5-31-1999

An impact study of the positive benefits of a technology course on students' critical thinking skills

Jerry J. Marinacci
Rowan University

AN IMPACT STUDY OF THE POSITIVE BENEFITS OF A TECHNOLOGY COURSE ON STUDENTS' CRITICAL THINKING SKILLS

by
Jerry J. Marinacci

A Thesis

Submitted in partical fulfillment of the requirements of the
Master of Arts Degree
of
The Graduate School
at
Rowan University
April 22, 1999

Approved by

Professor

Date Approved May 1999

ABSTRACT

Jerry J. Marinacci

A Study to Determine the Positive Benefits to Students of the New Technology Course at Bridgeton High School. Does the course enhance students' critical skills? 1998-99. Dr. R.L. Capasso. School Administration.

The purpose of this study was to determine the positive benefits to students enrolled in the new Applied Technology course offered at Bridgeton High School. The intern wishes to determine if the course has enhanced students' ability in critical skills such as: communicating, teamwork, problem solving and critical thinking.

The study will focus on students' ability to define and solve real world problems as presented in a high school technology laboratory. The design of the study was based on qualitative research of students' ability to identify criteria, develop possible solutions and solve problems of a technical nature based on pre-test and post-test research of each lesson. In addition, teachers will be questioned to obtain input on the relevance of this programs assistance in increasing students' competency in other courses such as in mathematics and science.

Data will be analyzed by comparing pre-test and post-test scores administered before and after the treatment. In addition to the pre-test and post-test, student observations will be conducted throughout the treatment, as well as surveys conducted with the sample students mathematics and science teachers.

The conclusions of this study were inconclusive. At this juncture no measurable benefit to the enhancement of students' critical skills were found.

MINI-ABSTRACT

Jerry J. Marinacci

A Study to Determine the Positive Benefits to Students of the New Technology course at Bridgeton High School. Does the course enhance students' critical skills? 1998-99. Dr. R.L. Capasso. School Administration.

This study investigated the question, has the new Applied Technology Course at Bridgeton High School enhanced students' critical skills such as: communicating, teamwork, problem solving and critical thinking.

The conclusions of this study were inconclusive. At this juncture no measurable benefit to the enhancement of students' critical skills were found.

Acknowledgments

I wish to thank my field mentor, Mr. I. Marshall for his wisdom and understanding and my university mentor, Dr. R. Capasso for his guidance during my internship. I wish to dedicate this project to my mother for her patient understanding for the lack of time available to spend with her.

Table of Contents

Page

CHAPTER 1

Introduction

Focus of the Study

This study was conducted to determine the positive benefits toward overall academic achievement for students enrolled in the new Applied Technology course offered at Bridgeton High School. The intern desires to determine if the course has enhanced students' ability in critical skills such as: communicating, teamwork, problem solving and critical thinking.

The study focused on students' abilities to define and solve real-world problems as presented in a high school technology laboratory shop atmosphere. The design of this study will be based on the qualitative research of students ability to identify and solve problems and information based on pre-test and post-test, survey and questionnaire research.

The intern desires that interested parties such as the district Curriculum Coordinator, Assistant Superintendent and Board of Education will see first-hand results of student improvement in critical skills due to this technology program.

Purpose of the Study

The intern wishes to learn if a course in Applied Technology can enhance and strengthen students' critical skills in the following areas: communicating, teamwork, problem solving and critical thinking. Students within Bridgeton High School, grades ten through twelve, will be offered a course in Applied Technology as an elective for the 1998-1999 academic year. The intern wishes to determine the effectiveness of the Applied Technology Course on students' ability to communicate with others, work within a team, solve problems and think critically.

A course in Applied Technology regarding the identification and solving of real-world type problems seems to be the best theater of instruction to improve our students' employability skills. Why Technology? Technology is not simply applied science. Despite the popular tendency to equate technology with sophisticated machines such as magnetic resonance imaging or the patriot missile, it is not an invention of the 20th century. Technology has existed throughout history as the processes and products by which humans have coped and changed their environment (Lisensky et el. 1985, Kerka, 1994). People from the beginning of human existence have always lived and worked in a technological society. Technology is the how that links what is (science, social science) to what should be (humanities, religion) (Lisensky et el. 2985, Kerka, 1994).

The concept of an "educated person" includes an element of technological literacy (Kerka, 1994). A students' employability, the ability to participate in paid work is of

great importance if our students are to become self-reliant contributing individuals in our future workforce.

In Canada a major project of the Conference Board of Canada's Corporate Council on Education was to identify and communicate the skills they require as employers of half a million Canadians (McLauhhlin, 1995). This article is one of many in which this project is based.

In 1991 the Secretary's Commission on Achieving Necessary Skills (SCANS), U.S. Department of Labor, issued its report on the competencies, skills and personal qualities needed to succeed in the high performance workplace (Lankard, 1995). The SCANS report identified five categories for competencies required for the successful transition from school to work. These competencies include: resources, interpersonal, information, systems, technology recommending that these competencies be learned in context in the environment in which they will be applied (Lankard, 1995).

The purpose of this study is to develop a program in Applied Technology for the high school students at Bridgeton High School using a qualitative research design. The major purpose of the program is to strengthen our students' abilities to think creatively, make decisions, solve problems, visualize, reason, analyze, interpret, and know how to learn; these skills are most often mentioned in definitions of critical thinking.

Characteristics of critical thinkers are perseverance, flexibility, metacognition, transfer of knowledge, problem orientation, open mindedness, use of quality standards, and independence (Lee, 1989, Kerka, 1992). The SCANS report challenged schools,

parents, and businesses to help students develop competencies in basic skills, thinking skills, and personal qualities required for work in the current and future workplace (Lankard, 1995). A program in applied technology will assist in developing student competencies in critical skills as referenced by the SCANS report recommendations.

This study will result in a report to the district Curriculum Coordinator, Assistant Superintendent and the Board of Education members emphasizing the need for a continued and enhanced Technology Program to include a multi-media technology lab, for grade levels 10 through 12, which will be shared by other curricular areas within the Industrial Technology Department and the Science Department.

The program will contribute to student technological literacy based on first-hand experience of real world problems and their solutions. Helping our students to develop thinking skills is critical if our students are to compete and succeed in the future workplace. Thomas (1992) cites the following argument as one example for higher order thinking skills, "The changing work environment requires flexibility and adaptability to changing conditions" (Kerka, 1992). Each student will gain experience and reinforcement in critical skills, especially those of communication, teamwork, problem solving, and critical thinking.

In addition this program will contribute to our district's alignment with the State of New Jersey Department of Education Core Curriculum Content Standards regarding Cross-Content Workplace Readiness curricular programs (May 1996), i.e. applied technology and science.

Definitions

The following terms or programs will be defined in an effort to offer the reader a better understanding of this study.

a. Core Curriculum Content Standards:

Standards established by the New Jersey Department of Education in an attempt to define the meaning of "Thorough" in the context of the State constitutional guarantee that all students would be educated within a thorough and efficient system of free public schools.

b. Cross Content Workplace Readiness Standards:

Eight subject specific standards were reviewed and found to have certain reoccurring themes. The subject areas are: Visual and Performing Arts, Comprehensive Health and Physical Education, Language Arts/Literacy, Mathematics, Science, Social Studies, World Languages and Career Education. These common themes reinforced the notion that each content area draws on certain key elements of the other content areas. The standards are identified as:

1. All students will develop career planning and workplace readiness skills.
2. All students will use technology, information and other tools.

3. All students will use critical thinking, decision-making, and problem-solving skills.

4. All students will demonstrate self-management skills.

5. All students will apply safety principles.

c. SCANS:

Secretary's Commission on Achieving Necessary Skills. A committee organized by the U.S. Department of Labor.

d. SCANS Report:

A report issued by SCANS which identified five categories of competencies required for the successful transition from school to work. These competencies are: resources, interpersonal, information, systems and technology.

e. TLA:

Technology Learning Assignment.

Limitations of the Study

The limitations which may effect the study include:

1. The size of the sample population may be too small to justify or contribute to any major improvement in student abilities regarding the total population of the building.

2. The study will be conducted using a subject population which includes

all students in grades ten through twelve enrolled at Bridgeton High School. Although Bridgeton High School contains grades nine through twelve, students in grade nine are not permitted to enroll in the technology course.

3. Data collection will be obtained through the use of a pre-test, post-test design of qualitative research. This may be a problem if the sample population size is small because it will fail to provide data conducive to a major impact on student abilities within the high school, only those who are members of the sample.

Setting of the Study

The community setting within which this study takes place is Bridgeton, New Jersey. Bridgeton, New Jersey is an urban (inner city) Abbott district situated within a rural area of Cumberland County, New Jersey. An Abbott, or property poor, district is a district which is unable to generate funding due to a diminished and dwindling tax base and has been judged unable to provide the same thorough and efficient education as wealthier districts based on the New Jersey Supreme Court judgement in Abbott vs. Burke.

The majority of the students come from within the city, with only two sending districts, Fairton and Cedarville, New Jersey. The city of Bridgeton suffers from high unemployment, high crime, domestic violence, teen pregency, ethnic gangs and drug use.

The district serves approximately three thousand eight hundred students, of which over eight hundred are classified under special education. The enrollment at the high school is approximately sixty-five percent Afro-American and the balance split between Hispanic and Caucasian students.

The educational setting within which this study takes place is the Industrial Technology Department of Bridgeton High School, school district of Bridgeton Public Schools, Bridgeton, New Jersey.

Significance of the Study

The significance of this study is to determine if the new Applied Technology course, offered by the Industrial Technology Department at Bridgeton High School, will be beneficial in helping students to develop their critical skills in communicating, teamwork, problem solving and critical thinking.

What is the effectiveness of the Applied Technology course on students' ability to solve problems is the major question to be answered. Subquestions to be considered are:

1. Has student ability to think critically been enhanced?
2. Has student ability to work in groups or teams been enhanced?
3. Has student ability to communicate with others been enhanced?
4. Has student ability to make decisions been enhanced?

Organization of the Study

The study to determine the benefits of the new Applied Technology course offered by the Industrial Technology Department at Bridgeton High School will be organized as follows:

Chapter Two, Review of the Literature, will define Technology, its purpose and curriculum within the educational community. The chapter further discusses the importance of students' becoming information literate and the employability skills students require to compete in the global marketplace.

Chapter Three, The Design of the Study, addresses five areas related to the research design used for the study. The chapter will also answer the question of what evidence was gathered to prove that the project is having an impact on students enrolled in the Applied Technology course offered by the Industrial Technology Department at Bridgeton High School.

The first of the five areas related to the research is a description of the research design, Second, a description of the development and design of the research instruments used in the study. Third, a description of the sample and sampling techniques used in the study. Fourth, a description of the data collection approach used in the study. Fifth, a description of the data analysis plan.

Chapter Four, Presentation of the Research Findings, will answer two major questions related to the study. The first question, "What information was found?" and the second question, "What did it mean?".

Chapter Five, Conclusions, Implications and Further Study, will describe the study's major conclusions and corresponding implications. The chapter will also study the interns leadership development, address how the organization changed as a result of the study and address the need for further study.

CHAPTER 2

Review of Literature

Defining Technology

Dr. Charles E. Vela, the lead engineer of the Mitre Corporation, commission member of the Technology for All American Standards Project and executive director of the Center for the Advancement of Hispanics in Science and Engineering Education defines technology as "a pivotal stone in contemporary science and society". Adding, "At times, differences between science and technology are blurred by those who mechanically impose the scientific method on technological sciences without considering one fundamental difference: Scientific Laws operate in nature regardless of human intervention; Technology is solely a human construction. Whereas nature exists outside our will, Technology exists because of it" (Vila, 1995).

There is a need to acknowledge the difference and separate the technical sciences from the experimental, physical and natural sciences, mathematics, and of course, the social sciences. Technical sciences borrow from all the sciences and, at the same time. serve all, including themselves (Vila, 1995).

This intern believes Dr. Vilas' statements encompasses the total meaning of the way we must teach Technology Education in our schools. Technology, as our students, is mankinds future. Technology molds our future and encourages mankind to express

their imagination for the improvement of the human mind, spirit and evolution. Technology is not a result of random chance or discovery, but the product of the human mind, shaped by our hand and implemented by our desire to achieve a better existence. Without it man would have never flew above the clouds or walked on the moon.

Purpose

Whatever kind of technological programs educators develop, the primary consideration should be the purpose of using the technology (Jorden & Follman, 1993)(Burnett, 1994). Burnetts' agreement with Jorden & Follman is an important factor in this interns theory of what is missing in technological education of our students today. Technology educations primary goal is to assist our students' to develop the attitude of becoming life-long learners emphasizing critical skills such as: communications, teamwork, problem solving and critical thinking.

Information regarding technology education is readily available to educators from on-line sources such as: United States Department of Education, ERIC, and EBSCOhost to name just a few. Additional information can be obtained from college and university libraries as well as local community college and county libraries.

Curriculum

Curricula must contain challenging ideas and tasks applied to real-life problem-solving activities that stimulate reasoning, foster creativity and an integration of knowledge, and develop evaluative, decision-making skills (The New Jersey Department of Education Core Curriculum Content Standards, May 1996). Although these standards

do not directly address or include technology education they do make reference to technology education as being a contributing factor in students' achieving the expected results as specified in the standards. However, what better method is there to achieve these goals than Technology Education. For students to become life-long learners it is essential they be engaged in an environment conducive to obtaining and processing information. In an information literate environment students engage in active, self-directed learning activities and teachers facilitate students' engagement through a more adventurous style of instructional delivery (Hancock, 1993). Hancocks' statement is important because it is the teachers role to direct students' participation in their self-directed learning activities. Students who learn to become self-starters and self-sufficient have engaged in the primary functions necessary to become life-long learners.

Our students will eventually become the workers of the future and they must be information literate. In a global marketplace data is dispatched in picoseconds and gigabits, The deluge of information must be sorted, evaluated, and applied, and workers must be able to gather, synthase, interpret, and evaluate (Hancock, 1993). Students who have obtained a good background in technology will be able to participate and compete in the global marketplace offering employers the skills employers require.

Employability Skills

Employability skills are the most important characteristics our students' must develop. In Canada the Conference Board of Canada's Council on Education drafted a list of skills based on the hiring criteria of the companies they represented. For simplicity

the profile used the work "skills" to represent the set of characteristics that make a person employable, including knowledge, know-how, attitudes and behaviors (McLaughlin, 1995). One of the guiding principles in the Employability Skills Profile was that the skills required for a high-quality Canadian work force now and in the future must be generic foundational skills rather than skills specific to certain occupations, levels of responsibility, or limited to today's jobs (McLaughlin, 1995). McLaughlin makes an important breakthrough in his review of the Employability Skills Profile used in Canada. Skills of a generic nature are what is important for our students' to develop. They must be able to cope with change, be flexible, and posses an understanding of critical skills which will enable them to maintain their marketability in the job market. Skills of this degree are obtainable through technology education.

In addition to Canada's Employability Skills Profile, in 1991, the Secretary's Commission on Achieving Necessary Skills (SCANS), United States Department of Labor, issued its report on the competencies, skills and personal qualities needed to succeed in the high performance workplace (Lankard, 1995). The SCANS report challenged schools, parents, and businesses to help all students' develop competencies in the basic skill, thinking skills, and personal qualities required for work in the current and future workplace. SCANS identified five categories of competencies that would lead to students' successful transition from school to work, they are: Resources, Interpersonal, Information, Systems, and Technology. The SCANS report recommended that these

competencies be learned in context in the environment in which they will be applied (Lankard, 1995).

If we expect our graduates to contribute to the quality of life through their individual creative work in family, jobs, and society, we need to recognize that all of us are involved in and interact with a highly technological environment, and that education should develop the capability for life-long learning in all of the disciplines which contribute to that environment (Lisensky et el., 1985)(Kerka, 1994).

Technology has existed throughout history, and is not merely applied science. Technology is the process by which humans have coped with and changed their environment. Technology is "woven throughout the very fabric of our culture as an agent for social, economic and cultural change" (Caster, 1990)(Kerka, 1994). This statement binds all others in the concept of the need for Technology Education. For the State of New Jersey Department of Education to ignore technology education as a separate component of the core curriculum may develop into an error of critical proportions. The concept od an " educated person " includes an element of technological literacy (Kerka, 1994). If our students' are to become life-long learners who contribute to the general well being of society, they must become proficient in the critical skills of communication, teamwork, problem solving, and critical thinking as defined within the technological environment which humans have lived in since man discovered the use of fire. This literacy can be accomplished through the study of technology and its' practical applications.

Critical Skills

The literature cites, the ability to think creatively, make decisions, solve problems, visualize, reason, analyze, interpret, communicate, and know how to learn are skills most often used in definitions of critical thinking. Characteristics of critical thinkers are perseverance, flexibility, metacognition, transfer of knowledge, problem orientation, open mindedness, use of quality standards, and independence is a list that resembles many descriptions of the desirable qualities of the future work force (Kerka, 1992). Take a minute to ponder this fact: The nature of the workplace is constantly changing. In addition, people are living much longer, it is clear to this researcher that a sound foundation in critical skills, based on technology education is needed for a forty to fifty plus year work life. As educators, it is our obligation to our students to provide the best we can offer to prepare them for their future.

CHAPTER 3

The Design of the Study

Introduction

Chapter Three will address the five areas related to the research design used for this study. The first area addressed will be a general description of the research design used for this thesis. The second area addressed will be a description of the development and design of the research instruments used in the study. The third area will be a description of the sample and sampling technique used in the study. The fourth area will be a description of the data collection approach used, and the fifth area will be a description of the data analysis plan used in the study.

General Description of the Research Design

The research design used in this study is qualitative research. In qualitative research the researcher operated in a natural setting while maintaining an open mind about what is being observed. The researcher does not manipulate or intervene in the research activities, except by their presence in the situation. This research design requires flexibility and a tolerance for adjustment as the research progresses. It is the perceptions of those being observed that are important to the study; therefore, these perceptions must be observed and recorded in order to obtain an accurate measure of reality.

Qualitative research uses inductive inquiry, which means it commences without any preconceived theories or hypotheses. However, the researcher is usually influenced by their own backgrounds so some information is likely to be available regarding the research problems.

Development and Design of the Research Instruments

Data collection in qualitative research deals with a host of issues, especially when the data collection is done in a current situation such as in a new technology course. There are two methods of data collection in qualitative research, interactive and noninteractive. In this study the interactive method was used meaning the researcher actually interacts with the subjects who are being studied.

Data collection techniques used were the pre-test and post-test, given to subjects before and after the treatment. In addition, the subjects were observed during the treatment period. Interviews conducted with subjects math and science teachers, and questionnaires given to the subjects at specific times during the treatment. Samples of all data collection instruments can be found in the appendix, Research Instruments on page 35.

The development and design of the collection techniques were driven by the technology learning assignments (TLA), materials and projects undertaken during the treatment.

Sample and Sampling Technique

Sampling is an example of the need for specific detail. The sampling plan used

must consider terms of both external and internal validity of the research project being studied. This study involves Bridgeton High School students in grades ten through twelve (the population) . The actual sample is the students who enroll in the new Applied Technology course offered by the Industrial Technology Department.

Currently, there are four students enrolled in the course. This is not a random sample taken from the population, but rather a specific group of volunteers who chose to enroll in the course. It should be mentioned that the most positive aspect of volunteers is the fact they are usually better informed regarding the project, its purpose and concepts as compared to randomly chosen subjects. However, it was the researcher's displeasure that the sample size was not larger. A larger sample could have given the research findings greater validity.

Data Collection Approach

Data collection in qualitative research must deal with many issues, especially if the data collection is done in a current situation. The researcher must have access to the situation which in some cases may require special arrangements. However, for this study the researcher is conducting a study in his own classroom, the technology shop. Access is automatic and data collection is unobtrusive.

The researcher assumes the roll as instructor and classmate. This roll will offer basic instruction to the sample subjects as a class, and individually as required. It also allows the instructor to demonstrate specific skills, such as brainstorming, critical thinking, design concepts, fabrication and problem solving. The instructor will distribute

both the pre-test and post-test including questionnaires before, during and after the TLA. However, the researcher will not offer any additional assistance, such as design ideas or working with any one specific subject over the others, which may taint the study or the data being collected. In addition, the researcher will also utilize the survey in obtaining data from each subjects math and science teachers, as well as observation of the subjects while they participate in the TLA activity, i.e. the treatment.

Data collection instruments will be collected and reviewed. Their information will be recorded for use later in the studies evaluation of the data.

Data Analysis Plan

Data analysis in qualitative research begins soon after collection of data begins. One major complication of qualitative research is that it produces large quantities of information in the form of tests, field notes, questionnaires and interviews. All of these examples are present in this study. Organizing this information is important in order to determine what is necessary for the purpose of this study. Information will be categorized into several headings; they are communicating, teamwork, problem solving and critical thinking.

Pre-test and post-test instruments, before and after the treatment TLA, are used in an effort to determine what prior knowledge the subject may have regarding the treatment. They are also used to determine what new knowledge the subject has obtained due to the treatment. Questionnaires will be distributed to each subject during the treatment to obtain information regarding each subjects reaction to the TLA. Questions

such as, has the TLA enhanced critical skills such as communicating, teamwork, problem solving and critical thinking? Have the subjects sensed a change in their thought patterns regarding ideas for solving specific problems native to the treatment? Are subjects finding it easier to communicate among themselves regarding sharing ideas or particular shop skills? Do the subjects find it easier to work together as a team?

During the study survey questionnaires will be distributed to each subject's math and science teachers requesting their input to determine if the research treatments are of benefit to the subjects when performing in their math or science classes. These teachers will be requested to observe for certain behavior characteristics such as increased class participation, higher order thinking and reasoning skills and improved communicating skills.

CHAPTER 4

Presentation of the Research Findings

Introduction

Chapter Four will present the research findings and answer the two major questions, "What information was found?" and "What did it mean?". Several exceptions from the original proposal must be made at this juncture before we can proceed to the research findings. They are the size of the sample, taken from the sample population, which enrolled in the new Applied Technology course, the number of technology learning activities or TLA's the sample actually completed and the fact that several subjects did not require a science course at this juncture of their education. Therefore, for those subjects there will be no information obtained from that particular curriculum.

The sample size consisted of four students, they will be referred to as subjects A, B, C, and D. Based on the high school total enrollment of students in grades ten through twelve this represents approximately .45 percent of the sample population far too small a sample to determine any significant contribution to the study. Furthermore, the original number of TLA's proposed were six. To date this sample have only completed three TLA's which have been the basis used for the research findings.

What Information Was Found?

The purpose of this study was to determine the positive benefits toward overall

academic achievement for students enrolled in the new Applied Technology course. The study was designed to determine if the course had enhanced students' abilities in critical skills. These skills include communication, teamwork, problem solving and critical thinking based on students performance dealing with real world problems as presented in a technology laboratory shop atmosphere.

The presentation of the research findings have been discussed in general terms, based on the overall academic performance, of the four subjects, within the applied technology course. In addition, the results of the interviews with the subjects' mathematics and science teachers will be included in an effort to indicate any improvement in the subjects performance in these academic areas.

To date, three of the six TLA's have been completed. During the three TLA's activities the subjects were observed by the researcher to build on their critical skills in communicating, teamwork and critical thinking. At first the subjects progressed slowly in these skills, mostly due to the fact this course is a radical change from the normal types of courses offered at Bridgeton High School and the fact that , for our subjects, this type of unstructured, self-learning, activity was new and probably confusing to them.

The basis of the Applied Technology course was to present subjects with the TLA assignment, a real world problem. Give the subjects the necessary background information, which included an assignment pre-test, and the basic parameters and limitations of the assignment before beginning. Subjects were allowed to progress through

the assignment using teamwork, critical thinking and communication skills to solve the problems which were presented.

Subjects were encouraged to work together sharing ideas and individual skills in an effort that all subjects succeed at this task. Very little input was offered by the instructor unless the subject became completely perplexed and required a gentle push to get back on task. In all cases the pre-test indicated no or a limited knowledge of the TLA being presented. During the TLA activity the subjects were allowed to progress at their own pace within specified time limitations. As problems surfaced and subjects required assistance, the instructor would only offer enough information so as to get the subject thinking and developing their own solutions.

Post-tests indicated the subjects' levels of learning regarding the problem assignment, but most importantly, the post-test indicated the subjects did in fact improve their knowledge of the TLA's problem in addition to an enhancement of their critical skills including, communications, teamwork, problem solving and critical thinking.

During the TLAs' the researcher observed an increase in the subjects' confidence levels which comes from the experience of self-accomplishment in a successfully completed assignment. As the subjects progressed from one TLA to the next the subjects were observed to be less intimidated by the material, more open to communicating and working in teams and encountered fewer problems with the material which was confirmed by the number of questions being asked the researcher. Subjects were now

inclined to propose a problem and solution to the researcher, inquiring if their course of action was correct rather than the question, "how should I do this?".

Grades obtained by each subject were satisfactory, stable and consistent within the applied technology course. All students indicated the same pattern regarding each TLA, which was a limited knowledge at the beginning of the assignment with an increase in knowledge by the completion of the assignment. Grades for all subjects were recorded as "A" for the first and second marking periods. This in itself may not indicate an improvement in knowledge or critical skills. However, all subjects demonstrated a willingness to work and learn and did in fact show improvement in knowledge and critical skills during the TLA assignments.

Interviews with each subjects' mathematics and science teachers indicated that all students were bright, intelligent, willing to learn and improve themselves through hard work and diligence. All were labeled by their mathematics and science teachers as good students with a fair to good level of consistency regarding their grades for the interim and final grades of the first and second marking periods (subjects "A" and "D" had no science classes). See appendix, Research Instruments, page 35, for a sample of the interview instrument.

Unfortunately, this researcher believes the study was tainted due to several intervening variables. First, several of the subjects who entered this course in September were under the impression the Technology course was an advanced computer course. Second, the remaining subjects indicated they were informed by the Guidance

Department that the Technology course was an advanced woodworking course. Generally speaking this researcher believes the information obtained from the subjects was very damaging in itself due to the fact all subjects were under a false impression of what the Technology courses was offering.

What Did It Mean?

This researcher has determined what the information obtained means regarding the validity of this study. For something to be valid it must be based on fact or evidence. It must be capable of being justified. Validity involves two concepts simultaneously. It must posses both internal validity and external validity. Internal validity is the extent to which research results can be interpreted. External validity is the extent to which the research results can be generalized to situations, conditions, or in this case populations.

It is this researcher's belief that this study is not valid due to several existing conditions. First, the sample size was not sufficient to make even the smallest impact on the population, which in this case are the students at Bridgeton High School in grades ten through twelve. The number of subjects who enrolled in the new Technology course represented approximately .45 percent of the student population in grades ten through twelve. This sample was far too small to make any determination as to weather or not the new Technology course was beneficial in enhancing critical skills in regard to the population. Second, the number of TLAs completed was not, in this researcher's opinion, a sufficient number to determine any benefit to the subjects in regard to the enhancement

of their critical skills. Third, the sample subjects were under a false impression of the Technology courses actual curriculum description. In their minds the subjects were expecting something totally different from the actual course curriculum.

Although this researcher did observe the subjects experiencing some benefit from participating in the Technology course TLAs. These benefits include: the willingness to work in teams. The ability to solve problems on their own, both individually and collectively. The improvement in their communication skills, which was used to exchange ideas and concepts for the solution of problems experienced by several or all of the subjects, but most observed was the growing self confidence each subject experienced.

Therefore, even though this researcher believes the study to be invalid in its main concept, the improvement of the subjects' confidence and critical skills does indicate some benefit experienced by enrolling in the Technology course.

CHAPTER 5

Conclusions, Implications and Further Study

Introduction

Chapter Five describes the study's major conclusions and their corresponding implications. In addition, the chapter highlights the conclusions and implications of the study on the intern's leadership development and how the organization changed as a direct result of the study. Finally, the chapter will discuss the need for further study.

Conclusions

The major conclusions of this study were at best inconclusive. Several factors contributed to this conclusion. First, the study involved the introduction of a new and radical type of course as compared to other courses offered at Bridgeton High School. Second, the sample subjects were mislead by the guidance department as to the nature of the applied technology course. Several subjects entered the course believing it to be a computer course, several others entered the course believing it to be an advanced woodworking course. This misinterpretation of the nature of the course was very damaging to the study. Within several weeks two dissatisfied students dropped the course.

These students were removed from the study and their data to date discarded. Third, the sample size was too small, in comparison to the total population, to make an impact on

the school's curriculum. This was observed during the interviews with the subjects' mathematics and science teachers. The teachers of all subjects indicated they had not observed any significant change in the subjects' classroom attitudes, behaviors and performance, which could be credited as a result of the technology course. Furthermore, teachers indicated no significant increase regarding the grades of the subjects. Generally speaking, all subjects were ranked average to good students by their teachers.

Implications

At this juncture the researcher concluded that the new applied technology course may not have been beneficial in enhancing students' critical skills as observed in the study of the four subjects who had enrolled in the course. However, it is this researcher's belief that the curriculum as presented and the experience gained by the sample subjects did indeed enhance their awareness of the kinds of skills required to successfully enter the competitive workforce of the outside world. In this respect the researcher believed the new applied technology course to be successful in enhancing students' awareness of the critical skills required to be successful once they enter the workforce.

During the course of the study the researcher directed the course as well as observed and studied the reactions of the sample subjects as they participated in the assignments and projects required by the curriculum. The researchers' leadership development was limited to the contribution of his expertise in the on-going development and institution of the course in regard to student enlightenment to the type of skills required by industry. The researcher continuously made adjustments to student projects

and requirements to ensure a constant level of student participation and understanding with a minimum of student frustration. Generally speaking the main purpose of the technology course was to develop a curriculum which would challenge students and develop their thinking skills while at the same time introducing them to real world experiences and their solutions.

Further Study

Due to the circumstances of this study, the researcher suggests the need for further study based on the following:

1. The Applied Technology course was a new offering to the high school curriculum and not much was known about the course by the students
2. The course only had four participants. This in itself was not a good number of subjects to base a study of how effective a new course could be to the student popluation.
3. The course was misinterpreted by the guidence department and students were not given the true nature of the course when they enrolled.
4. The course description has been improved in the student course book for the year of 1999-2000 to indicate a true representation and description of the course.

In conclusion, this researcher believes in the necessity of an applied technology course as a means of preparing our students for the future workforce. It is not important at this stage whether a student will enter college, junior college or trade school or

become a professional or skilled or unskilled laborer. The important factor is whether or not our students can reconize problems when they appear and formulate their solutions in a timely and cost effective manner. This researcher believes a curriculum in applied technology, for all students, to be the answer.

References

Vila, Dr. C. E. (1995) . On the Nature of Technology. Ties, The Magazine of Design and Technology Education, 1 .

Kerka, S. (1992) . Higher Order Thinking Skills in Vocational Education. [On-Line] . ED350487. ERIC Digest No. 127 . http://www.ed.gov/databases/ERIC_DIGESTS/INDEX

Kerka, S. (1994) . Life and Work in a Technological Society. [On-Line] . ED368892. ERIC Digest No. 147 . http://www.ed.gov/databases/ERIC_DIGEST/INDEX

Lankard, B. A. (1995) . SCANS and the New Vocationalism. [On-Line] . ED389879. ERIC Digest No. 165 . http://www.ed.gov/databases/ERIC_DIGEST/INDEX

McLaughlin, M. (1995) . Employability Skills Profile: What Are Employers Looking For? [On-Line] . ED399484. ERIC Digest . http://www.ed.gov/databases/ERIC_DIGEST/INDEX

Hancock, V. E. (1993) . Information Literacy for Lifelong Learning. [On-Line] . ED358870. ERIC Digest . http://www.ed.gov/databases/ERIC_DIGEST/INDEX

Burnett, G. (1994) . Technology as a Tool for Urban Classrooms. [On-Line] . ED368809. ERIC/CUE Digest No. 95 . http://www.ed.gov/databases/ERIC_DIGEST/INDEX

New Jersey State Department of Education. (1996) . Core Curriculum Content Standards, May 1996 (PTM 1400.06) . Trenton, New Jersey: Klagholz, L. , Commissioner of Education

Appendix A

Research Instruments

A STUDY TO DETERMINE THE POSITIVE BENEFITS TO STUDENTS OF THE NEW TECHNOLOGY COURSE AT BRIDGETON HIGH SCHOOL. DOES THE COURSE ENHANCE STUDENTS CRITICAL SKILLS?

COURSE PRE-TEST QUESTIONNAIRE

BY
JERRY J. MARINACCI

Please read each question carefully and write your answer in the space provided. Use rational thought and complete sentences. Please write neatly.

1. Regarding teamwork in an educational or business environment, write, in 25 words minimum, what teamwork means to you.

2. In your own words, 25 minimum, write why it is important to have good communications skills in the workplace.

3. Write, in 25 words minimum, why it is important for an employee in any business or industry to posses good problem solving skills.

4. In your opinion, 25 words minimum, write what the term "Critical Thinking" means to you in reference to an employee working on a difficult manufacturing problem in a factory environment.

5. In your opinion, 25 words minimum, why is it important for a high school student to become proficient in " CROSS-CONTENT WORKPLACE READINESS SKILLS? "

NAME: _____ **PER:** _____ **DATE:** _____

TECHNOLOGY

KNOWLEDGE PRE-TEST

1. In your own words, minimum 50, write what *TECHNOLOGY* means to you.

_____

_____

_____

_____

_____

2. TRUE or FALSE QUESTIONS

Place a "T" for true or an "F" for false on the line provided for each question. Are the following statements, persons or things examples of *TECHNOLOGY*?

a. ____ The Golden Gate Bridge.

b. ____ The micro-computer.

c. ____ Ether as an anesthetic.

d. ____ The Great Depression.

e. ____ The Universal Milling Machine.

f. ____ Barney Clark.

g. ____ Amateur Radio.

h. ____ The first pre-selective Juke Box.

i. ____ The first TV broadcast in color.

j. ____ The Vacuum Tube.

k. ____ The lead Pencil.

l. ____ The Cellular Phone.

m. ____ The ATM Machine.

n. ____ The CD-ROM.

NAME: _____ PER: _____ DATE: _____

TECHNOLOGY

MOUSETRAP DRAGSTERS TLA
PRE-TEST QUESTIONNAIRE

Instructions: Read each question carefully and answer the question to the best of your ability in the space provided. Use complete sentences and write neatly and clearly.

1. Examining examples of mousetrap dragsters constructed by past students, list two possible examples of problems which may have been overlooked by those designers.

   a. _____

   _____

   b. _____

   _____

2. The word "TRACKING", for our purposes is defined as: the ability to travel straight down the raceway without hitting or rubbing against the side rails. In your opinion do you feel this MAY or MAY NOT (circle one) be a problem for the mousetrap dragster designer? Explain your answer.

   _____

   _____

   _____

   _____

3. If you had the choice of using front or rear wheel drive for your mousetrap dragster, which of the two would you believe to be the best method to drive your dragster? WHY?

   _____

   _____

4. Will the size of the drive wheels determine if a dragster will reach the end of the track ? Circle one YES NO Explain your answer.

NAME: _____ PER: _____ DATE: _____

TECHNOLOGY

TLA TEST MOUSETRAP DRAGSTERS

INSTRUCTIONS: Answer the questions with complete sentences. Give details and examples of how you satisfied each design problem on your mousetrap dragster.

1. Discuss in detail how you were able to overcome the problems listed below. Be specific, there is not right or wrong answer. However, your answers must indicate your degree of design thought, ingenuity and mechanical expertise.

    a. Car Tracking. Discuss how you were able to overcome your car running along the sidewall of the race track.

    _____

    _____

    _____

    _____

    _____

    _____

    _____

    b. Lack of friction (spin-outs) at the starting line.

    _____

    _____

    _____

    _____

    _____

NAME: _____ **PER:** _____ **DATE:** _____

TECHNOLOGY
SOLAR CELL PRE-TEST QUESTIONNAIRE

DIRECTIONS: READ EACH QUESTION CAREFULLY AND ANSWER EACH TO THE BEST OF YOUR ABILITY.

1. List one use for solar cells which you are familiar with.

_____

_____

2. What does a solar cell do with the light energy from the sun?

_____

_____

3. What is the basic material used in making a solar cell?

_____

4. When were solar cells first used?

_____

5. Can a solar circuit be used with a battery?

_____

NAME: _____ PER: _____ DATE: _____

TECHNOLOGY

SOLAR TLA POST-TEST

Directions: Using your solar hand-out answer the following questions

1. What year where the first solar cells used? _____

2. What does a solar cell do with the light energy collected from the sun?

_____

3. Name two of the first products which used solar cells.

   a. _____ b. _____

4. According to the hand-out what are the two methods of slicing the solar ingot into individual solar cells?

   a. _____ b. _____

5. What is the basic material used to manufacture a solar cell?

_____

6. Can a solar cell be used in a circuit with a battery? _____

7. In question #6, what would be the function of the battery within the circuit?

_____

8. In question #6, What would be the function of the solar cell within the circuit?

_____

9. According to the hand-out, how many layers are there to a solar cell?

_____

10. According to the hand-out, list the material that is used to coat the positive (+) layer of the solar cell.

_____

11. Name one of the gases used to impregnate the solar material when it is being formed into an ingot.

_____

12. Refer to the back of the solar hand-out. Describe what happens to the electrical output of a solar cell when it is broken in half.

_____

_____

_____

NAME: _____ PER: _____ DATE: _____

TECHNOLOGY

ROBOTICS TLA PRE-TEST

Please answer the following questions to the best of your ability.

1. Regarding robotics what does the term ANTHROPOMORPHIC mean?

_____

_____

2. Name the four basic parts of a robot.

   a. _____

   b. _____

   c. _____

   d. _____

3. Define a ROBOT as specified by the Robot Institute of America.

_____

_____

_____

4. Define the term "Reprogrammable" in regards to robotics.

_____

_____

5. Define the term "Multifunctional" in regards to robotics.

_____

_____

NAME: _____ PER: _____ DATE: _____

TECHNOLOGY

ROBOTICS TLA POST-TEST

Instructions: Read each question carefully and write your answer on the lines provided. Use complete sentences and write neatly.

1. What is the definition of a ROBOT as defined by the Robot Institute of America?

_____

_____

_____

2. List the four basic parts of a robot and the human sense each simulates.

a. _____

b. _____

c. _____

d. _____

3. Discuss the most common method of classifying a robot.

_____

_____

_____

4. Describe the meaning of a robots working envelope.

_____

_____

_____

Technology Student Evaluation

Math & Science or (Equivalent Course)

Subject: _____

Math Teacher: _____

First marking period interim grade _____

First marking period final grade _____

Second marking period interim grade _____

Second marking period final grade _____

Science Teacher: _____

First marking period interim grade _____

First marking period final grade _____

Second marking period interim grade _____

Second marking period final grade _____

Questions:

1. Have you observed subject participating in class more often? yes no
2. Has subject shown improvement in their problem solving techniques? yes no
3. During group work, has subject taken a more active role within the group? yes no
4. Has subjects' communicating skills with classmates improved? yes no
5. Have you observed the subject becoming more inquisitive during class? yes no

TECHNOLOGY

STUDENT DAILY OBSERVATION SHEET

NAME: _____ **PER:** ____ **DATE:** _____

TLA: _____ **DAY:** _____

Biographical Data

Name	Jerry J. Marinacci
High School	Vineland Senior High School Vineland, NJ
Undergraduate	Bachelor of Science Glassboro State College Glassboro, NJ
Graduate	Master of Arts School Administration Rowan University Glassboro, NJ
Present Occupation	Industrial Technology Teacher Bridgeton High School Bridgeton, NJ