elementary school graduated from and year level.

The man effect of the row factor the type of elementary school graduated from (public or private) and the column factor the year level (first, second, third, and fourth) were tested. Two hypotheses were tested, namely: 1) There is no significant effect of the type of elementary school graduated from on the mastery level of the basic science process skills with respect to year level, 2) There is no significant effect of year level on the mastery level of the basic science process skills with respect to the type of elementary school graduated from. The results of the two-way ANOVA reveal the computed F = 0.2025791 is less than the tabular F = 10.12796, hypothesis 1 was accepted. "There is no significant effect of elementary school graduated from on the mastery level of the basic science process skills with respect to year level" was accepted. This means that the type of elementary school (public or private) where the high school students graduated do not affect their mastery level of the basic science process skills in all the year level.

The computed F = 23.152782 which is very much greater than the critical F = 9.276619, the hypothesis that "There is no significant effect of year level on the mastery level of the basic science process skills with respect to type of elementary school graduated from" is rejected.

Table 18

Two-way ANOVA for Mastery Level of the Four Groups of Respondents with Respect to Type of Elementary School Graduated From

Sources of Variation	SS	df	MS	F comp.	F crit	Interpre-tation
Between						
Rows	0.30	1	0.30	0.2028	10.1280	NS
Columns	102.97	3	34.32	23.1528	9.2766	S
Error	4.45	3	1.48			
Total	**107.72**	7				

NS = Not Significant
S = Significant

This means that students' mastery level of the basic science process skills differ by year level as to type of elementary school graduated from. This explains the differences in the mastery level of the different year levels as to type of the elementary school the graduated from.

<u>Basic science process skills with respect to location of elementary school graduated from</u>. Table 19 shows the four groups of respondents mastery level of the basic science process skills with respect of two factors, location of elementary school they graduated from and the column factor, the year level of the respondents (first year, second year, third year, and fourth year).

The mean scores obtained are 46.03425 and 45.8075 respectively. The mean scores covered only one range in the scale of Alindada (1991) which is

Table 19

Respondents' Mastery Level of the Basic Science Process Skills with Respect to Location of Elementary School Graduated From

Location of Elementary School	Year Level				Total	Grand Mean
	I	II	III	IV		
Urban	40.9	44.06	48.69	50.49	184.137	46.03425
Rural	39.9	45.10	45.40	52.83	183.230	45.80750
Total	**80.8**	**89.16**	**94.09**	**103.32**	**367.367**	**91.84175**
Grand Mean	**40.4**	**44.58**	**47.04**	**51.66**	**183.684**	**45.92080**

interpreted as "average difficulty" in the mastery level of the different year levels considering the location of elementary schools graduated from.

For the column factor, the mean score values are increasing, starting with a smaller value for the first year, 40.4 followed by a much higher value of 44.58 for the second year, 47.045 for the third year and 51.6585 for the fourth year respectively. The mean scores covered two ranges in the scale of Alindada (1991) which is interpreted as "average difficulty" to "easy" in the mastery level of the basic science process skills for the four-year levels with respect to location of elementary school they graduated from.

Two-way ANOVA for effect of location of elementary school graduated from and year level. Table 20 shows the result of the two-way ANOVA for the mastery level of the basic science process skills with respect to the effect of two factors, location of elementary school graduated from and year level. The main effect of the row factor the location of elementary school graduated from (rural or urban) and the column factor, the year level (first, second, third, and fourth) were tested. Two hypotheses were tested, namely: 1) There is no significant effect of the location of elementary school graduated from on the mastery level of the basic science process skills with respect to year level, 2) There is no significant effect of year level on the mastery level of the basic science process skills with respect to the location of elementary school graduated from. The result of the two-way ANOVA reveal the computed F = 0.0339196 on the effect of the factor, location of the elementary school graduated from (column factor) on the mastery level of the basic science process skills for each year level is much less than the tabular F = 10.12796, hypothesis 1 was accepted. "There is no

Table 20

Two way ANOVA for Mastery Level of the Four Groups of Respondents with Respect to Location of the Elementary School Graduated From

Sources of Variation	SS	df	MS	F comp.	F crit	Interpretation
Between						
Rows	132.92	3	44.31	14.6153	9.2766	S
Column	0.10	1	0.10	0.0339	10.1280	NS
Error	9.10	3	3.03			
Total	**142.12**	7				

NS = Not Significant
S = Significant

significant effect of the location of the elementary school graduated from on the mastery level of the basic science process skills with respect to year level" was accepted. This means that the location of the elementary school (urban or rural) where the highs school students graduated do not affect their mastery level of the basic science process skills in all the year level.

The computed F = 14.615316, for the other factor (column) which is very much greater than the critical F = 9.276619, the hypothesis that "There is no significant effect of year level on the mastery level of the basic science process skills with respect to the location of elementary school graduated from" is rejected. This means that students' mastery level of the basic science process skills differ by year level as to the location of elementary school graduate from.

Effects of Year Level on the Mastery Level of the Basic Science Process Skills due to Type of Elementary Schools Graduated From

Table 21 presents the results of the Scheffe's test to determine the effect of year level on the mastery level of the basic science process skills considering the type of elementary school graduated from. The rejection of hypothesis 1 will mean that the mastery level of the high school students coming from the four different levels differ significantly with respect to the type of elementary school graduated from – public and private. Mean difference in the mastery level of the basic science process skills of the different year levels were obtained with respect to students coming from: 1) public schools, and 2) private schools. With

Table 21

Comparisons of the Different Year Levels Mastery Level of the Basic Science Process Skills as to Type of Elementary School Graduated from

Group Pair	Mean Differences	Computed F-value	Tabular F-value	Interpre-tation
Public				
First & Second	4.08	13.44	27.81	NS
First & Third	8.67	51.02	27.81	S
First & Fourth	10.56	98.01	27.81	S
Second & Third	4.59	12.82	27.81	NS
Second & Fourth	6.48	32.09	27.81	S
Third & Fourth	1.89	2.32	27.81	NS
Private				
First & Second	2.80	6.33	27.81	NS
First & Third	4.55	14.05	27.81	NS
First & Fourth	8.71	66.68	27.81	S
Second & Third	1.75	1.86	27.81	NS
Second & Fourth	5.91	26.70	27.81	NS
Third & Fourth	4.16	11.21	27.81	NS

students graduated from public schools, six pair groups were compared. Pair 1 – first year and second year, the difference between the sample mean is 4.08 and the computed F is 13.44 which is less than the tabular F value of 27.81 interpreted as not significant. Pair 2 – first year and third year, the difference between the sample mean is 8.67 and the computed F is 51.02 which is less than the tabular F value of 27.81 interpreted as significant. Pair 3 – first year and fourth year, the difference between the sample mean is 10.56 and the computed F is 98.01 which is greater than the tabular F value of 27.81 interpreted as significant. Pair 4 – second year and third year, the difference between the sample mean is 4.59 and the computed F is 12.82 which is less than the tabular F value of 27.81 interpreted as not significant. Pair 5 – second year and fourth year, the difference between the sample mean is 6.48 and the computed F is 32.09 which is greater than the tabular F value of 27.81 interpreted as significant. Pair 6 – third year and fourth year, the difference between the sample mean is 1.89 and the computed F is 2.315 which is less than the tabular F value of 27.81 interpreted as not significant.

With students graduated from private schools, six pair-groups were compared. Pair 1 – first year and second year, the difference between the sample mean is 2.8 and the computed F is 6.33 which is less than the tabular F value of 27.81 interpreted as not significant. Pair 2 – first year and third year, the difference between the sample mean is 4.55 and the computed F is 14.05 which is less than the tabular F value of 27.81 interpreted as not significant. Pair 3 – first year and fourth year, the difference between the sample mean is 8.71 and the computed F is 66.68 which is greater than the tabular F value of 27.81 interpreted as significant. Pair 4 – second year and third year, the difference between the sample mean is 1.75 and the computed F is 1.863 which is less than the tabular F value of 27.81 interpreted as not significant. Pair 5 – second year and fourth year, the difference between the sample mean is 5.91 and the computed F is 26.7 which is less than the tabular F value of 27.81 interpreted as not significant. Pair 6 – third year and fourth year, the difference between the sample mean is 4.16 and the computed F is 11.21 which is less than the tabular F value of 27.81 interpreted as not significant.

Effects of Year Level on the Mastery Level of the Basic Science Process Skills due to Location of Elementary Schools Graduated from

Table 22 presents the results of the Scheffe's test to determine the effect of year level on the mastery level of the basic science process skills considering the location of elementary school graduated from. The rejection of hypothesis 1 will mean that the mastery level of the high school students coming from the four different levels differ significantly with respect to the location of elementary school graduated from - urban and rural. Mean difference in the mastery level of the basic science process skills of the different year levels were obtained with respect to students coming from: 1) urban schools, and 2) rural schools. With students graduated from urban elementary schools, six pair groups were compared. Pair 1 - first year and second year, the difference between the sample mean is 4.08 and the computed F is 15.39 which is less than the tabular F value of 27.83 interpreted as not significant. Pair 2 - first year and third year, the difference between the sample mean is 8.67 and the computed F is 58.41 which is greater than the tabular F value of 27.83 interpreted as significant. Pair 3 - first year and fourth year, the difference between the sample means is 8.67 and the computed F is 112.20 which is greater than the tabular F value of 27.83 interpreted as significant. Pair 4 - second year and third year, the difference between the sample mean is 10.56 and the computed F is 14.67 which is less than the tabular F value of 27.83 interpreted as not significant. Pair 5 - second year

Table 22

The Basic Science Process Skills as to Location of Elementary School Graduated From

Group Pair	Mean Differences	Computed F-value	Tabular F-value	Interpre-tation
Urban				
First & Second	4.08	15.39	27.83	NS
First & Third	8.67	58.41	27.83	S
First & Fourth	10.56	112.20	27.83	S
Second & Third	4.59	14.67	27.83	NS
Second & Fourth	6.48	36.74	27.83	S
Third & Fourth	1.89	2.65	27.83	NS
Rural				
First & Second	2.80	7.25	27.83	NS
First & Third	4.55	16.09	27.83	NS
First & Fourth	8.71	76.33	27.83	S
Second & Third	1.75	1.86	27.83	NS
Second & Fourth	5.91	2.13	27.83	S
Third & Fourth	4.16	12.84	27.83	NS

and fourth year, the difference between the sample mean is 6.48 and the computed F is 36.74 which is greater than the tabular F value of 27.83 interpreted as significant. Pair 6 – third year and fourth year, the difference between the sample mean is 1.89 and the computed F is 2.65 which is less than the tabular F value of 27.83 interpreted as not significant.

With students graduated from rural elementary schools, six pair-groups were compared. Pair 1 – first year and second year, the difference between the sample mean is 2.8 and the computed F is 7.247 which is less than the tabular F value of 27.83 interpreted as not significant. Pair 2 – first year and third year , the difference between the sample mean is 4.55 and the computed F is 16.09 which is less than the tabular F value of 27.83 interpreted as not significant. Pair 3 – first year and fourth year, the difference between the sample mean is 8.71 and the computed F is 76.33 which is greater than the tabular F value of 27.83 interpreted as significant. Pair 4 – second year and third year, the difference between the sample mean is 1.75 and the computed F is 2.133 which is less than the tabular F value of 27.83 interpreted as not significant. Pair 5 – second year and fourth year, the difference between the sample mean is 5.91 and the computed F is 30.56 which is greater than the tabular F value of 27.83 interpreted as significant. Pair 6 – third year and fourth year, the difference between the sample mean is 4.16 and the computed F is 12.84 which is less than the tabular F value of 27.83 interpreted as not significant.

Effects of Year Level on the Mastery Level of the Basic Science Process Skills due to Attitudes Toward Science of the Respondents

Table 23 presents the results of the Scheffe's test to determine the effect of year level on the mastery level of the basic science process skills considering the attitudes of the respondents toward science. The rejection of hypothesis 1 will mean that the mastery level of the different levels of high school students differ significantly with respect to their attitudes toward science. Mean difference in the mastery level of the basic science process skills of the different year levels was obtained with respect to students' attitudes toward science. Ten pair groups

Table 23

Comparison of Students' Mastery Level of the Basic Science Process Skills Belonging to the Different Level/Degree of Attitude Towards Science by the Respondents

Group Pair	Mean Difference	Computed F-value	Tabular F-value	Interpretation
Strongly Agree & Agree				
1st	0.00	0.00	13.04	NS
2nd	53.00	1.58	13.04	NS
3rd	57.60	4.41	13.04	NS
4th	51.90	9.52	13.04	NS
Strongly Agree & Neutral				
1st	-43.50	37.66	13.04	S
2nd	42.20	26.87	13.04	S
3rd	48.10	26.14	13.04	S
4th	50.30	44.55	13.04	S
Strongly Agree & Disagree				
1st	-40.70	32.95	13.04	S
2nd	44.00	29.20	13.04	S
3rd	46.00	23.94	13.04	S
4th	55.50	54.20	13.04	S
Strongly Agree & Strongly Disagree				
1st	0	0	13.04	NS
2nd	0	0	13.04	NS
3rd	0	0	13.04	NS
4th	0	0	13.04	NS
Agree & Neutral				
1st	-43.50	0	13.04	NS
2nd	10.79	0	13.04	NS
3rd	9.50	0	13.04	NS
4th	1.59	2.13	13.04	NS
Agree & Disagree				
1st	2.61	0.16	13.04	NS
2nd	-1.79	0.05	13.04	NS
3rd	2.07	0.05	13.04	NS
4th	-5.18	0.47	13.04	NS

Table 23 continued

Group Pair	Mean Difference	Computed F-value	Tabular F-value	Interpretation
Agree & Strongly Disagree				
1st	0	37.66	13.04	S
2nd	53.00	26.87	13.04	S
3rd	57.57	26.14	13.04	S
4th	51.91	44.55	13.04	S
Neutral & Disagree				
1st	2.81	0.16	13.04	NS
2nd	-1.79	0.05	13.04	NS
3rd	2.07	0.05	13.04	NS
4th	-5.18	0.47	13.04	NS
Neutral & Strongly Disagree				
1st	43.50	37.66	13.04	S
2nd	42.21	26.87	13.04	S
3rd	48.07	26.14	13.04	S
4th	50.32	44.55	13.04	S
Disagree & Strongly Disagree				
1st	0	0	13.04	NS
2nd	0	0	13.04	NS
3rd	0	0	13.04	NS
4th	0	0	13.04	NS

were compared for each level under attitudes toward science.

Pair 1 – Attitudes toward science strongly agree and agree.

The first year respondents difference between sample mean is zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is -53 and the computed F is 1.58 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is -57.6 and the computed F is 4.43 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is -51.9 and the computed F is 9.52 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 2 – Attitudes toward science strongly agree and neutral.

The first year respondents' difference between sample mean is -43.5 and the computed F is 37.66 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is -42.2 and the computed F is 26.87 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The third year the difference between sample mean is -48.1 and the computed F is 26.14 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is -50.3 and the computed F is 44.55 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 3 – Attitudes toward science strongly agree and disagree.

The first year respondents difference between sample mean is -40.7 and the computed F is 32.95 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is -44 and the computed F is 29.20 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The third year the difference between sample mean is -46 and the computed F is 23.94 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is -55.5 and the computed F is 54.20 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 4 – Attitudes toward science strongly agree and strongly disagree.

The first year respondents difference between sample mean of zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 5 – Attitudes towards science agree and neutral.

The first year respondents difference between sample mean is -43.5 and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is 10.79 and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is 9.5 and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is 1.59 and the computed F is 2.0 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 6 – Attitudes toward science agree and disagree.

The first yea respondents difference between sample mean is 2.81 and the computed F is 0.16 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is -1.79 and the computed F is 0.05 which is les than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is 2.07 and the computed F is 0.05 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is -5.18 and the computed F is 0.47 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 7 – Attitudes toward science agree and strongly disagree.

The first year respondents difference between sample mean is zero and the computed F is 37.66 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is 53 and the computed F is 26.87 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The third year the difference between sample mean is 57.57 and the computed F is 26.14 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is 51.91 and the computed F is 44.55 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 8 – Attitudes toward science neutral and disagree.

The first year respondents difference between sample mean is 2.81 and the computed F is 0.16 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is -1.79 and the computed F is 0.05 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is 2.07 and the computed F is 0.05 which is less than the tabular F = 13.14 this difference is interpreted as not significant.

Fourth year the difference between sample mean is -5.18 and the computed F is 0.47 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 9 – Attitudes toward science neutral and strongly disagree.

The first year respondents difference between sample mean is 43.5 and the computed F is 37.66 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is 42.21 and the computed F is 26.87 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The third year the difference between sample mean is 48.07 and the computed F is 26.34 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is 50.32 and the computed F is 44.55 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 10 – Attitudes towards science disagree and strongly disagree.

The first year respondents difference between sample mean is zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is zero and the computed F is zero which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is zero and the computed F is zero which is greater than the tabular F = 13.04 this difference is interpreted as not significant.

Effects of Study Habits on the Mastery Level
of the Basic Science Process Skills
of the Respondents

Table 24 presents the results of the Scheffe's test to determine the effect of study habits on the mastery level of the basic science process skills considering the respondents in all year levels. The rejection of hypothesis 1 means that the mastery level of the high school students differ significantly with respect to their levels of study habits. Comparison of the levels of study habits resulted to ten pair groups.

Pair 1 - Study habits practiced always and often practiced by the respondents.

The first year respondents difference between sample mean is -43.1 and the computed F is 4.54 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is -48.5 and the computed F is 1.32 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is -41 and the computed F is 2.24 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is -51.8 and the computed F is 9.46 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Table 24

Comparison of Students' Mastery Level of the Basic Science Process Skills Belonging to the Different Level/Degree of Study Habits Practiced by the Respondents

Group Pair	Mean Difference	Computed F-value	Tabular F-value	Interpretation
Always & Often				
1st	-43.10	4.54	13.04	NS
2nd	48.50	1.32	13.04	NS
3rd	41.00	2.24	13.04	NS
4th	51.80	9.46	13.04	NS
Always & Frequently				
1st	-40.1	31.94	13.04	S
2nd	44.00	20.15	13.04	S
3rd	48.60	26.76	13.04	S
4th	50.50	44.93	13.04	S
Always & Sometimes				
1st	-35.50	25.08	13.04	S
2nd	0	0	13.04	NS
3rd	0	0	13.04	NS
4th	5.35	0.50	13.04	NS
Always & Not at All				
1st	0	0	13.04	NS
2nd	0	0	13.04	NS
3rd	0	0	13.04	NS
4th	0	0	13.04	NS
Often & Frequently				
1st	3.07	5.50	13.04	NS
2nd	4.53	2.76	13.04	NS
3rd	7.64	0	13.04	NS
4th	1.22	0	13.04	NS
Often & Sometimes				
1st	7.63	1.16	13.04	NS
2nd	48.50	35.48	13.04	S
3rd	41.00	19.07	13.04	S
4th	46.40	33.88	13.04	S

Table 24 continued

Group Pair	Mean Difference	Computed F-value	Tabular F-value	Interpre-tation
Often & Not at All				
1st	43.13	37.02	13.04	S
2nd	48.50	35.48	13.04	S
3rd	41.00	19.01	13.04	S
4th	51.75	47.12	13.04	S
Frequently & Sometimes				
1st	4.56	31.94	13.04	S
2nd	43.96	29.15	13.04	S
3rd	48.64	26.76	13.04	S
4th	50.53	44.93	13.04	S
Frequently & Not at All				
1st	35.50	25.08	13.04	S
2nd	0	0	13.04	S
3rd	0	0	13.04	S
4th	5.35	0.50	13.04	S
Sometimes & Not at All				
1st	35.50	25.08	13.04	S
2nd	0	0	13.04	NS
3rd	0	0	13.04	NS
4th	5.35	0.50	13.04	NS

Pair 2 – Study habits always and frequently practiced.

The first year respondents' difference between sample mean is -40.1 and the computed F is 31.94 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is -44 and the computed F is 29.15 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The third year the difference between sample mean is -48.6 and the computed F is 26.76 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth yea the difference between sample mean is -50.5 and the computed F is 44.93 which is greater than the tabular F = 13.04 difference is interpreted as significant.

Pair 3 - Study habits always and sometimes practiced.

The first year respondents difference between sample mean is -35.5 and the computed F is 25.08 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is -5.35 and the computed F is 0.50 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 4 - Study habits always and not at all practiced.

The first year respondents difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 5 – Study habits often and frequently practiced.

The first year respondents difference between sample mean is 3.07 and the computed F is 5.5 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is 4.53 and the computed F is 2.76 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is -7.64 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is 1.22 and the computed F is 1.26 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Pair 6 – Study habits often and sometimes practiced.

The first year respondents difference between sample mean is 7.63 and the computed F is 1.16 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is 48.5 and the computed F is 35.48 which is greater than the tabular F = 13.014 this difference is interpreted as significant.

The third year the difference between sample mean is 41 and the computed F is 19.07 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is 46.4 and the computed F is 37.88 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 7 – Study habits often and not at all practiced.

The first year respondents difference between sample mean is 43.13 and the computed F is 37.02 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is 48.5 and the computed F is 35.48 which is greater than the tabular F = 13.04 this difference in interpreted as significant.

The third year the difference between sample mean is 41 and the computed F is 19.01 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is 51.75 and the computed F is 4 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 8 – Study habits frequently and sometimes practiced.

The first year respondents difference between sample mean is 4.56 and the computed F is 0.41 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The second year respondents difference between sample mean is 43.96 and the computed F is 29.15 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The third year the difference between sample mean is 48.64 and the computed F is 26.76 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is 45.18 and the computed F is 35.92 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 9 – Study habits frequently not at all practiced.

The first year respondents difference between sample mean is 40.06 and the computed F is 31.94 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is 43.96 and the computed F is 29.15 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The third year the difference between sample mean is 48.64 and the computed F is 26.76 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Fourth year the difference between sample mean is 50.53 and the computed F is 44.93 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

Pair 10 – Study habits sometimes and not all practiced.

The first year respondents difference between sample mean is 35.5 and the computed F is 25.08 which is greater than the tabular F = 13.04 this difference is interpreted as significant.

The second year respondents difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

The third year the difference between sample mean is 0.00 and the computed F is 0.00 which is less than the tabular F = 13.04 this difference is interpreted as not significant.

Fourth year the difference between sample mean is 5.35 and the computed F is 0.50 which is lesser than the tabular F = 13.04 this difference is interpreted as significant.

Science Process Skills that are Difficult in Each Year Level

The process skills that are difficult in first year, and third year are based on Table 8 are those, which the respondents have very low facility level.

First year, second year, and third year high school students encountered difficulties in answering the following basic science process skills – inferring, predicting, and experimenting. However, fourth year respondents do not find difficulties in any of the nine science process skills.

Science Process Skills to be Developed in Each Year Level

The process skills to be developed in each year level based on Table 8 are those, which the respondents by year level have very low facility level. These science process skills were rated very difficult and average difficulty.

From first year to third year, the following basic science process skills needs to be developed – inferring, predicting, and experimenting.

Based on the facility level of the basic science process skills, the fourth year level already possessed these skills.

Results shows that the high school respondents from first year to third year level were still deficient in inferring, predicting, and experimenting.

This implies that the teachers in science need to be resourceful, creative, and imaginative in preparing and selecting activities that will develop these science process skills.

The teacher as one of his/her strategies should exposed students to field trips, educational tour, science fair, quiz bee in science, and games in science.

Laboratory works should develop these basic science process skills that were identified as very difficult. Hence, the teacher should monitor student work in the laboratory, to allow students to investigate, experiment and discover new ideas in science with his guidance and supervision.

Classrooms should monitor real life situation in order for the students to have real life experience in science. Students should be given more opportunities to develop their science abilities through the selection of science task that are appropriate to their age, year level, interest, and needs.

Teachers in science should augment instruction in the classroom by assigning students to investigatory projects in science which will developed these science process skills. There should be an open discussion between the teacher and students regarding science ideas to develop their science process skills

Teachers should encourage students' positive attitudes towards science since it was found out those positive relationships between attitude and mastery level of the basic science process skills.

Science textbooks should emphasize these science process skills. Exercises included should aim to develop the basic science process skills.

Chapter 5

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter presents the summary of the major findings in this study, the conclusions derived from the major findings and the recommendations of the researcher based on the conclusions drawn.

Summary of Findings

On the basis of the data collected, organized and analyzed, the following are the salient findings of the study:

1. The respondents of this study were from the four year secondary levels of first year, second year and third year. Majority of the first year high school students belong to age level of 13 where there are 71 or 74.74 percent. The average age was pegged at 13.04 with the standard deviation of 0.02. Most of the second year respondents belong to age level of 14 where there are 51 or 70.83 percent. The average age was pegged at 14.02 with a standard deviation of 0.08 out of 54 number of third year respondents, most of them belong to age level of 15 where there are 32 or 59.26 percent. The average age was pegged at 14.82, and the standard deviation is equal to 0.04. Majority of the fourth year high school students belong to age level of 16 where there are 60 or 71.4 percent. There average age was pegged at 15.93 with the standard deviation equal to 0.49.

2. Out of 95 first year high school students, 34 or 35.79 percent are male and 61 or 64.21 percent are female. Of 72 second year high school students, 41 or 56.94 percent are male and 31 or 43.06 percent are female. For the third year, out of 54 numbers of respondents 19 or 35.19 percent are male and 35 or 64.81 percent are female. Of 84 fourth year high school respondents, 34 or 40.48 percent are male and 50 or 59.52 percent are female.

3. For the attitudes statements of SSPC high school respondents, the highest rating of 3.68 interpreted as "agree" to what the statements says was given to the statements "I find textbooks in science interesting". The lowest rating of 2.48 interpreted as "disagree" was given to the following statements: 1) Science makes me feel relaxed, happy and very comfortable; and 2) I feel alive and alert in my science class.

4. The study habits statement, which was perceived to be often practiced by the respondents was "I prefer to study my lesson alone rather than with others". This statement was given the highest mean rating of 3.68. Two statements which was perceived to be "sometimes practiced" with a lowest mean rating equal to 2.39 and 2.48. These statements were the following: 1) When tests are returned I find my grades have been raised by my careful solution on problems; and 2) during examinations, I bear in my mind the concepts, formulas, and other details that I study.

5. The respondents were mostly coming from public elementary schools and most of them graduates from elementary schools in urban areas.

6. The level of facility in the basic science process skills of students and their mastery level were based on the Revised Perez Test 2000. Insofar as the mastery level/facility level of the basic science process skills, the scale formulated by Alindada (1991) was used. For observing, comparing, quantifying, and measuring, the respondents find it "easy" or nearing mastery. For communicating, first year, third year, and fourth year, respondents find this process skill as "easy" or "nearing mastery". For classifying, first year, second year, and fourth year respondents, they find this science process skill as "easy" or "nearing mastery", while the third year respondents find it "very easy" or "at mastery level". For these science process skills – inferring, predicting, and experimenting, the first year, second year, and third year respondents encounter "average difficulty" or "far from mastery", while the fourth year respondents find it "easy" or nearing mastery".

7. The result of the Two-way ANOVA revealed that "there is no significant effect of year level on the mastery level of the basic science process skills with respect to age and sex". However, there is a significant effect of year level on the mastery level of the basic science process skills with respect to attitude towards science, study habits, type of elementary school graduated from and location of elementary school graduated from.

8. Also, based on the computed result of the Two-way ANOVA, there is no significant effect of age, sex, attitudes toward science, study habits, type of elementary school graduated from, and location of elementary school graduated

from, on the mastery level of the basic science process skills with respect to year level.

9. The science process skills that are difficult in first year, second year, and third year are the following: inferring, predicting, and experimenting. However, fourth year respondents do not find difficulties in any of the nine basic science process skills.

Conclusions

The following were the conclusions drawn from the findings of the study:

1. The first year, second year, and third year students already acquired the science process skills, namely: observing, comparing, classifying, quantifying, measuring, and communicating.

2. The fourth year high school students of SSPC already possessed to a certain extent the nine basic science process skills.

3. The high school students of SSPC have not yet mastered the basic science process skills since 66.89 percent of them were on the level of average difficulty.

4. There is no significant difference in the four groups of respondents' mastery level of the basic science process skills with respect to age.

5. There is no significant difference in the four groups of respondents' mastery level of the basic science process skills with respect to sex.

6. There is a significant difference in the four groups of respondents' mastery level of the basic science process skills with respect to the level of attitude toward science.

7. There is a significant difference in the four groups of respondents' mastery level of the basic science process skills with respect to level of their study habits.

8. SSPC high school students' mastery level of the basic science process skills differ by year level as to type and location of elementary school they graduated from.

9. The type and location of elementary school where the high school students graduated from do not affect the mastery level of the basic science process skills in all year levels.

10. Inferring, predicting and experimenting, are the basic science process skills that are difficult and needs to be develop among the first year, second year, and third year high school students in SSPC, Catbalogan, Samar.

<u>Recommendations</u>

Based on the findings and conclusions arrived at, the following recommendations are submitted:

1. There is still a need to further develop the science process skills of the first year, second year, and third year high school students of SSPC by giving

them more opportunities to apply their knowledge of the basic science process skills.

2. Science educators and policy – makers shall collaboratively explore on plausible measures and strategies that would alleviate the level of mastery of the basic science process skills of students.

3. Science teaching should give students more time to apply their knowledge of science process skills in order to achieve mastery over them.

4. Science educators should exert more efforts in identifying and utilizing some teaching and laboratory techniques that would not only optimize science achievements but also science learning attitudes. They should extend more motivation and encouragement to students during the teaching-learning activities so that students can conceptualize their perception about science learning in order for them to be more involved in the activities. Innovative and creative instructional styles, such as peer collaboration, among others, may also aid in facilitating a fun-filled and enjoyable science environment. Students should be convinced that science as a subject is exciting and fascinating and is not only for smart or intelligent students. It is only when students feel that studying science as a subject worthwhile and gratifying and that positive and wholesome attitudes towards learning science is assured.

5. Teachers should impose restrictions on the submission of assignments, science research and investigatory projects to lead students to have

proper study habits towards the subjects and in the course of the process lead to the development of their skills in science process.

6. The basic science process skills of those low average mean scores should be strengthened.

7. Since science skills are substantially dependent on knowledge of more experimental procedures, and on reflective understanding of the scientific concepts, care should be considered in selecting investigations appropriate to the students' knowledge and skills.

8. Students should receive close supervision and should be taught in an encouraging and reassuring environment to be able to overcome difficulties in the basic science process skills.

9. Promotion of a satisfying, wholesome science classroom environment need also to be maintained to enable the students to be proficient and adapt in the science process skills.

10. Finally, it is recommended that a similar study be conducted to include other factors not covered in this study.

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APPENDICES

APPENDIX A

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

June 10, 2000

DR. EUSEBIO T. PACOLOR
Samar State Polytechnic College
Catbalogan, Samar

Sir:

In my desire to start writing my thesis proposal, I have the honor to submit for your approval one of the following research problems, preferably no. 1:

1. "HIGH SCHOOL STUDENTS' MASTERY LEVEL OF THE BASIC SCIENCE PROCESS SKILLS: BASIS FOR TEACHING AND CURRICULUM REDIRECTIONS."

2. "MODULARIZED INSTRUCTION IN CHEMISTRY IN SELECTED SECONDARY SCHOOLS IN THE DIVISION OF SAMAR."

3. "THE BEHAVIOR OF THIRD YEAR STUDENTS TOWARDS CHEMISTRY."

I hope for your early and favorable action on this request.

Very truly yours,

(SGD.) MA. MARGIE L. PAGLIAWAN
Researcher

APPROVED:

(SGD.) EUSEBIO T. PACOLOR, Ph. D.
Dean, College of Graduate Studies

APPENDIX B

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

Assignment of Adviser

November 22, 2000

Dear Prof. Marco,

Please be informed that you have been designated as adviser of **Mrs. Margie L. Pagliawan** candidate for the degree in **Master of Arts in Teaching Major in Chemistry** who proposes to write a thesis on **"HIGH SCHOOL STUDENTS MASTERY LEVEL OF THE BASIC SCIENCE PROCESS SKILLS."**

Thank you for your cooperation.

Very truly yours,

(SGD.) EUSEBIO T. PACOLOR, Ph. D.
Dean, College of Graduate Studies

CONFORME:

(SGD.) PROF. FLORIDA B. MARCO
Adviser

In 3 copies
1st copy – for the Dean
2nd copy – for the Adviser
3rd copy – for the Applicant

APPENDIX C

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

January 5, 2001

DR. MARILYN D. CARDOSO
Dean, College of Education
Samar State Polytechnic College
Catbalogan, Samar

Madam:

I have the honor to request permission to field in your school the questionnaire pertinent to my research entitled **"SSPC HIGH SCHOOL STUDENTS' MASTERY LEVEL OF BASIC SCIENCE PROCESS SKILLS: BASIS FOR CURRICULUM REDIRECTION"**.

Thank you so much for your kind accommodation of my request.

Very truly yours,

(SGD.) MA. MARGIE L. PAGLIAWAN
Researcher

Noted by:

(SGD.) PROF. FLORIDA B. MARCO
Adviser

APPROVED:

(SGD.) MARILYN D. CARDOSO, Ph. D.
Dean, College of Education

APPENDIX D

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

ORGANIZATION OF THE STUDY

	Scheduled Activities	Time Frame
1.	Approval of Problem	June 10, 2000
2.	Requests of Adviser	June 20, 2000
3.	Organization of Chapter 1	July – August 2000
4.	Research for Related Literature and Studies	August – October 2000
5.	Borrowed Standard Research Instrument	October 2000
6.	Organization of Chapters 1 – 3	November 2000
7	Change of Adviser	November 16, 2000
8.	Pre-oral Defense	December 2000
9.	Data Gathering	January 2001
10	Organization of Chapter 4 and 5	February 2001 – 2003
11.	Final Defense	February 24, 2003

APPENDIX E

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

ANSWER SHEET IN
PEREZ TEST OF SCIENCE PROCESSES

Name: ______________________ Yr. & Sec.: ______________

Age: [ ] Sex: [ ] Date: ______________

School: ____

Elementary School where graduated: ______________ Total Score: ______

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APPENDIX F

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

DATA ON PROFILE OF SSPC FIRST YEAR HIGH SCHOOL RESPONDENTS AND THEIR MASTERY LEVEL OF THE BASIC SCIENCE PROCESS SKILLS

No.	Sex	Age	Attitude	Interpretation	Study Habits	Interpretation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpretation
1	F	14	4.2	A	4	O	1	1	48	AD
2	M	13	3.6	A	3	F	1	1	39	AD
3	F	13	3.2	N	3.8	O	1	2	38	AD
4	F	13	3.25	N	3.5	F	2	1	43	AD
5	M	13	3.5	N	3.7	O	2	1	43	AD
6	F	13	3.25	N	3.6	O	2	1	37	AD
7	M	13	3.3	N	3.2	F	1	1	32	AD
8	M	13	2.95	A	4	O	1	1	40	AD
9	F	13	3.85	N	4	O	1	1	43	AD
10	M	13	3.1	N	3.7	O	1	1	50	EASY
11	F	13	3.15	N	3	F	1	1	40	AD
12	F	12	3.15	N	4	O	2	1	40	AD
13	F	13	3.25	N	3	F	2	1	38	AD
14	M	13	3.45	N	3.7	O	1	1	45	AD
15	F	14	3.05	A	3	F	2	1	38	AD
16	M	13	3.8	A	4	O	1	1	35	AD
17	F	14	3.85	SA	3.1	F	2	1	52	EASY
18	F	13	4.95	N	4.9	A	2	1	52	EASY
19	F	13	2.65	N	2.7	F	1	2	39	AD
20	F	13	2.95	N	2.8	F	1	2	41	AD
21	M	14	3	N	4	O	2	1	32	AD
22	F	13	2.5	A	5	A	1	1	33	AD
23	F	12	3.9	N	4	O	1	1	51	EASY
24	F	13	3.7	N	3.3	F	2	1	54	EASY
25	F	13	3.2	N	3.2	F	1	1	32	AD
26	F	13	4.2	N	2.9	F	1	1	42	AD
27	F	13	2.65	A	2.99	F	1	2	48	AD
28	F	12	2.95	N	4	O	1	1	53	EASY
29	F	13	3.56	N	5	A	2	1	43	AD
30	M	13	2.9	N	3.7	O	2	1	32	AD
31	F	13	3.1	N	3.3	F	1	1	39	AD
32	M	13	3.05	N	5	A	2	1	38	AD
33	F	14	3.2	A	3.7	O	2	1	37	AD
34	F	13	3.1	N	3.1	F	1	1	39	AD
35	F	13	3.05	N	3.08	F	1	1	50	EASY
36	F	13	3	N	4	O	1	2	43	AD
37	F	14	3.1	N	3.1	F	1	1	29	AD

Appendix F continued

No.	Sex	Age	Attitude	Interpre-tation	Study Habits	Interpre-tation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpre-tation
38	F	13	3.8	A	3.8	O	1	1	57	EASY
39	F	13	3.05	N	3.05	F	2	1	45	AD
40	M	13	2.9	N	2.8	F	2	1	39	AD
41	F	12	3.1	N	3.1	F	2	1	38	AD
42	F	12	3.4	N	3.4	F	2	1	52	EASY
43	M	13	3.8	A	3.8	O	1	1	38	AD
44	M	12	2.95	N	2.98	F	1	1	42	AD
45	F	13	3.3	N	3.6	O	1	1	47	AD
46	F	13	2.85	N	5	A	1	1	43	AD
47	F	13	3	N	3	F	2	1	42	AD
48	M	13	4.8	SA	3.9	O	1	1	55	EASY
49	F	13	3.1	N	3.1	F	1	1	41	AD
50	F	13	2.9	N	2.9	F	2	1	46	AD
51	F	13	3.2	N	3.2	F	2	1	35	AD
52	F	13	3	N	3	F	1	1	43	AD
53	F	13	3.1	N	3.1	F	2	1	48	AD
54	F	13	3.7	A	3.9	O	1	1	48	AD
55	M	13	3	N	4	O	2	1	37	AD
56	F	13	2.5	N	2.5	S	2	1	38	AD
57	F	13.5	2.75	N	2.9	F	1	1	39	AD
58	F	13	3.45	N	3.45	F	2	1	49	AD
59	F	13	4.7	SA	3.2	F	2	1	50	EASY
60	F	12	4	A	5	A	2	1	52	EASY
61	F	12.5	2.9	N	3.8	O	1	1	45	AD
62	F	14	2.7	N	2.9	F	1	2	47	AD
63	F	13.5	3.1	N	3.1	F	1	1	44	AD
64	F	12	2.9	N	2.9	F	1	1	41	AD
65	F	13.5	3.05	N	3.05	F	1	2	37	AD
66	F	13	2.75	N	2.75	F	1	1	41	AD
67	M	13	3.1	N	3.1	F	1	1	26	AD
68	M	12	3	N	3	F	2	1	47	AD
69	F	13	2.35	D	2.35	S	1	1	37	AD
70	F	13.5	3.2	N	3.2	F	2	1	42	AD
71	M	12	3.3	N	3.3	F	1	1	26	AD
72	M	13	3.8	A	3.8	O	1	1	42	AD
73	F	13	2.85	N	2.85	F	1	1	47	AD
74	F	12.5	4.9	SA	3.65	O	1	2	50	EASY
75	M	13	3.25	N	3.25	F	1	1	40	AD
76	M	14	3	N	3	F	2	1	21	AD
77	M	13	2.35	D	2.35	S	2	1	51	EASY
78	M	13	3.7	A	3.7	O	1	1	39	AD
79	M	14	3.35	N	3.7	O	1	1	34	AD
80	M	13	2.5	D	2.9	F	1	1	38	AD
81	M	13	3.3	N	3.3	F	1	1	25	AD
82	F	13	3.3	N	4.4	O	2	1	26	AD
83	M	13	3.95	A	3.95	O	1	1	50	EASY
84	M	13	2.85	N	3	F	1	1	25	AD
85	F	13	3.1	N	3.5	F	1	1	38	AD

Appendix F continued

No.	Sex	Age	Attitude	Interpre-tation	Study Habits	Interpre-tation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpre-tation
86	M	13	3.25	N	3.25	F	1	2	16	AD
87	M	12.5	5	SA	2.9	F	1	1	53	EASY
88	M	14	2.9	N	2.9	F	1	1	35	AD
89	M	13	2.75	N	2.6	F	2	1	38	AD
90	M	13	3.1	N	4	O	1	1	33	AD
91	M	13	3.2	N	5	A	1	1	38	AD
92	M	13	2.85	N	2.85	F	2	1	38	AD
93	F	13	3.25	N	3.25	F	1	1	37	AD
94	F	13	2.8	N	2.8	F	1	1	40	AD
95	F	13	2.9	N	2.9	F	2	1	39	AD

APPENDIX G

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

DATA ON PROFILE OF SSPC SECOND YEAR HIGH SCHOOL RESPONDENTS AND THEIR MASTERY LEVEL OF THE BASIC SCIENCE PROCESS SKILLS

No.	Sex	Age	Attitude	Interpretation	Study Habits	Interpretation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpretation
1	F	14	3.1	N	3.2	F	1	1	38	AD
2	F	13	4.52	SA	4.6	A	1	1	53	EASY
3	M	14	2.9	N	2.5	S	1	1	42	AD
4	M	14	3.8	A	4	O	2	1	43	AD
5	M	14	3.25	N	3.2	F	1	1	40	AD
6	F	15	2.65	N	2.5	S	1	1	47	AD
7	M	15	3.15	N	3.15	F	1	1	44	AD
8	M	14	3.15	N	4	O	1	2	32	AD
9	M	15	3.1	N	4	O	1	1	48	AD
10	M	14.5	4.7	SA	4.7	A	1	2	57	EASY
11	M	14	3.15	N	4	O	2	1	36	AD
12	F	15	3.1	N	3.1	F	1	1	28	AD
13	M	13.5	3.65	A	3.3	F	1	1	38	AD
14	M	14	3.1	N	3.2	F	1	1	43	AD
15	M	14	4.2	A	4	O	1	2	53	EASY
16	M	14	3.3	N	3	F	1	1	40	AD
17	M	13	4.7	SA	4.7	A	1	2	56	EASY
18	M	14	2.7	N	2.3	S	1	1	47	AD
19	M	14	3	N	4	O	1	2	43	AD
20	M	14	4.6	SA	4.8	A	1	1	56	EASY
21	M	13	2.7	N	2.4	S	1	2	34	A
22	M	14	3.25	N	3	F	1	1	56	EASY
23	M	13	2.85	N	3	F	1	1	43	AD
24	M	14	3.15	N	3	F	1	1	43	AD
25	M	14	3.9	A	4	O	1	1	53	EASY
26	M	14	3.35	N	3.35	F	1	1	35	AD
27	M	15	3.6	N	4	O	1	2	47	AD
28	M	14	3.05	A	3	F	2	1	47	AD
29	M	14	3.15	N	3.2	F	1	2	48	AD
30	M	14	4.9	SA	4	O	1	1	56	EASY
31	M	13	2.95	N	3	F	1	1	44	AD
32	M	14	2.8	N	2.8	F	1	1	32	AD
33	M	13	2.6	N	2.6	F	1	1	48	AD
34	M	14	2.9	N	3	F	1	1	43	AD
35	M	14	3.1	N	3.6	O	2	1	38	AD
36	M	14	3	N	3	F	1	1	48	AD
37	M	14	2.9	N	3	F	1	1	44	AD

Appendix C continued

No.	Sex	Age	Attitude	Interpretation	Study Habits	Interpretation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpretation
38	M	14	2.9	N	2.9	F	1	2	37	AD
39	M	14	2.75	N	2.75	F	1	1	47	AD
40	M	13.5	3.05	N	3.05	F	1	1	41	AD
41	M	13.5	3.1	N	4	O	1	1	47	AD
42	M	14	2.9	N	2.9	F	1	1	47	AD
43	M	14	2.85	N	2.85	F	1	1	41	AD
44	M	14	2.5	D	2.5	S	1	1	39	AD
45	MF	14	2.5	D	3	F	1	1	42	AD
46	F	16	3.15	N	3.15	F	1	1	48	AD
47	F	14	3.05	N	3.05	F	1	1	48	AD
48	F	15	2.9	N	3	F	1	1	43	AD
49	F	14	3.7	A	4	O	2	1	50	EASY
50	F	14	3.2	N	3.2	F	1	1	45	AD
51	F	14	3.2	N	3.2	F	2	1	45	AD
52	F	14	3.15	N	4	O	1	1	47	AD
53	F	13	3.1	N	3.1	F	1	1	47	AD
54	F	14	3.25	N	4	O	1	1	40	AD
55	F	14	2.95	N	3	F	1	2	44	AD
56	F	14	2.85	N	2.85	F	2	1	52	EASY
57	F	14	4	A	4	O	1	1	54	EASY
58	F	14.5	2.65	N	3	F	1	1	32	AD
59	F	14	3.05	N	5	A	2	1	53	EASY
60	F	14	3.65	A	3.65	O	2	1	43	AD
61	F	13	2.75	N	2.75	F	1	1	37	AD
62	F	14.5	2.8	N	2.8	F	1	1	38	AD
63	F	14.5	3	N	4	O	1	1	44	AD
64	F	14	2.9	N	2.9	F	1	1	34	AD
65	F	15	3.65	N	3.65	O	1	1	39	AD
66	F	15	3.4	N	4	O	1	1	40	AD
67	F	14	3.1	N	3.1	F	1	1	44	AD
68	F	14	3.05	N	3.05	F	1	1	48	AD
69	F	14	3.2	N	3.2	F	2	1	43	AD
70	F	14	2.45	D	2.45	S	1	1	40	AD
71	F	14	3.1	N	3.1	F	1	1	42	AD
72	F	14	4.55	SA	4.7	A	1	1	60	EASY

APPENDIX H

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

DATA ON PROFILE OF SSPC THIRD YEAR HIGH SCHOOL RESPONDENTS AND THEIR MASTERY LEVEL OF THE BASIC SCIENCE PROCESS SKILLS

No.	Sex	Age	Attitude	Interpretation	Study Habits	Interpretation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpretation
1	M	14	2.95	N	3	F	1	1	46	AD
2	M	15	3.25	N	3	F	1	2	34	AD
3	M	15	2.95	N	4	O	1	1	46	AD
4	M	15.5	2.65	N	3	F	2	1	38	AD
5	M	15	4.8	SA	5	A	2	1	59	EASY
6	M	14	2.5	N	4	O	1	1	58	EASY
7	M	14	2.9	N	3	F	1	1	60	EASY
8	M	15	2.75	N	3	F	1	2	46	AD
9	M	14	2.9	N	3	F	1	1	55	EASY
10	M	15	2.85	N	3	F	1	1	55	EASY
11	M	15	2.95	N	3	F	2	1	51	EASY
12	M	15.5	2.65	N	3	F	1	1	39	AD
13	M	16	2.55	N	3	S	1	1	52	EASY
14	M	15	4.51	SA	5	A	1	1	56	EASY
15	M	15	3	N	3	F	2	1	40	AD
16	M	15	3.4	N	3	F	1	2	56	EASY
17	M	15.5	2.85	N	3	F	1	1	47	AD
18	M	15	2.7	N	3	F	1	2	47	AD
19	M	14	2.9	N	3	F	1	2	44	AD
20	F	15	3.9	A	4	F	2	1	53	EASY
21	F	15	2.5	D	3	S	1	1	51	EASY
22	F	15	2.8	N	3	F	1	1	52	EASY
23	F	16	3.25	N	3	F	1	1	32	AD
24	F	14	3	N	3	F	1	1	47	AD
25	F	15	3.1	N	3	F	1	1	46	AD
26	F	15	2.6	N	2	S	1	1	47	AD
27	F	14.7	2.85	N	3	F	1	1	46	AD
28	F	15	3	N	3	F	2	1	45	AD
29	F	15	4.7	SA	5	A	1	1	59	EASY
30	F	15	2.7	N	3	F	1	1	44	AD
31	F	14	2.85	N	3	F	1	1	46	AD
32	F	15	4	A	4	O	1	1	41	AD
33	F	15	2.8	N	3	F	1	1	52	EASY
34	F	15	2.9	N	3	F	1	1	46	AD
35	F	15	3	N	4	O	1	1	41	AD
36	F	15	2.9	N	3	F	1	1	47	AD
37	F	14	2.8	N	3	F	1	1	45	AD

Appendix H continued

No.	Sex	Age	Attitude	Interpre-tation	Study Habits	Interpre-tation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpre-tation
38	F	15	4.51	SA	4	O	1	1	57	AD
39	F	15	3.6	A	4	O	1	1	47	AD
40	F	16	4.9	SA	5	A	1	1	63	EASY
41	F	14	2.95	N	3	F	1	1	57	EASY
42	F	14	3.9	A	4	O	1	1	58	EASY
43	F	15	2.9	N	3	F	1	1	43	AD
44	F	16	3.05	N	3	F	1	1	42	AD
45	F	15	2.5	D	3	S	1	1	46	AD
46	F	14	2.9	N	3	F	1	1	39	AD
47	F	15	4	A	4	O	1	1	51	EASY
48	F	14	4	A	3	F	1	1	48	AD
49	F	14	4.6	SA	5	A	1	1	60	EASY
50	F	14	3.2	N	3	F	2	1	48	AD
51	F	15	2.95	N	3	F	1	1	46	AD
52	F	15	3.05	N	3	F	2	1	45	AD
53	F	14	4.6	SA	4	O	1	1	56	EASY
54	F	15	2.95	N	3	F	1	1	44	AD

APPENDIX I

Republic of the Philippines
SAMAR STATE POLYTECHNIC COLLEGE
Catbalogan, Samar

DATA ON PROFILE OF SSPC FOURTH YEAR HIGH SCHOOL RESPONDENTS AND THEIR MASTERY LEVEL OF THE BASIC SCIENCE PROCESS SKILLS

No.	Sex	Age	Attitude	Interpretation	Study Habits	Interpretation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpretation
1	M	17	3.3	N	3.3	F	1	1	30	AD
2	M	16	2.95	N	4	O	1	1	47	AD
3	M	16	4	A	3	F	2	1	59	EASY
4	M	16	2.95	N	2.6	F	1	1	56	EASY
5	M	16	2.95	N	3	F	1	2	53	EASY
6	M	15	4	A	4	O	2	1	54	EASY
7	M	15	4.7	SA	3	F	2	1	59	EASY
8	M	15	2.3	D	3	F	1	1	44	AD
9	M	16	2.85	N	2.7	F	1	1	48	AD
10	M	16	3	N	4	O	2	1	50	EASY
11	M	16	4.6	SA	3.05	F	2	1	50	EASY
12	M	16	3.15	SA	3	F	1	1	38	AD
13	M	16	3.15	N	3.15	F	1	1	53	EASY
14	M	16	4	A	4	O	1	1	58	EASY
15	M	16	3.53	A	2.95	F	1	2	52	EASY
16	M	16	4.6	SA	4.7	A	1	1	61	EASY
17	M	16	3.2	N	3.2	F	2	1	53	EASY
18	M	16	4	A	3	F	1	1	61	EASY
19	M	16	3	N	2.9	F	1	1	61	EASY
20	M	16	2.75	N	2.75	F	1	1	52	EASY
21	M	16	2.25	D	2.45	S	1	1	36	AD
22	M	15	2.9	N	2.9	F	1	1	55	EASY
23	M	17	3.1	N	3.1	F	1	1	47	AD
24	M	16	2.8	N	2.3	S	2	1	51	EASY
25	M	15.5	3.9	A	3.9	O	1	1	45	AD
26	M	16	3.3	N	4	O	1	1	51	EASY
27	M	16	3.1	N	3.1	F	1	1	54	EASY
28	M	16	4.51	SA	4.52	A	1	1	62	EASY
29	M	15	3.05	N	3	F	1	1	54	EASY
30	M	16	2.9	N	2.9	F	1	1	54	EASY
31	M	17	3.1	N	3.1	F	1	1	55	EASY
32	M	16	2.85	N	4.6	A	2	1	61	EASY
33	M	16	2.95	N	2.95	F	1	1	53	EASY
34	M	17	4	A	4	O	2	1	55	EASY
35	F	16	3.3	N	3	F	1	1	58	EASY
36	F	16	2.95	N	4	O	1	1	42	AD
37	F	15	4	A	3	F	1	2	59	EASY

Appendix I continued

No.	Sex	Age	Attitude	Interpre-tation	Study Habits	Interpre-tation	Urban (1) Rural (2)	Public (1) Private (2)	Mastery Level	Interpre-tation
38	F	16	2.95	N	2.6	F	1	1	36	AD
39	M	16	2.95	N	3	F	1	2	53	EASY
40	F	16	4	A	4	O	1	1	49	AD
41	F	16	4.7	SA	3	F	1	1	43	AD
42	F	17	2.3	D	3	F	1	2	52	EASY
43	F	16	2.85	N	2.7	F	2	1	48	AD
44	F	15	3	N	4	O	2	1	48	AD
45	F	15.5	4.6	SA	3.05	F	1	1	62	EASY
46	F	16	3.15	N	3	F	2	1	55	EASY
47	F	15	3.15	N	3.15	F	2	1	47	AD
48	F	16	4	A	4	F	2	1	48	AD
49	F	15	3.53	A	2.95	F	1	1	56	EASY
50	F	16	4.6	SA	4.7	A	2	1	40	AD
51	F	16	3.2	N	3.2	F	1	1	58	EASY
52	F	17	4	A	3	F	1	1	38	AD
53	F	16	3	N	2.9	F	1	1	57	EASY
54	F	16	2.75	N	2.75	F	2	1	40	AD
55	F	16	2.25	D	2.45	S	1	1	57	EASY
56	F	16	2.9	N	2.9	F	1	1	48	AD
57	F	16	3.1	N	3.1	F	1	1	46	AD
58	F	16	2.8	N	2.3	S	1	1	53	EASY
59	F	17	3.9	A	3.9	O	2	1	61	EASY
60	F	16	3.3	N	4	O	2	1	52	EASY
61	F	15	3.1	N	3.1	F	1	1	59	EASY
62	F	15	4.51	SA	4.52	A	1	1	57	EASY
63	F	16	3.05	N	3	F	1	1	35	AD
64	F	16	2.9	N	2.9	F	1	1	61	EASY
65	F	15	3.1	N	3.1	F	1	1	49	AD
66	F	16	2.85	N	4.6	A	1	1	48	AD
67	F	16	2.95	N	2.95	F	1	2	49	AD
68	F	16.5	4	A	4	O	1	1	45	AD
69	F	16	2.7	N	4.7	A	1	1	63	EASY
70	F	16	3.3	N	3.3	F	1	1	54	EASY
71	F	15.5	3.5	N	3.5	F	2	1	35	AD
72	F	16.5	4	A	3.5	F	1	1	47	AD
73	F	16	3.2	N	3.2	F	2	1	53	EASY
74	F	16	2.95	N	4	O	1	1	52	EASY
75	F	16	3.8	A	3.8	F	1	1	50	EASY
76	F	16	3.15	N	3.15	F	1	1	48	AD
77	F	16	3	N	4	O	1	1	60	EASY
78	F	16	2.9	N	2.9	F	2	1	43	AD
79	F	16	3.4	N	3.4	F	1	1	33	AD
80	F	16	2.8	N	2.8	F	1	1	33	AD
81	F	16	3	N	3	F	1	1	52	EASY
82	F	16	2.95	N	2.95	F	2	1	58	EASY
83	F	16	4	A	3.15	F	1	1	48	AD
84	F	16	2.75	N	2.75	F	1	1	45	AD

CURRICULUM VITAE

CURRICULUM VITAE

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Place of Birth	:	Pangdan Cathalogan, Samar
Address	:	Purok 1, Brgy. Socorro Catbalogan, Samar
Civil Status	:	Married
Husband	:	Antonio Tomalabcad Pagliawan
Children	:	Anton Vanmar L. Pagliawan Antonette Marie L. Pagliawan

EDUCATIONAL BACKGROUND

Elementary	:	Patong Elementary School Patong Calbiga, Samar 1982 – 1986
		Pangdan Elementary School 1986 – 1989
Secondary	:	Samar National School Cathalogan, Samar 1989 – 1993
College	:	Samar State Polytechnic College Cathalogan, Samar BSE – Chemistry 1993 – 1997
Graduate Studies	:	Samar State Polytechnic College Catbalogan, Samar

CIVIL SERVICE ELIGIBILITY

Licensure Examination for Teachers (LET)
May 28, 1998
76.40%

HONORS AND AWARDS RECEIVED

Second Honor	:	Grade I to Grade III Patong Elementary School Calbiga, Samar
First Honor	:	Grade IV Patong Elementary School Calbiga, Samar
Second Honor	:	Grade V and VI Pangdan Elementary School Catbalogan, Samar
Second Place Winner	:	200 Meters Freestyle Swimming Competition Provincial Meet Katbalud, Catbalogan, Samar
Second Place Winner	:	400 Meters Freestyle Swimming Competition Provincial Meet Katbalud, Catbalogan, Samar
Certificate of Recognition	:	Outstanding Coach, 3rd Place Winner in the 1999 – 200 DAMATH Division Level Competition January 14, 2000

IN-SERVICE TRAININGS/SEMINARS AND WORKSHOPS ATTENDED

Seminar Workshop in Chemistry, Physics and Mathematics
Basey National High School
November 27 – 29, 1997

Seminar Workshop of School Trainors on the Implementation of the Revitalized Homeroom Guidance Program (RHGP)
DECS Catbalogan, Samar
August 20 - 21, 1998

Echo - Seminar Workshop on the Refinement and Finalization of the RHGP
DECS Catbalogan, Samar
September 16 - 17, 1999

Basic Leadership Training Course for Scout Leaders
Catbalogan, Samar
October 15 - 17, 1999

Regional Based Training Program for the Institutionalization of the Thinking Skills Development of Maximized Cognitive Performance (TSD – MCP)
DECS Catbalogan, Samar
November 5, 1999

Division Echo Training Workshop for Secondary English and Science Teachers
DECS Catbalogan, Samar
July 13 - 14, 2000

Seminar Workshop on Item Analysis and Test Validation
Casandig National High School
August 3 - 4, 2000

Orientation Conference on Project: Remedial Instruction in Schools (RIS)
DECS Catbalogan, Samar
September 13, 2000

Seminar Workshops on the Dynamics of Science Camping
DECS Catbalogan, Samar
September 14 - 15, 2000

Training on Basic First Aid and Emergency Disaster Preparedness
DECS Catbalogan, Samar
November 7, 2000

Seminar Workshop on Upgrading Physics Teaching on Secondary and Tertiary Level
SSPC, Catbalogan, Samar
February 15 - 16, 2001

Seminar Workshop on Chemistry Teaching
SNS Catbalogan, Samar
September 15 – 16, 2001

School Based Training on the 2002 Basic Education Curriculum Reforms and Its Implementation
Motiong National High School
Motiong, Samar
May 6 – 10, 2002

Outdoor Leadership Course
GSP Samar Council
November 15 – 17, 2002

25th National Physics Convention/Seminar Workshop
SSPC, Catbalogan, Samar
April 2 – 5, 2003

Division Training for Teacher Trainers in Science for Secondary Schools
Calbayog City
August 28 – 30, 2003

Division Orientation on TCP Approach in TB Prevention and Control and Preventive Nephrology
Redaja Hall, Catbalogan, Samar
October 17, 2003

2003 National Seminar Workshop/for Science Club Leaders
Ecotech Center, Lahug, Cebu City
October 1 – 5, 2003

Philippine Organization of science and Technology educators Seminar
Leyte National High School, Tacloban City
November 21 – 23, 2003

CO-CURRICULAR ACTIVITIES

Unit Patrol Leader : Troop
Lawaan National High School

Member	:	Philippine Association of Graduate Education (PAGE) 1999 – 2000
Member	:	Philippine Physics Society SY 2000 - 2001
Member	:	Philippine Organization of Science and Technology Educators (POSTE) 2003 – Present
Member	:	Science Club Advisers Association of the Philippines (SCAAP) 2003 - Present
Business Manager	:	Chemistry Class SSPC, Catbalogan, Samar 2nd Semester 1998 – 1999
Muse	:	Foundation of Education SSPC Catbalogan, Samar 1st Semester, 1998 - 1999
Muse	:	Statistics SSPC Catbalogan, Samar 1st Semester 1998 - 1999

TEACHING EXPERIENCE

Classroom Teacher	:	Holy Name Academy Villareal, Samar 1997 – 1998
		Lawaan National High School Lawaan Paranas, Samar 1998 – Present

LIST OF TABLES

Table		Page

LIST OF FIGURE