THE RELATIONSHIP OF EDUCATIONAL TECHNOLOGY

AND APPLIED ACADEMICS TO THE DEVELOPMENT

OF CRITICAL THINKING SKILLS AMONG

VOCATIONAL AND COMPREHENSIVE

SCHOOL STUDENTS IN

OKLAHOMA

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CHAPTER I

INTRODUCTION

Vocational education grew out of a need for an educated workforce (Calhoun and Finch, 1982). An educated workforce was needed to meet the changing skill requirements in industry. As skill requirements continue to increase, those concerned with developing workplace competencies must develop programs and implement methods to meet the needs of business and industry, as well as society.

Industry has moved from a mass production, high-value process to an orientation based on customization and high-value (Reich, 1991). Berryman (1988) contributed the change in production orientation to the application of new technology. The influence of technological advancements allows companies to more easily adapt to new ideas and concepts for meeting customers' needs.

Calhoun and Finch (1982) contended that occupations created by technological change hold certain identifiable characteristics. They identified the characteristics as:

1. Fewer manual skills and more cognitive understanding.

2. More skills of higher order and for the use of more technical knowledge.

3. A more complete functional general education than the jobs they replaced.

4. More maturity by workers to fill the jobs successfully (p. 10).

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The call for increased thinking processes is one identified competency that is receiving much attention. Companies are moving more decisions and responsibilities to the factory floors (O'Neil, 1992). Entry-level workers are being expected to think on their feet, solve problems, and apply knowledge and skills in new contexts.

Carnavale, Gainer, and Meltzer (1988) composed Workplace Basics: Skills Employers Want for the American Society for Training and Development to outline the basic workplace skills required by employers. The two-year joint study with the United States Department of Labor revealed a great need for increased application of basic academic skills and the ability to utilize various thinking processes. The importance of employees being able to display critical thinking skills is emphasized by:

> An organization's ability to achieve its strategic objectives often depends on how quickly and effectively it can transcend barriers to improved productivity and competitiveness. These pressures put creative thinking and problem solving at a premium - at all levels of an organization (Carnavale, Gainer, and Meltzer, 1988, p. 12).

The Secretary's Commission on Achieving Necessary Skills (1991) issued a report that likewise indicated a need for employees to display thinking skills. The report suggested that critical thinking skills are needed to meet the changing faces of the world of work. It is contended that workers must be creative and responsible problem solvers to establish productivity and boost company growth. Application of thinking skills, accompanied with desired attitudinal characteristics and basic academic skills,

results in "high performance" which The Secretary's Commission on
Achieving Necessary Skills (1991) described as: "Work settings
relentlessly committed to excellence, product quality, and customer
satisfaction" (p. vi).

This business and industry initiative to create a competitive,
customized production orientation through worker-based operations
places increased responsibility on education. The United States
Congress recognized the need for vocational-technical education to
be increasingly responsive to the skill requirements of business and
industry. The American Vocational Association Guide to the Carl D.
Perkins Vocational and Applied Technology Act of 1990 cited Section
2: Statement of Purpose, of the Carl D. Perkins Vocational and
Applied Technology Act of 1990, as emphasis for a national
initiative to fully develop the skills required by employers to
enable American companies to compete in a globalizing market.
Section 2: Statement of Purpose characterized vocational education's
responsibility by stating:

> It is the purpose of this Act to make the United States
> more competitive in the world economy by developing more
> fully the academic and occupational skills of all
> segments of the population. The purpose will principally
> be achieved through concentrating resources on improving
> educational programs leading to academic, occupational,
> training, and retraining skill competencies needed to
> work in a technologically advanced society (p. 19).

The expanding needs and growing expectations of employers make
it clear that vocational-technical education must give concentrated
attention to critical thinking (Mauter, 1988). Mauter (1988)
suggested that vocational administrators and teachers could
transform vocational education into an exemplary teaching and

learning laboratory for the development of higher-order thinking skills.

As school leaders work to ensure that students can think critically and creatively, American communities today and tomorrow will benefit from thinkers who can more effectively solve problems wrought by change (Collins, 1991). Therefore, it is imperative for those concerned with preparation for the workplace to determine if current instructional delivery systems produce critical thinking skills to promote individual and company success.

Statement of the Problem

Considerable effort at the state and national levels is being expended to improve the quality of the American workforce. Quality, measured by such factors as productivity and customer satisfaction, is becoming increasingly reliant on workers' abilities to display more cognitive understanding and higher-order thinking skills and involvement in worker-based operations. Furthermore, individual employee success is dependent on the individual's ability to exhibit these skills. Several strategies have been developed to accomplish this goal, including the development of applied academic courses and the use of educational technology in the classroom. The problem, however, is that there is a lack of empirical evidence to determine if current educational technology in vocational-technical programs and applied academics curriculum instructional delivery systems increases students' critical thinking skills.

Purpose of the Study

The purpose of the study was to determine if the use of educational technology in vocational-technical programs and applied academics curriculum instructional delivery systems increased students' critical thinking skills. The relationship between individual student personality type and instructional delivery systems as they relate to the development of students' critical thinking skills was also examined.

Research Questions

The following research questions guided the study to provide an analysis of the relationship of educational technology and applied academics to the development of critical thinking skills among vocational and comprehensive school students in Oklahoma.

1. Does the use of educational technology in vocational-technical programs increase students' critical thinking skills?

2. Does the use of applied academics curriculum in comprehensive high schools increase students' critical thinking skills?

3. Do individual personality types differ as they relate to instructional delivery systems?

4. Do individual personality types as they relate to instructional delivery systems influence the development of students' critical thinking skills?

The null hypothesis tested was, H_o: there are no differences in instructional delivery systems as they relate to the development of critical thinking skills.

Limitations

The study had the following limitations:

1. The sample of five vocational-technical program areas may limit information regarding all vocational-technical programs utilizing educational technology. Findings are limited to program areas that utilize educational technology similar to that used with the sample.

2. The administered test, <u>Cornell Critical Thinking Test: Level X</u>, may provide some limitation in attempting to measure all critical thinking skills. The <u>Cornell Critical Thinking Test: Level X</u> is characterized as a general test of critical thinking (Ennis, 1985).

Assumptions

1. Students in like applied academics courses receive similar instruction.

2. Like vocational-technical programs utilize similar educational technology delivery systems.

Definition of Terms

The following definitions were used in the study:

Critical Thinking Skills: A complex process involving reasonable and reflective thinking that is focused upon deciding what to believe or do (Norris and Ennis,1985). Included for the purpose of this study are induction, deduction, observation/credibility, and identification of assumptions as measured by the Cornell Critical Thinking Test (Ennis, 1985).

Educational Technology: An integrated process involving people, procedures, ideas, devices, and organization for analyzing problems and devising, implementing, and evaluating, and managing solutions to these problems (The Definition of Educational Technology, 1977). For the purpose of this study, educational technology will include the educational technology instructional delivery systems utilized in the vocational-technical program areas that contained the sample (i.e. computer-assisted instruction, interactive video, simulation).

Applied Academics: Academic foundation courses that include practical application of learned concepts (Hull and Parnell, 1991). For the purpose of this study, applied academics will include Applied Math I and Applied Math II curriculum developed by the Center for Occupational Research and Development, Waco, Texas.

Personality Type: The variations in human individuality that explain the manner in which individuals typically process experience as related to Carl Jung's identification of psychological typology (Mamchur, 1984). For the purpose of this study, personality type will be individual type as identified by the Myers-Briggs Type Indicator.

Traditional Instruction: Instruction in which the teacher provides information that the students are expected to learn (Summers, 1990).

Vocational-Technical Center: For the purposes of this study, an area vocational-technical center is a public school formed to deliver vocational and technical training programs and services to the people residing in comprehensive school districts who have voted to join together, and the combined geographic boundaries of the comprehensive school districts comprise the vocational-technical district. Furthermore, the area of the vocational-technical district is taxed and served for that purpose. Area Vocational-Technical Center, Vo-Tech School, AVTS, Vocational Center, and Vocational-Technical School are all used interchangeably.

Comprehensive High School: For the purposes of this study, a comprehensive high school is a public school created to provide academic preparation, vocational classes, extra-curricular activities, and other services to secondary age patrons residing in the school district. Such schools represent final formal education or preparation for further study at a postsecondary institution. Comprehensive High School, High School, and Secondary School are all used interchangeably.

CHAPTER II

REVIEW OF THE LITERATURE

The review of related literature was conducted to identify what had been written regarding critical thinking skills, the development of critical thinking, and particular attention to the use of educational technology and applied academics curriculum as instructional delivery systems for the development of critical thinking skills. In addition, a literature review was conducted to examine what had been written regarding personality type as it relates to student placement in differing instructional delivery systems. The review revealed much had been written on critical thinking skills and its development including the use of educational technology as an effective method in developing students' critical thinking skills. The researcher was unable to find literature relating the use of applied academics curriculum to the development of critical thinking skills. Concerning the issue of personality type, much had been written regarding the identification of type in educational settings. Little information was available that specifically addressed the instructional delivery systems of applied academics and educational technology.

However, a study had not been done that provided an analysis of the use of educational technology in vocational-technical programs and applied academics curriculum in comprehensive high schools and the development of critical thinking skills.

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The following topics guided the review of related literature.

1. Critical thinking and its development.

2. Educational technology as an effective instructional delivery system for the development of students' critical thinking skills.

3. Applied academics curriculum as an effective instructional delivery system for the development of students' critical thinking skills.

4. Personality Type.

Critical Thinking and Its Development

Norris and Ennis (1987) indicated critical thinking is a complex process involving reasonable and reflective thinking that is focused on what to believe or do. Reasonable thinking infers good thinking relies on good reason, as Norris and Ennis (1987) concluded, "good reason results in the best conclusions" (p. 8). Norris and Ennis (1987) addressed the component of reflective thinking by suggesting it involves the examination of the reasonableness of one's own and others' thoughts. "Focused," which Norris and Ennis (1987) identified as the vital component in critical thinking, relates to the consciousness of the thinker who engages in the process. McPeck (1981) emphasized the concept of focused in his statement: "Critical thinking always manifests itself in connection with some identifiable activity or subject area and never in isolation" (p. 5). Paul (1992) added that critical thinking is disciplined, self-directed thinking. The idea that the

thinker engages in practical thought is exemplified by Halpern's

(1985) connection of critical thinking to everyday life. "Whenever

we solve a problem, make an inference, or arrive at a decision we

are engaging in critical thinking" (Halpern, 1984, p. 3).

Critical thinking holds three major purposes.

1. To achieve understanding.
2. To evaluate viewpoints.
3. To solve problems (Maiorana, 1992, p. 22).

Maiorana (1992) further described critical thinking as a "process"

that is utilized when "we seek to understand, evaluate, or resolve"

(p. 22).

The work of Pauker (1987) suggested individuals engage in

critical thinking to achieve one of two objectives.

1. Problem solving to reach a specific goal, even
   though the basic information is not available or
   immediate resources for the solution are not in
   existence.

2. Decision making that requires an act based on the
   advantages or disadvantages of the alternatives
   (p. 31)

Beyer (1987) provided opposition to the connection between

critical thinking skills and problem solving. His position on the

relationship between critical thinking and problem solving is

characterized with:

Critical thinking begins with a previous claim,
conclusion or product and considers the question, Of
what truth or worth is it? Problem solving on the
other hand, begins with a perceived problem and asks,
How might this be resolved (p. 33)?

Critical thinking incorporates various types of thinking and

thought processes. Pauker (1987) cited a list of cognitive skills

developed by the Northwest Regional Educational Laboratory in

Portland, Oregon as evidence that critical thinking requires the use

of various levels of thinking, including higher-order thinking

skills. The list included:

1. Recall - retrieval of stored information needed
    to associate with other concepts.

2. Analysis - operations are divided into components
    for the purpose of examining cause/effect
    relationships.

3. Comparison - similarities and differences are
    recognized.

4. Inference - deductive and inductive reasoning are
    used to make generalizations or take generalizations
    and explain relevant evidence.

5. Evaluation - quality is judged, credibility, worth or
    practicality is concluded. Often related to a set of
    criteria (p. 31).

Ennis (1985) classified the process of critical thinking into

five categories. His categories included:

1. Elementary clarification to provide basic clarity
    on the issues at hand.

2. Basic support that allows consideration of all
    issues.

3. Inference for evaluating the available information.

4. Advanced clarification to be based on attained and
    inferred information.

5. Creation of strategies and tactics to address the
    issues (pp. 54-55).

In addition to the utilization of various levels of cognitive

processes, there are indications critical thinking demands certain

conditions and abilities to be in place. Ennis (1985) indicated

dispositions and abilities, on the part of the thinker, must be

apparent for the process of critical thinking to occur. He

identified thirteen dispositions that must be in place.

1. Seek clear statements of the thesis or question.
2. Seek reasons.
3. Try to be well informed.
4. Use and mention credible sources.
5. Take into account the total situation.
6. Try to remain relevant to the point.
7. Keep in mind the original or basic concern.
8. Look for alternatives.
9. Be open-minded.
10. Take a position (and change) when evidence and reason is sufficient.
11. Seek precision in correlation as the subject permits.
12. Use critical thinking abilities.
13. Be sensitive to feelings, knowledge level, and degree of sophistication of others (p. 54).

Paul (1992) offered a similar viewpoint regarding the need for

certain conditions to exist in order for the critical thinking

process to be facilitated. His list of elements and domains

included:

1. Identification of problems or questions.
2. Knowledge of the purpose or goal of thinking.
3. Having a frame of reference for the point of view.
4. Making assumptions.
5. Hold central concepts of ideas.
6. Identification of the principles and authorities used.
7. Utilization of evidence, data, and lines of formal thought.
8. Interpretations or claims are made.
9. Drawing of inferences and reasons through lines of formal thought.
10. Consideration of implications or consequences of thought (p. 11).

The work of Ennis indicated various thinking abilities are

required to transfer through the process of critical thinking.

Abilities required to operationalize the critical thinking process

include analysis, judging, induction, deduction, value judgement, and identification.

Standard disciplines offer the most direct, if not the only efficient route, to teaching critical thinking (McPeck, 1990). The contention is exemplified by McPeck's (1990) statement: "School is knowledge, after all, about the real world" (p. 40). He provided further support for the transfer of skills with: "Many cognitive tasks, both in life and in school, have well-trodden paths to, or procedures for, their solution" (p. 41).

Heiman and Slomianko (1985) provided methods to stimulate students' critical thinking skills that appear to be viable for vocational education and applied academics. Active involvement in practical application opportunities, by the student, is key in the development of critical thinking skills and should be based on the "process" rather than the memorization of facts. Such development is achieved by identifying student learning styles and coordinating material presentation.

D'Angelo (1971), Burton and Radford (1978), and Hayes (1981) provided implications for vocational education regarding the development of critical thinking skills in light of Calhoun and Finch's (1982) contention that the philosophy of vocational education is affected by economic and sociological factors. D'Angelo (1971) suggested that the preservation of society is dependent on the need to develop individual's critical thinking skills as evidenced in his statement:

Promoting critical thinking is essential in a democracy. In a society where the destiny of the nation is supposedly determined by the will of the people, it is imperative that its citizens analyze critically. It is an important way of improving the individual and creating a better society (p. 3).

Critical thinking allows the identification of flaws in arguments or theories and it becomes the basis for what Hayes (1981) noted to be, "a powerful source of inspiration for creating new theory" (p. 201). Burton and Radford (1978) contended through the creation and testing of hypotheses of underlying operations, advancement is attained.

Higher-order thinking skills should be as common in vocational classes as skills demonstrations and tests (Miller, 1990). Vocational education offers the path to critical thinking skills development, because "higher-order thinking occurs when students are able to use what they learn to deal with real-world problems and situations" (Miller, 1990, p. 26). The problem of a lack of critical thinking skills in the workplace will be solved by classroom teachers employing methodologies that transform their students' cognitive processes (Maiorana, 1992).

Educational Technology as an Effective

Instructional Delivery System for

the Development of Students'

Critical Thinking Skills

While the improvement of critical thinking skills has been recognized as a national goal (Banks, 1987), the debate revolves around the issue of how best to develop these skills. Pfieffer,

Feinberg, and Gelber (1987) suggested teachers cannot give the "gift" of thinking, acquiring procedural knowledge (process) involves active participation. The concept of relevant practice, accompanied with motivation, is the primary method of assisting students in the development of techniques to solve problems. "There is no substitute for students' own efforts and practice, and for adequate time, especially when acquiring procedural knowledge" (Pfieffer, Feinberg, and Gelber, 1987, p. 102).

Educational technology is a medium that promotes the processing ability of students. Processing, which Norris and Ennis (1987) and Bell (1992) indentified as the method to operationalize critical thinking, can be facilitated through the use of educational technology. Wagner (1992) characterized the value of educational technology in developing student's processing abilities with:

> Educational technology is not simply computers and videodiscs but rather a broader vision of the context and process of learning. When properly used, educational technology can enhance the presentation of context and stimulate the information processing abilities of students (p. 4).

The utilization of technology as an instructional delivery system allows students to experience concepts in terms of practical application. Eisele and Eisele (1990) promoted the use of technology in learning as opposed to pure academics by suggesting pure science seeks knowledge for its own sake, while technology seeks practical application. The AECT Task Force on Definitions and Terminology (1977) described the usefulness of technology in education by insisting instruction utilizing technology allows

manipulation of processes to develop student competencies and skills.

Educational technology for critical thinking skills development is valuable in trade area training removed from the workplace (Feurzig, 1989). The work of Feurzig (1989) suggested the use of simulation through computer assisted instruction allows students to model problem solving behavior toward the pursuit of thoughtful planning and reflective analysis. Feurzig (1989) applied the concept to workplace training situations with:

> What is valuable about apprentice training is not that it is carried out in the workplace, but that it actually initiates the student in the actual process used by the experts to perform the real tasks. These experiences can be realized in the schools by exploiting computer technology to develop apprentice training tools and activities designed to motivate and prepare students for doing intellectual work in the discipline (p. 108).

Computer-aided instruction offers various advantages in the development of critical thinking. Through the work of Matsumoto (1985), it is suggested computer-aided instruction deals with process rather than strictly content. The computer offers a shift from amassing a body of knowledge to a more sophisticated level of problem solving and decision making (Matsumoto, 1985). The nature of computers stimulates thinking and self-reflection based on Widerhold's (1985) contention that the computer becomes both the data source and teacher. He indicated such a process requires the user to determine content and form needed for inquiry. "It is in this way that the computer has captured the imagination of problem solvers and offers the greatest potential for addressing high-order thinking skills" (Widerhold, 1985, p. 225).

Computer aided instruction has a serendipitous affect by creating orderly and logical thinking (Heinrich, Molenda, and Russell, 1977). Heinrich, Molenda, and Russell (1977) reported a tendency for computer programming students to show orderly and logical thinking in other areas of their schoolwork as result of computer aided instruction. The transfer of skills to other areas were attributed to computer aided instruction and its practical application in order that students could "better understand the materials being studied" (Heinrich, Molenda, and Russell, 1977, p. 368).

The work of Riding and Buckle (1987) indicated computer developments provide several significant ways in which critical thinking can be improved that appear valuable in vocational education. Critical thinking skills and problem-solving development occurs through simulation of situations such as business management, controlling of aircraft, the running of a goods yard, and the layout of a newspaper.

Norris, Jackson, and Poirot (1992) conducted a study to measure the effect of computer aided instruction on the development of critical thinking skills and the concept of skills transfer. The study showed student increases occurred in critical thinking skills and transfer of knowledge. Norris, Jackson, and Poirot (1992) summized that "the results imply that problem solving and critical thinking abilities are transferable to other situations" (p. 340). The study's findings hold promise in relation to a concern held by Pea (1988). Pea emphasized the importance of knowledge transfer

from formal education is needed to ensure the acquired skills, concepts, and strategies gained are valid in work situations. The findings of Norris, Jackson, and Poirot (1992) regarding knowledge transfer of critical thinking skills through educational technology to other areas is important to the field of vocational education, as they stressed, "a person's ability to critically think is not only recognized as an important educational objective, but is also known to be a key success factor in many kinds of occupations" (p. 334).

Simulation offers a route to critical thinking skills development. Lookatch (1989) reported significant critical thinking skills gains for students receiving laser-disc training for employment skills. This may, at least in part, be contributed to Percival and Ellingtons' (1988) contention that "simulations create exercises that involve ongoing representations of some aspects of real situations" (p. 109).

Consensus does not exist, however, regarding the use of educational technology as an effective delivery system to promote the development of critical thinking skills. The work of Summers (1990) opposed the proposition that student achievement is enhanced through interactivity. He found that the use of interactive videodisc resulted in no significant gains in the treatment group as compared to the control group who received traditional instruction. Although no significant gains were reported, Summers (1990) did "indicate that the students expressed a significant preference for the medium" (p. 53).

Striler (1989) found computer aided instruction did not increase students' critical thinking skills. In addition, it was found that no difference existed in the relationship of ethnicity, intelligence quotient, grade point average, and grade level as they relate to the development of critical thinking skills. The study's findings were based on 200 minutes per week of instructional time over a four month period.

Support exists, although not unanimous, for the use of educational technology as an instructional delivery system for cognitive development. Saettler (1990) contended that "an educational technology based instructional delivery system focuses on the learner as an active participant in the teaching-learning process" (p. 332). "The outcome of learning will depend on how information is presented and on how the learner processes that information" (Saettler, 1990, p. 332). Such a medium is valuable in "enhancing and perpetuating a democratic society, dealing with everincreasing complexity of societal issues and problems, processing a tremendous proliferation of information, and functioning in a highly technological age" (Stewart, 1990, p. 72).

Applied Academics Curriculum as an Effective

Instructional Delivery System for

the Development of Students'

Critical Thinking Skills

Applied academics curriculum presents subject matter in a way that integrates a particular academic discipline with personal

workforce applications (Pedrotti and Parks, 1991). Pedrotti and Parks (1991) indicated applied academics curriculum allows "head skills" and "hand skills" to be developed together. A solid base of applied science, math, and literacy courses teaches students to think analytically, to examine critically, and use skills in life (Shapiro, 1986). Applied academic instructional methods result in "understanding greatly enhanced and the application of knowledge and skills will be transferable" (Pedrotti and Parks, 1991, p. 71).

The concept of applied academics grew out of a concern for academic performance and workplace skill demands. A Nation at Risk reported in 1983 that many seventeen year olds did not possess high order intellectual skills. Forty percent could not draw inferences from written material. Only one-fifth were able to write a persuasive essay. And only one-third of the same seventeen year olds were able to solve problems that required several steps. The A Nation at Risk (1983) report suggested high school curriculums should provide students with opportunities to advance personal, educational, and occupational goals.

Bishop (1988) reiterated the findings in the late 1980's in his citing of the National Assessment of Educational Progress. The 1988 report indicated that ninety-three percent of the seventeen year olds did not have the capacity to apply mathematical operations in a variety of problem settings. Bishop attributed the results to a lack of connectedness between work and schools.

The National Center for Educational Statistics (1993) reported that nearly one-half of adult Americans read and write so poorly

that they are unable to function effectively in the workplace.

Based on 13,000 randomly selected adults, age sixteen and older, it

was predicted that 90 million adults were functioning at the lowest

two proficiency levels. It was further predicted that only 34 to 40

million adults were functioning at the two highest proficiency

levels. Connected findings indicated those adults functioning at

the higher skill levels were more likely to be employed and earn

higher wages (National Center for Educational Statistics, 1993).

The National Education Goals Panel (1993) reported similar

findings regarding the status of academic achievement. The panel's

findings are summarized by the following:

1. Nearly half of all adult Americans read and write
   at the lowest two levels of prose.

2. Fewer than one in five fourth and twelfth-graders,
   and one in four eighth-graders, understand complex
   mathematics theory and problems.

3. Today's high school dropout will earn less than half
   the amount of someone who dropped out of school in
   1973.

4. Today, a mechanic needs to know statistical quality
   control, understand computers and read manuals for
   someone with at least a twelfth-grade education
   (pp. 1-2).

Current trends in the academic levels of secondary students do

not meet the emerging needs of the workplace. By the year 2000, it

is projected the majority of available new jobs will require

education past the secondary level. Byrne, Constant, and Moore

(1992) reported that "approximately twenty million sixteen to

twenty-four year olds are unlikely to go on to college directly

after high school" (p. 23). The present system of educating youth,

as Byrne, Constant, and Moore suggested, "is not adequately related to what they need to know to succeed after leaving school" (p. 23).

Workplace trends are also demanding a shift in academic preparation. Berryman (1988) reported that between 1975 and 1985 that the number of lower skilled jobs decreased due to technological advancement. The ratio of operators to technicians decreased from 4.2 to 1.0 in 1975 to 3.5 to 1.0 in 1985 (Berryman, 1988, p. 4). Berryman suggested those unable to move from the unskilled level to the skilled labor level are unlikely to survive.

Service connected areas comprise the largest number of available job openings (Wirth, 1992, Reich, 1991, and Leftwich, 1992). Wirth (1992) identified areas such as clerks, secretaries, and computer operators as the fields holding the most promise. Even these jobs will have increased expectations for being able to read and understand directions, do arithematic, and being able to speak and think clearly (Wirth, 1992). Leftwich (1992) cited the Bureau of Labor Statistics forecast that 26 million new jobs will be available over the next fifteen years, with half appearing in the service sector of the economy. "Jobs in service industry will grow nearly twice as fast as the overall employment rate" (Leftwich, 1992, p. 18).

Reich (1991) suggested the movement toward a service-based economy requires a change in what is being taught. Skills such as problem-solving and problem-identifying are needed to add-value to a globalizing economy (Reich, 1991).

A redirection of teacher methodology is needed to develop the necessary workplace connected skills (Packer, 1992). Packer (1992) suggested "schools must become high performance organizations committed to providing quality education to all students - not just the elite few" (p. 30). Schools are not singularly responsible for preparing students to "make a living," but they must ensure young people are ready for the world of work (p. 28).

Applied academics is an instructional delivery system that addresses the needs of workers and the workplace. Parnell (1991) indicated that a strong academic foundation based on "real-life" applications provides students with lifelong competencies they need - while providing employers with the kind of workers they need to remain competitive (p. 4). Pedrotti and Parks (1991) summized the value of applied academics relating to the diverse skills needed in American industry. Applied academics instructional delivery systems allow students to "master the associated practical, relevant head skills," with the needed technical skills (Pedrotti and Parks, 1991, p. 68).

Hull (1991) indicated applied academics curriculum holds advantages for students as they prepare for the changing conditions in the workplace. The advantages include:

1. A solid base of math and science principles.

2. A pre-technology foundation is formed for transfer to postsecondary technical education programs.

3. A flexible knowledge base is developed that ensures flexibility for a changing workforce.

4. Math and science courses are more accessible and less threatening (p. 37).

Efforts to raise academic levels and workplace competencies through integrated academic and vocational education is evident throughout the United States. Bottoms (1993) reported programs, such as the High Schools That Work program established by the Southern Regional Education Board, were initiated to increase the academic levels of "career-bound" high school students. The High Schools That Work program holds two primary goals:

1. To increase the mathematics, science, and communications achievement of students in general and vocational studies by the year 2000.

2. To combine basic content of traditional college prep math, science, and communications courses with vocational studies by creating conditions that support school principals and faculties in carrying out key practices (Bottoms, 1993, p. iii).

Bottoms (1993) further identified the key practices of applied academics relating to the development of critical thinking skills. They include:

1. Enabling students to see a relationship between course content and the future.

2. A challenging program of study to emphasize math, science, and communications to develop student competencies for cognitive, intellectual, and problem solving skills (p. iii).

In conjunction with the Southern Regional Education Board and Oklahoma Department of Vocational-Technical Education, several Oklahoma high schools have joined the High Schools That Work project. Choctaw High School in Choctaw, Oklahoma and Meeker High School in Meeker, Oklahoma exemplify efforts to infuse applied academics courses for increased preparation of non-college bound and associate degree seeking students. The efforts are designed to

provide an equally stringent alternative route to that of college preparatory courses for the academic skills development of students.

Wirth (1992) cited similar efforts in states such as Ohio and New York as having valid responses to workplace needs. He reported the integration of vocational and academic instruction as a "balance between the intellectual and practical" (p. 182). Through this approach, individuals will be able to achieve abstraction that allows simplification of complex reality so that it can be understood and integrated to reveal new solutions, problems, and choices (Wirth, 1992, pp. 201-202).

Applied academics curriculum has been successful in facilitating academic achievement. Bottoms (1993) reported that of the original twenty-eight pilot sites in the Southern Regional Education Board's integrated academic and vocational education pilot project, eight showed significant academic gains and eleven made academic gains. The influence of integrated vocational and academic education enables students to see how course content is related to future roles that students envision for themselves (Bottoms, 1993).

A study conducted by the Center for Occupational Research and Development (1993) found applied academics surpassed traditional instructional delivery systems for the development of students' academic skills. The comparison of exiting Applied Math 2 and Algebra I students revealed:

1. The Applied Math 2 students averaged 48.5% correct answers, while Algebra I students averaged 43.5% correct answers.

2. Approximately 33% of the Applied Math 2 students
   correctly answered more than 60% of the test items
   as compared to approximately 15% for the Algebra I
   students.

3. The Applied Math 2 students scored higher than the
   Algebra I students on 24 of the 36 items.

4. The Applied Math 2 students scored higher than the
   Algebra I students in twelve of the sixteen
   competencies identified on the test (p. 15).

Wirth (1992) credited the Carl D. Perkins Vocational and

Applied Technology Act Amendments (1990) with having a continued

influence in the movement toward integrated vocational and academic

skills. "The health of a competitive postindustrial society depends

not only on the skills of the intellectual and technical elites but

on the skills and involvement of the work force as a whole" (Wirth,

1992, p. 166). Wirth (1992) reported the major changes resulting

from the Carl D. Perkins Vocational and Applied Technology

Amendments (1990) concerning workplace education as:

1. Funds will be appropriated to school districts
   with the highest proportion of disadvantaged
   children. This approach places funding where
   remedial services can be targeted to students
   with diverse needs and where improvement is greatly
   needed.

2. Initiatives are to be created at the local level
   versus the state level. Needs assessments generated
   at the local level allow for a framework of plans
   created by those who best know the needs and
   characteristics of the economically distressed
   communities.

3. A change in focus concerning postsecondary
   occupational training. Support for the tech/prep
   concept allows for the integration of applied
   academics with technical training at the high
   school level as a lead for postsecondary training.

4. Integration of applied academics and vocational
    studies. This provides educational opportunities
    to both better academically and technically prepare
    students, congruent with the very skills business
    and industry demands (pp. 167-168).

Cognitive research is discovering that intelligence and competence develops best out of interaction between obtaining and applying knowledge (Parnell, 1991). Parnell (1991) contended that applied academics curricula best meets this approach by combining "theoretical and applied knowledge" (p. 11). Efforts to integrate academic and vocational education gives a balance between the general and specific capacities, manipulative and behavioral as well as cognitive skills that successful individuals must possess (Douglas, 1992).

Personality Type

Identifiable personality differences exist, based on variation in human behavior (Myers, 1980). Myers (1980) and Mamchur (1984) contended the individual is a product of his or her environment and the differences are manifested in the way people prefer to use their minds and the way they make judgements. It is through the individual's perceptions that the person determines what is seen in a situation and judgement of the situation determines what the individual does about the situation (Myers, 1980).

Mamchur (1984) credited Carl Jung as being the first to analyze people in a way which systematically enables people to better understand themselves and others. Jung's method became known as the study of psychological type and gave order to the apparent

variations in human individuality (Mamchur, 1984). He examined the various orientations the conscious mind might take toward the world and found the two that predominated, extraversion (E) (an outward moving, action oriented attitude) and intraversion (I) (an inward looking, reflective oriented attitude) (Mamchur, 1984).

Jung also identified four mental functions that are the center of all conscious mental activity (Lawrence, 1982). All four functions are apparent in each individual, with one being predominate and the others serve as auxillary functions to maintain balance when viewing and dealing with situations (Mamchur, 1984). Jung's four mental functions included:

1. Sensing (S) — seeks the fullest possible experience of what is immediate and real.

2. Intuition (N) — seeks the furthest reaches of the possible and imaginative.

3. Thinking (T) — seeks rational order and plan according to impersonal logic.

4. Feeling (F) — seeks rational order according to harmony among subjective values (Myers and McCaulley, 1985).

Lawrence (1982) reported that Briggs and Myers elaborated on the work of Jung and created a dimension that is characterized by the individual's attitude taken in the world. This dimension is characterized by:

1. Perceptive attitude (P) — individual is attuned to incoming information.

2. Judging attitude (J) — individual is concerned with making decisions, seeking closure, planning, operations, or organizing activities (Myers and McCaulley, 1985, p. 10).

When a perceptive attitude is taken toward the outside world, keeping plans and organization to a minimum dominates and allows for response to new perceptions and flexibility to new circumstances (Lawrence, 1982). A judging attitude toward the outside world results in the handling of circumstances in ways which are decided, judged, planned, organized, and managed according to plan (Lawrence, 1982).

The Myers-Briggs Type Indicator (MBTI) was developed by Isabel Myers and Katheryn Briggs, based on Jung's work concerning psychological type, to identify personality type. Myers wrote extensive descriptions of the sixteen possible types created through combining the letters based on completion of the MBTI (Lawrence, 1982) (See Appendix D). Personality balance is maintained through the presence and use of auxiliary type to allow for individual balance in the various processes (Myers, 1980).

A relationship exists between type and learning style which is characterized by the nature of the dominant mental process in each personality (Lawrence, 1982). Children of different types have a different mix of abilities, needs, interests, motivation, and different degrees of success in school (Myers, 1980). Type makes a predictable difference in learning styles and student responses to teaching methods (Myers, 1980). Because varying types are represented in each classroom, varied methods of subject presentation and assignments will develop enthusiasm for education and more learning will take place (Myers, 1980). The identification

of type allows teachers to utilize methodology that coincides with the learning needs of students (Myers and McCaulley, 1985).

Identifying student learning styles allows material to be presented in a manner that enhances the acquisition of skills (Heiman and Slomianko, 1985). Although it is impossible to be all things to all people, it is possible to:

> vary activities to allow individual expression, make both structured and open-ended assignments, ask students to work individually and in pairs, ask students to find specific supporting arguments, and as students to imagine future worlds from discoveries made (Heiman and Slomianko, 1985, p. 18).

McCaulley and Natter (1980) supported the idea of varying activities to meet the learning needs of students. "As schools improve their capicity to help each type develop in its best way, we shall find less visible disruption, less silent disruption, and less underachievement" (McCaulley and Natter, 1980, p. 208). They suggested results of such shall be the training of citizens who can effectively direct their lives and value the contributions of all types of people to the complex decisions of a democratic society.

Myers (1980) offered a connection that appears beneficial for student placement in vocational-technical, applied academics, and traditional instructional delivery systems. Individuals categorized as "sensing types" like practical application, the "what" and "hows" (Myers, 1980). Intuitives prefer the principle, the "theory," the "why" (Myers, 1980). Such may merit consideration in the placement of students in academic courses or applied academic courses at comprehensive schools, as well as placement in vocational-technical programs at vocational-technical schools.

Soliday (1992) found that a significant difference existed in the personality type/learning styles of vocational-technical education students and non-participants in vocational education. Due to the difference, it is necessary to incorporate different teaching techniques, curricular objectives, and learning environments to accomodate the personality type/learning styles of the two groups (Soliday, 1992).

The work of Rollins (1988) supports the construct of enhancing learning and critical thinking skills development through matching learning styles with instructional methods. He found the use of the problem solving approach to instruction, as matched to certain individual learning styles, resulted in student gains in learning and critical thinking. As a result, Rollins (1988) recommended the use of instructional methods that correlate with individual learning styles to enhance student learning and critical thinking skills development.

Myers (1980) reported research has shown types differ in interests, values, and needs. Different types learn differently, cherish different ambitions, and respond to different rewards (Myers, 1980). Because type development starts at an early age, successful development of type can be greatly helped or hindered by the individual's environment (Myers, 1980).

Summary

The review of related literature revealed several areas pertinent to the development of critical thinking skills and its

development through the use of educational technology and applied
academics curriculum instructional delivery systems. Critical
thinking is a process requiring the application of various thinking
skills in order to solve, analyze, or decide about real situations.
The review of literature suggested that knowledge transfer from
school to everyday life and connectedness to the workplace is needed
to facilitate the development of critical thinking skills.

Current workplace trends indicate that there is a need to
develop academic and thinking skills. Workers are expected to make
decisions, analyze situations, and solve problems. The very
existence of the individual's ability to compete in the job market
and the ability of American industry to compete in a global market
relies on a combination of academic, higher-order thinking skills,
and technical skills.

Research suggested a redirection in educational methodology is
needed for the development of the academic and cognitive skills as
related to current and projected workplace requirements. The number
of secondary students experiencing low achievement in academic areas
is below national expectations. Technological change requires
students to know more today than ten or fifteen years ago. In
addition, the current level of adult literacy is preventing
workplace productivity. Therefore, it should be concluded that
traditional instructional delivery systems, at least in part, have
failed to develop student skills commensurate with the changing
needs of the workplace.

Research indicated the use of educational technology is valuable in developing cognitive skills, such as critical thinking. Educational technology based instructional delivery systems infuse the application of thought processes to real situations. Such practical application provides transfer from the school setting to the workplace. As result, the worker is productive and satisfied and the organization experiences increased productivity.

Applied academics curriculum is an instructional delivery system that fosters student academic skills. In addition, its practical application basis allows students to develop analytic, problem-solving, and thinking skills. Available research indicated that applied academics curriculum equals or surpasses traditional delivery systems in the development of student academic skills. Little information was found connecting applied academics to the development of critical thinking skills.

The literature suggested individual personality type influences the way a person processes information, uses his or her mind, and makes judgements. Additionally, various "types" have different needs, interests, and motivation, and abilities. The literature suggested that utilizing varying instructional methodology would likely increase student learning and success, based on the premise that each classroom contains students with varying personality types. Related research indicated that a significant difference existed in the personality type/learning styles of students enrolled in vocational-technical schools and students in comprehensive high

schools. As result, the identification of student personality type

is valuable in student placement. Placement that can lead to

enhanced performance, skill attainment, and overall student success.

CHAPTER III

METHODOLOGY

This chapter deals with the major topics utilized to conduct

the study, The Relationship of Educational Technology and Applied

Academics to the Development of Critical Thinking Skills Among

Vocational and Comprehensive School Students in Oklahoma. Chapter

III is divided into five major sections.

1. Research design

2. Selection of subjects

3. Instrumentation

4. Collection of data

5. Analysis of data

Research Design

A survey of prior research involving the development of

critical thinking skills yielded little information involving the

use of educational technology in vocational-technical programs and

applied academics curriculum. This is significant in that

vocational education has the responsibility of preparing individuals

for employment in order that the economic system will operate

efficiently (Calhoun and Finch, 1982) and applied academics, as

noted by Pedrotti and Parks (1991), is an educational strategy to

assist in the preparation of students for employment. Employment

that requires workers to display the ability to utilize higher-order thinking skills, such as critical thinking.

The study employed a quasi-experimental, non-equivalent control group design to provide an analysis of the relationship between the use of educational technology and applied academics and the development of critical thinking skills. Campbell and Stanley (1963) diagram the study design as follows:

$$O_1 \quad X_1 \quad O_2$$
$$\overline{}$$
$$O_3 \qquad O_4$$
$$\overline{}$$
$$O_5 \quad X_2 \quad O_6$$

The null hypothesis tested was:

H_o: There are no differences in instructional delivery systems as they relate to the development of critical thinking skills.

Research subjects were administered a test to measure levels of critical thinking skills at the beginning of the investigation period (pretest) and an identical administration occurred at the conclusion of the investigation period (posttest). Subjects were also administered an instrument to determine individual student personality type as it relates to individual learning style. Results from the two administrations of the critical thinking skills test were used to determine if a significant difference on the dependent variable (critical thinking skills) occurred in the two treatment groups (educational technology and applied academics curriculum delivery systems) and in the control group (traditional delivery system). Additionally, the results from the administration of the personality type indicator were used to determine if a

significant difference in personality type existed in the sample.
Selection of the non-equivalent control group design was based on
Campbell and Stanley's (1963) statement that such a design is well
suited for instances where naturally assembled collectives were a
characteristic of the subjects. McGuigan (1990) added that the non-
equivalent control group design allows the study to be applied to
everyday life situations where much less control is possible than
under laboratory situations.

Selection of Subjects

The population for the study included secondary students
enrolled in Oklahoma public schools. Oklahoma's system of
vocational-technical education allows secondary students to attend
vocational programs at area vocational-technical centers one-half
day and at traditional comprehensive high schools one-half day. The
total number of secondary students enrolled in Oklahoma
comprehensive high schools from August, 1993 to May, 1994 was
162,561 students. The total number of secondary students enrolled
in Oklahoma area vocational-technical centers was 14,745 for the
same period. Population data were supplied by the Oklahoma
Department of Vocational-Technical Education and the Oklahoma State
Department of Education.

A purposive sampling technique was used to select the subjects
based on Kidder and Judds' (1986) rationale that cases are selected
when typical of the population in which the researcher was

interested. The total sample size was 317 which included 128 secondary students enrolled in vocational-technical programs at Oklahoma area vocational-technical centers, 82 students enrolled in applied academics courses at comprehensive high schools in Oklahoma, and 107 students enrolled in courses that utilize traditional instructional methods at comprehensive high schools in Oklahoma. The selection of subjects was based on the criteria of availability of program course offerings, and on a geographical basis to allow researcher administration of the data colleging instruments.

Subjects enrolled in programs at the vocational-technical centers comprised the educational technology treatment group. Subjects included in the group were not enrolled in applied academics courses in addition to their vocational-technical program. The vocational-technical programs that comprised the educational technology treatment group included:

1. Electronics,

2. Computer Aided Drafting,

3. Business and Office Technology,

4. Data and Information Processing,

5. Carpentry.

The Oklahoma area vocational-technical centers that provided the sample receiving the educational technology delivery system treatment included:

1. Canadian Valley Area Vocational-Technical School, El Reno, Oklahoma.

2. Eastern Oklahoma County Area Vocational Center, Choctaw, Oklahoma.

3. Mid-Del Vocational-Technical School, Midwest City, Oklahoma.

4. Autry Technology Center, Enid, Oklahoma.

Four comprehensive high schools served to provide the applied academics treatment group of 82 subjects and the control group of 107 subjects. Subjects in the applied academics curriculum treatment group were enrolled in applied academics courses at comprehensive high schools, but were not concurrently enrolled in vocational-technical programs at Oklahoma area vocational-technical centers. The applied academics courses that comprised the applied academics curriculum treatment group included Applied Math I and Applied Math II. The control group sample subjects were neither enrolled in applied academics courses or vocational-technical programs at Oklahoma area vocational-technical centers. The courses that comprised the traditional group (control) included classes that are considered to be both for college and non-college bound students. The comprehensive schools participating to supply the applied academics curriculum treatment group and the control group included:

1. Carl Albert High School, Midwest City, Oklahoma.

2. Choctaw High School, Choctaw, Oklahoma.

3. Jones High School, Jones, Oklahoma.

4. Meeker High School, Meeker, Oklahoma.

The schools selected for use in the study were included based on the availability of program, course offerings, and geographical

location to facilitate the researcher's administration of the instruments utilized in the study.

Instrumentation

The study employed a critical thinking test and personality type indicator to gather data on the development of critical thinking skills and to identify personality types as they relate to individual learning styles.

Cornell Critical Thinking Test -
Level X (CCTT)

The Cornell Critical Thinking Test - Level X was administered as the pretest and posttest to measure levels of critical thinking. The instrument, according to Ennis (1985), was designed for evaluation and has been used in curriculum and teaching experiments for the appraisal of critical thinking of a group. Ennis indicated that the Cornell Critical Thinking Test - Level X was designed for students in grades four through fourteen, which meets an expected disparity in reading levels contained in the sample. The instrument meets the conditions of testing in both vocational-technical schools and in comprehensive high schools through its design to be administered in one fifty (50) minute period.

Reliability and validity for the instrument is viable for the sample. The CCTT Manual (1985) reports reliability estimates that range from .67 to .90.

Myers-Briggs Type Indicator (MBTI)

The Myers-Briggs Type Indicator - Form G was used in the study to determine personality type for relation to individual learning style. The MBTI was selected from the numerous available instruments due to its purpose for design and appropriateness for the sample. Myers and McCauley (1985) reported that the instrument was designed to identify personality type relating to Carl Jung's theory of psychological type. The instrument met the needs of the sample by containing a reading level estimated from seventh to eighth grade (Myers and McCauley, 1985).

The MBTI further met the conditions of the study in its design to be administered with no time limits with an expected completion time of twenty-five (25) to forty (40) minutes, which was suitable for both the comprehensive high schools and area vocational-technical centers.

Collection of Data

Consenting subjects were administered the Cornell Critical Thinking Test - Level X at the beginning of the investigation period. The researcher administered the pretest one day at each school to the various subjects between August 24, 1993 and September 15, 1993. A total of 517 pretests were administered in the study which included the following distribution.

1. Educational Technology Treatment Group - 238 subjects

2. Applied Academics Treatment Group - 127 subjects

3. Traditional Instruction Control Group - 152 subjects

A total of 286 posttests were administered by the researcher between March 30, 1994 and May 3, 1994. The posttest yielded a distribution as follows:

1. Educational Technology Treatment Group - 126 subjects

2. Applied Academics Treatment Group - 73 subjects

3. Traditional Instruction Control Group - 87 subjects

As a result, an overall recovery rate of 55.3 percent was obtained. Of the 238 subjects in the educational technology treatment group that were pretested, 126 were administered a posttest for a percentage of 52.9 percent. Of the 127 subjects in the applied academics treatment group that were pretested, 73 were posttested for percentage of 57.4. These compare to 152 and 87 for the group receiving traditional instruction (control group) which resulted in a recovery rate of 57.2 percent.

The researcher administered the <u>Myers-Briggs Type Indicator -</u> <u>Form G</u> for the purpose of identifying individual subject personality type as it relates to learning style. The MBTI was administered one time at each school throughout the spring semester of the 1993-94 school year. The MBTI administration yielded a slightly higher overall response rate than did the posttest administration of the CCTT. Of the 517 that were pretested with the CCTT, 302 completed the Myers-Briggs Type Indicator for a response rate of 58.4 percent. The educational technology treatment group had 123 subjects complete the type indicator for a rate of 51.7 percent. Of the 127 subjects who pretested in the applied academics group, 80 completed the type

indicator for a rate of 63.0 percent. In comparison, the group receiving traditional instruction had 99 of 152 complete the type indicator for a rate of 65.1 percent.

Analysis of Data

The data collected from the two administrations of the <u>Cornell Critical Thinking Test - Level X</u> and the administration of the <u>Myers-Briggs Type Indicator - Form G</u> were entered into a computer data base for sorting and analysis.

Analysis of covariance (ANCOVA) was used to analyze the critical thinking skills data, utilizing pretest scores as the covariate. ANCOVA is employed when the researcher is attempting to determine whether observed differences between the means of two or more groups may be due to chance or systematic differences among treatment populations (Shavelson, 1988). Shavelson (1988) indicated this is accomplished by statistically removing predictable individual differences from the dependent variable, thereby providing a more precise estimate of experimental error than does a between subjects design. Shavelson (1988) noted that "analysis of covariance is a very powerful test of the null hypothesis" (p. 533). According to McGuigan (1990), analysis of covariance is often used in pretest-posttest control group and non-equivalent control group designs. The application of an analysis of covariance permits the use of pre-existing student groups while still controlling the variables which otherwise might confound the results. Furthermore, it provides a basis for ruling out pre-treatment differences when

the interest is in testing post-treatment differences and the researcher can test for differences between two or more groups while compensating for initial differences between groups with respect to relevant variables.

Shavelson (1988) identified three design requirements when using analysis of covariance. They are as follows:

1. There is one independent variable with two or more levels. These levels may differ quantitatively or qualitatively.

2. A covariate is measured prior to the implementation of the treatment and control conditions.

3. Subjects are assigned to one and only one group in the design.

Shavelson (1988) also identified five assumptions made by the researcher when employing the analysis of covariance for statistical analysis. The assumptions are as follows:

1. Independence: An individual's scores on the covariate and dependent variable are independent of the scores of all other subjects.

2. Normality: For individuals with the same score on the covariate in the same group, the dependent variable has a normal distribution.

3. Homogeneity of Variance: The variance of the dependent scores for individuals with the same covariate score is the same for all groups and covariate scores.

4. Linearity: It is assumed that in the population, the regression of the dependent variable on the covariate is linear in each group.

5. Homogeneity of Regression Slopes: In the population, the regression of the dependent variable on the covariate is the same in each group.

The study met the above parameters. Three groups, two treatment groups and one control group, were used to investigate the difference in the development of critical thinking skills based on instructional delivery systems. The pretest and the posttest scores were provided, with the pretest scores serving as the covariate to equate the groups to compensate for initial differences. Predicted posttest scores were calculated from the pretest scores on the basis of the correlation between pretest and the postest scores. Predicted posttest scores were subtracted to obtain residual scores. Residual scores were analyzed to determine if significant difference had occurred between the treatment groups as compared to the control group. The researcher used an alpha level of .05 to determine significance.

One-way analysis of variance was used to determine if variance existed between the personality type of students enrolled in vocational-technical programs utilizing educational technology as an instructional delivery system, applied academics instructional delivery system, and traditional methods of instructional delivery. Shavelson (1988) described the purpose of one-way analysis of variance as the comparison of the means for two or more groups in

order to decide whether the observed difference represents a chance occurrence or a systematic effect. If the variability between groups is considerably greater than the variability within groups, there is evidence of a treatment effect (Shavelson, 1988). An alpha level of .05 was used to determine significance.

CHAPTER IV

PRESENTATION OF FINDINGS

Introduction

This chapter represents the analysis of data from the study of
the relationship of educational technology and applied academics to
the development of critical thinking skills among vocational and
comprehensive school students in Oklahoma. The relationship between
student personality type and instructional delivery systems as they
relate to the development of critical thinking skills was also
examined. Students enrolled in vocational-technical programs
utilizing educational technology in four Oklahoma area vocational-
technical centers and applied academics and traditional classes in
four Oklahoma comprehensive high schools comprised the study's
sample.

The relationship of the use of educational technology and
applied academics to the development of critical thinking skills was
investigated by reviewing students' scores on administrations of the
Cornell Critical Thinking Test - Level X and data obtained from a
demographic questionnaire. The relationship between individual
student personality type and instructional delivery systems as they
relate to the development of critical thinking skills was
investigated through the administration of the Myers-Briggs Type -
Form G.

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In this chapter, a description of the sample, the statistical analyses, and findings are presented.

Description of the Sample

A purposive sample of 128 secondary students enrolled in vocational-technical programs utilizing educational technology as an instructional delivery system at area vocational-technical schools, 82 secondary students enrolled in applied academics courses at comprehensive high schools, and 107 secondary students enrolled in courses utilizing traditional instructional methods comprised the 317 subjects for the study.

Table I depicts the distribution of demographic information of Educational Technology students. Age groups represented four teen years. The age category 16 years had 41 students (32.0%), the age category 17 years had the largest population with 73 students (57.0%), the age category 18 years had 13 subjects (10.2%), and the age category 19 years had one student (0.8%). The mean age for the educational technology treatment group was 16.8 years.

The Business Technology vocational-technical program had the largest population with 40 students (31.3%). Computer Aided Drafting had 35 subjects (27.4%). The Carpentry and Electronics programs had 19 students each (14.8% and 14.8%) while the Computer Technology program had 15 students (11.7%).

Three grade classifications were represented in the Educational Technology group. Tenth grade had 3 subjects (2.3%), eleventh grade

TABLE I

DISTRIBUTION OF DEMOGRAPHIC INFORMATION
OF EDUCATIONAL TECHNOLOGY STUDENTS

N = 128

Variable	Frequency	Percentage
Vocational Program Type		
Business Technology	40	31.3
Carpentry	19	14.8
Computer Aided Drafting	35	27.4
Computer Technology	15	11.7
Electronics	19	14.8
Age		
16	41	32.0
17	73	57.0
18	13	10.2
19	1	0.8
Mean	16.8	100.0
Grade Classification		
10	3	2.3
11	60	46.9
12	65	50.8

had 60 subjects (46.9%), and twelth grade had the largest population with 65 students (50.8%).

Table II reports the observations of demographic information of Applied Academics students. Age categories spanned six years for the group. The age category 14 years had 6 students (7.3%), age category 15 years had the second largest population with 23 students (28.0%), and the largest poulation was contained in the years category with 30 students (36.6%). The age category 17 years had 17 students (20.7%), age category 18 years had 5 students (6.1%), and the age category 19 years had 1 student (1.3%). The mean age for the Applied Academics treatment group was 15.9 years.

Two applied academic courses comprised the course type for the applied academics treatment group. Applied Math I had 46 students (56.1%) and Applied Math II had 36 students (43.9%).

Four grade classifications can be observed for the applied academics group. Ninth grade had 16 students (19.5%), tenth grade had the largest population with 31 students (37.8%), and eleventh grade had 20 students (24.4%). Twelth grade had the smallest population with 15 students (18.3%).

The distribution of demographic information of students comprising the Traditional group (control group) is depicted in Table III. Age groups represented five years spanning from age 14 years to 19 years. Age group 14 years had 12 students (11.2%), age category 15 years had the second largest population with 39 students (36.4%), and age category 16 years had the largest population with

TABLE II

DISTRIBUTION OF DEMOGRAPHIC INFORMATION
OF APPLIED ACADEMICS STUDENTS

N = 82

Variable	Frequency	Percentage
Type of Class		
Applied Math I	46	56.1
Applied Math II	36	43.9
Age		
14	6	7.3
15	23	28.0
16	30	36.6
17	17	20.7
18	5	6.1
19	1	1.3
Mean	15.9	100.0
Grade Classification		
9	16	19.5
10	31	37.8
11	20	24.4
12	15	18.3

TABLE III

DISTRIBUTION OF DEMOGRAPHIC INFORMATION
OF TRADITIONAL STUDENTS

N = 107

Varaiable	Frequency	Percentage
Type of Class		
Algebra I	43	40.2
Algebra II	43	40.2
English	5	4.7
General Math	4	3.7
Pre Algebra	12	11.2
Age		
14	12	11.2
15	39	36.4
16	42	39.3
17	12	11.2
18	2	1.9
Mean	15.7	100.0
Gender		
Female	47	43.9
Male	60	56.1
Grade Classification		
9	20	18.7
10	52	48.6
11	29	27.1
12	6	5.6

42 students (39.3%). Age category 17 years had 12 students (11.2%) and age category 18 years had 2 students (1.9%). The mean age for the Traditional group was 15.7 years.

Five courses comprised the course type for the Traditional group (control group). Algebra I and Algebra II both had 43 students (40.2% and 40.2%), Pre Algebra had the third largest population with 12 students (11.2%), English had 5 students (4.7%), and General Math had 4 students (3.7%).

Students in the Traditional Group represented four grade levels. Ninth grade had 20 students (18.7%). Tenth grade had the largest population with 52 students (48.6%) while eleventh grade had the second largest population with 29 students (27.1%) and twelth grade had 6 students (5.6%).

Table IV shows the distribution of personality type of the Educational Technology and Applied Academics treatment groups and the traditional group (control) as identified by the Myers-Briggs Type Indicator. For the Educational Technology group it was observed that six of the sixteen personality type categories contained 66.7% of the students (ENTP - 13.8%, ESTP - 12.2%, ENFP - 11.4%, ISTP - 10.6%, INTP - 9.8%, and ESTJ - 8.9%). Four personality type categories comprised 22.8% of the students (ISTJ - 6.5%, ISFJ - 6.5%, ISFP - 4.9%, and INFP -4.9%). Five of the remaining six personality type categories had 10.5% of the identified types (ESFJ - 3.3%, ESFP - 2.4%, ENTJ - 2.4%, INFJ - 1.6%, and ENFJ - 0.8%). Personality type INTJ showed no frequency (0.0%).

TABLE IV

DISTRIBUTION OF PERSONALITY TYPE OF PARTICIPANTS
BY GROUP

Type	ET Frequency	ET Percentage	AA Frequency	AA Percentage	TR Frequency	TR Percentage
ISTJ	8	6.5	5	6.2	8	8.0
ISFJ	8	6.5	0	0.0	4	4.0
ISTP	13	10.6	9	11.3	7	7.1
ISFP	6	4.9	6	7.5	6	6.1
INFJ	2	1.6	0	0.0	0	0.0
INTJ	0	0.0	0	0.0	2	2.0
INFP	6	4.9	5	6.2	7	7.1
INTP	12	9.8	6	7.5	5	5.1
ESTP	15	12.2	13	16.3	17	17.1
ESFP	3	2.4	6	7.5	7	7.1
ESFJ	4	3.3	4	5.0	5	5.1
ESTJ	11	8.9	8	10.0	5	5.1
ENTP	17	13.8	9	11.3	7	7.1
ENFP	14	11.4	7	8.7	16	16.1
ENTJ	3	2.4	2	2.5	2	2.0
ENFJ	1	0.8	0	0.0	1	1.0
Total	123	100.0	80	100.0	99	100.0

ET = Educational Technology,
AA = Applied Academics,
TR = Traditional
Type = Personality Type as Measured by the Myers-Briggs Type
       Indicator (See Appendix D for Type Descriptions)

The distribution of personality type for Applied Academics students showed four of the sixteen personality type categories had a percentage that either met or exceeded 10% for a total of 48.9% (ESTP - 16.3%, ISTP - 11.3%, ENTP - 11.3%, and ESTJ - 10.0%). Eight of the sixteen categories had a percentage range from 2.5% to 8.7% (ENFP - 8.7%, ISFP - 7.5%, ESFP - 7.5%, INTP - 7.5%, ISTJ - 6.2%, INFP -6.2%, ESFJ - 5.0%, and ENTJ - 2.5%) for a total of 51.1%. The remaining four personality type categories (ISFJ, INFJ, INTJ, and ENFJ) showed no frequency.

The distribution of personality type for the Traditional group showed that the two personality type categories of ESTP and ENFP accounted for 33.2% (ESTP - 17.1 and ENFP - 16.1%). Nine of the sixteen personality type categories had a percentage range of 5.1% to 8.0% that comprised a total of 57.8% (ITSJ - 8.0%, ISTP, 7.1%, INFP -7.1%, ESFP - 7.1%, ENTP - 7.1%, ISFP - 6.1%, INTP - 5.1%, ESFJ - 5.1%, and ESTJ - 5.1%). Four of five personality type categories comprised the remaining 9% of the Traditional students (ISFJ - 4.0%, INTJ - 2.0%, ENTJ - 2.0%, and ENFJ - 1.0%). Personality type INFJ showed no frequency (0.0%).

Statistical Analysis

Table V shows the pretest, postest, and gain scores for each group by subtest and total score on the critical thinking skills test used in the study. It can be observed that the Educational Technology Group had higher pretest and postest mean scores on three

TABLE V

COMPARISON OF PRETEST AND POSTTEST CRITICAL THINKING
SKILLS MEAN SCORES OF GROUPS BY SUBTESTS

Subtest	ET	AA	TR
Induction			
N	126	73	87
Pretest Mean Score	16.1	14.3	15.7
Posttest Mean Score	16.4	14.9	15.3
Gain Score	+0.3	+0.6	−0.4
Deduction			
N	126	73	87
Pretest Mean Score	14.1	10.0	13.3
Posttest Mean Score	14.4	11.7	14.3
Gain Score	+0.3	+1.7	+1.0
Observation/Credibility			
N	126	73	87
Pretest Mean Score	11.0	9.4	10.8
Posttest Mean Score	11.9	10.4	10.8
Gain Score	+0.9	+1.0	+0.0
Assumptions			
N	126	73	87
Pretest Mean Score	4.3	3.1	4.4
Posttest Mean Score	4.8	4.0	5.0
Gain Score	+0.5	+0.9	+0.6
Total			
N	126	73	87
Pretest Mean Score	46.3	38.4	43.9
Posttest Mean Score	47.5	41.1	45.0
Gain Score	+1.2	+2.7	+1.1

ET = Educational Technology,
AA = Applied Academics,
TR = Traditional

of the four subtests (Induction, Deduction, and Observation/

Credibility) and for the total score. The Traditional group had a

slightly higher pretest and posttest mean score on the Assumption

subtest (5.0) as compared to the two treatment groups with

Educational Technology (4.8) and Applied Academics (4.0). All three

groups showed gains on all subtests and total score from pretest to

postest, except for the Traditional group on the Induction (-0.4)

and Observation/Credibility (0.0) subtests. The Applied Academics

group had the highest gain on each of the subtests and total score.

The range of gains for the Applied Academics group was +0.6 on the

Induction subtest to +2.7 on the total score. This compared to a

gain score range of +0.3 to +1.2 for the Educational Technology

group and -0.4 to +1.1 for the Traditional group.

Table VI contains the Analysis of Covariance (ANCOVA) of

posttest scores of the two treatment groups (Educational Technology

and Applied Academics) and the control group (Traditional) using the

pretest score as a covariate. ANCOVAs were used in each subtest

area and the total score to isolate the effect, if any occurred, the

treatment variable (Educational Technology and Applied Academics)

had on the dependent variable (critical thinking skills).

Statistical significance was found in two subtest areas, Induction

(.050) and Observation/Credibility (.050). No statistical

significance was found in the Deduction and the Assumtions subtests,

as well as for the total score.

TABLE VI

ANALYSIS OF COVARIANCE OF POSTTEST SCORES ON A CRITICAL
THNKING SKILLS TEST USING PRETEST SCORE AS A COVARIATE

Subtest	ET	AA	TR	
Induction				
N	126	73	87	
Posttest Mean	16.4	14.9	15.3	
Variance	13.3	16.4	14.7	
Standard Deviation	3.6	4.0	3.8	
Significance Level				.050*
Deduction				
N	126	73	87	
Posttest Mean	14.4	11.7	14.3	
Variance	22.5	16.3	25.5	
Standard Deviation	4.7	4.0	5.0	
Significance Level				.603
Observation/Credibility				
N	126	73	87	
Posttest Mean	11.9	10.4	10.8	
Variance	10.1	13.1	14.4	
Standard Deviation	3.2	3.6	3.8	
Significance Level				.050*
Assumptions				
N	126	73	87	
Posttest Mean	4.8	3.9	4.9	
Variance	3.8	3.9	3.8	
Standard Deviation	2.0	2.0	1.9	
Significance Level				.108
Total				
N	126	73	87	
Posttest Mean	47.5	41.0	45.0	
Variance	86.8	86.1	128.9	
Standard Deviation	9.3	9.3	11.4	
Significance Level				.793

ET = Educational Technology,
AA = Applied Academics,
TR = Traditional
*Statistically Significant

Table VII represents the matrix for the Induction and Observation/Credibility subtests. Examination of the matrix found the difference to exist between the Educational Technology group and the control group (Traditional) for both the Induction (.050) and the Observation/Credibility (.019) subtests.

Table VIII depicts an Analysis of Variance (ANOVA) of age groups on a critical thinking skills test. The obtained F-values for all subtests (Induction - 0.86, Deduction - 1.24, Observation/ Credibility - 1.01, and Assumption - 0.20) showed no significant difference existed between the critical thinking skills scores of the age groups fourteen years old, fifteen years old, sixteen years old, and the seventeen to eighteen years old. The calculated F-value (1.29) for the total score also showed no significant difference existed between the age groups.

An Analysis of Variance (ANOVA) of personality type for the two treatment groups (educational technology and applied academics) and the control group (traditional instruction) is presented in Table IX. The calculated F-value (1.64) revealed no statistical difference existed in the personality type among the three groups (Educational Technology, Applied Academics, and Traditional).

Table X represents an Analysis of Covariance (ANCOVA) of posttest mean scores on a critical thinking skills test by personality type (IS, IN, ES, and EN) for the two treatment groups (educational technology and applied academics) and the control group (traditional instruction) using the pretest as a covariate. ANCOVAs were used in each subtest area and the total score to isolate

TABLE VII

MATRIX FOR ANALYSIS OF COVARIANCE OF POSTTEST
SCORES ON A CRITICAL THINKING SKILLS TEST
USING PRETEST AS A COVARIATE FOR
INDUCTION AND OBSERVATION/
CREDIBILITY SUBTESTS

Subtest	Adjusted Mean	Significance Level	
Induction:			
ET	16.29		TR
AA	15.25	ET	.050*
TR	15.25	AA	.999
Observation/Credibility			
ET	11.60		TR
AA	11.06	ET	.019*
TR	10.61	AA	.351

ET = Educational Technology,
AA = Applied Academics,
TR = Traditional
*Statistically Significant

TABLE VIII

ANALYSIS OF VARIANCE SUMMARY TABLE OF AGE GROUPS
ON A CRITICAL THINKING SKILLS TEST

Source of Variation	SS	df	MS	F
Induction				
Between Groups	51.46	4	12.86	0.86
Within Groups	4185.46	281	14.89	
Total	4236.91	285		
Deduction				
Between Groups	113.26	4	28.31	1.24
Within Groups	6441.14	281	22.92	
Total	6554.40	285		
Observation/ Credibility				
Between Groups	50.47	4	12.61	1.01
Within Groups	3520.80	281	12.53	
Total	3571.28	285		
Assumption				
Between Groups	3.23	4	0.81	0.20
Within Groups	1121.99	281	3.99	
Total	1125.22	285		
Total Score				
Between Groups	540.38	4	135.09	1.29
Within Groups	29512.88	281	205.03	
Total	30053.26	285		

$F < .05$ with 4,281
df = 2.41

TABLE IX

ANALYSIS OF VARIANCE SUMMARY TABLE OF PERSONALITY
TYPE ON A PERSONALITY TYPE INDICATOR

Source of Variation	SS	df	MS	F
Between Groups	3037.53	2	1518.8	1.64
Within Groups	276569.93	299	924.9	
Total	279607.46	301		

$F < .05$ with 2,299
df = 3.04

TABLE X

ANALYSIS OF COVARIANCE OF POSTTEST SCORES BY
PERSONALITY TYPE ON A CRITICAL THINKING
SKILLS TEST USING PRETEST SCORE
AS A COVARIATE

Subtest	Source of Variation			
	SS	df	MS	Significance Level
Induction	113.09	6	18.85	.155
Deduction	12.41	6	2.07	.987
Observation/Credibility	85.99	6	14.33	.126
Assumptions	21.24	6	3.54	.455
Total	68.57	6	11.43	.961

differences, if any existed, on the dependent variable (critical thinking skills) by independent variables (personality type and treatment). No statistical significance was found on any of the posttest mean scores of the subtests or total, thus, indicating that any differences in the critical thinking skills of varying personality types of the experimental groups (Educational Technology and Applied Academics) and the control group (Traditional) could have been due to other factors than personality type as related to the treatment variables (Educational Technology and Applied Academics).

An analysis of covariance (ANCOVA) was used to obtain information on the effect of instructional delivery systems (Educational Technology and Applied Academics) on the development of critical thinking skills. Utilizing the pretest as the covariate to remove any initial differences among subjects, it was observed that the overall differences between the Educational Techology group and Applied Academics group as compared to the control group (Traditional) were not statistically significant (Table VI). However, the subtests analyzed individually, did show statistical significance in two subtest areas (Induction and Observation/ Credibility) between the Educational Technology group and the control group (Traditional). In attempting to understand why this particular treatment group showed a significant difference, it was observed that (1) the mean age of the Educational Technology group (16.8) was higher than the mean age for the Traditional group (15.7) (Tables I and III); (2) there was a slightly higher percentage of

males in the Educational Technology group (62.5%) than in the Traditional group (56.1%) (Tables I and III); and (3) the Educational Technology group showed higher levels of achievement in the two subtest areas (Induction and Credibility/Observation) than did the Traditional group (Table V). The fact that something occurred that caused statistical significance in the subtest areas of Induction and Observation/Credibility that did not occur in the other subtest areas and the total score should not be overlooked. Speculation as to why this surfaced during the research might begin with an examination of the above noted variables in order to determine why Educational Technology subjects showed statistically significant gains in these areas as compared to subjects in the control group (Traditional).

Examination of the Null Hypothesis

The data presented in the study revealed statistical differences between the critical thinking skills posttest means scores of the two treatment groups (Educational Technology and Applied Academics) as compared to the control group (Traditional) in only two of the four critical thinking skills subtests used in the study. As seen in Table V, students enrolled in vocational-technical programs using an educational technology delivery system at area vo-tech schools had higher pretest and posttest mean scores on two of the four subtest areas (Induction and Observation/ Credibility) and achieved greater gain scores between the pretest and posttest mean scores for the same two subtest areas. Using the

pretest score as the covariate, the difference in the mean posttest scores between the Educational Technology group and the Traditional group was found to be statistically significant for the subtest areas of Induction and Observation/Credibility. While the Applied Academics groups showed higher gain scores from the pretest to posttest on all four subtests as compared to the control group (Traditional), differences were not found to be significant. The total posttest mean scores comparison between the two treatment groups (Educational Technology and Applied Academics) and the control group (Traditional) showed no statistical difference.

The null hypothesis tested was H_o: there are no differences in instructional delivery systems as they relate to the development of critical thinking skills. Based on the analysis of the data, the researcher failed to reject the null hypothesis in relation to the effect of instructional delivery systems on critical thinking skills development of the student groups who served as subjects.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study was conducted to determine if there were differences in the development of critical thinking skills of secondary students in vocational-technical programs that utilize an educational technology delivery system and secondary students in applied academic courses at comprehensive high schools as compared to secondary students enrolled in courses using traditional delivery systems at comprehensive high schools. A review of literature revealed a lack of consensus concerning the effect of educational technology on critical thinking skills development. Nothing could be found that compared the use of educational technology in vocational-technical programs or applied academics to traditional instruction for critical thinking skills development. As result, little could be said about the effectiveness of instructional systems for the development of critical thinking skills. This study provides an approach that seeks to compare instructional delivery systems concerning the application of critical thinking skills as needed in the workplace to meet worker skill requirements.

Four major research questions guided the study:

1. Does the use of educational technology in vocational-technical education increase students' critical thinking skills?

2. Does the use of applied academics curriculum in comprehensive high schools increase students' critical thinking skills?

3. Do individual personality types differ as they relate to instructional delivery systems?

4. Do individual personality types as they relate to instructional delivery systems influence the development of students' critical thinking skills?

Data for the study were collected using the <u>Cornell Critical Thinking Test - Level X (CCTT)</u> and the <u>Myers-Briggs Type Indicator (MBTI) - Form G (MBTI)</u>. The CCTT is designed to measure general critical thinking skills and contained four subtests. Those subtests included: (1) Induction, (2) Deduction, (3) Observation/Credibility, and (4) Assumptions.

The CCTT was used for both the pretest and posttest. The MBTI was used to identify subject personality type. The purposive sample for the study consisted of 128 secondary students enrolled in five vocational-technical programs at four area vo-tech schools that utilize edcuational technology as an instructional delivery system, 82 secondary students enrolled in applied academics courses at four comprehensive high schools, and 107 secondary students enrolled in courses utilizing traditional methods as the instructional delivery system at four comprehensive high schools. The researcher administered pretests of the CCTT in late August, 1993 to early September, 1993. Posttests were administered by the researcher from late March, 1994 to early May, 1994. The MBTI was administered by

the researcher to identify personality type during the spring semester. An overall recovery rate for students pretested who were also posttested on the CCTT was 55.3 percent (Educational Technology - 52.9%, Applied Academics - 57.5%, and Traditional - 57.2%). The recovery rate (55.3%) for students pretested and also posttested was attributed to subject dropout, students moving to another school district, students transferring to another class, or student absence on the posttest date. Furthermore, pretests and posttests were each administered only one day at each school. The MBTI yielded a slightly higher response rate for students who were pretested with the CCTT with an overall response rate of 58.4 percent (Educational Technology - 51.7%, Applied Academics - 63%, and Traditional - 65.1%). Differences in the recovery rates between students administered the MBTI (58.4%) and those posttested with the CCTT (55.3%) were attributed to subject dropout, students moving to another school district, students transferring to another class, or student attendance on the different test dates due to three test administration dates at each school participating in the study.

Results of the Study

The results of the study are summarized in the following seven findings:

1. Secondary students enrolled in vocational-technical programs using an educational technology delivery system had significantly higher gains in the critical thinking skills subtest areas of Induction and Observation/Credibility than did students

enrolled in courses utilizing traditional instruction methods at comprehensive high schools.

2. There is no significant difference in critical thinking skills gains of secondary students enrolled in vocational-technical programs utilizing an educational technology delivery system and students enrolled in courses using traditional instructional methods at comprehensive high schools in the subtest areas of Deduction and Assumptions, as well as total score.

3. There is no significant difference in critical thinking skills gains of secondary students enrolled in applied academics courses at comprehensive high schools and students enrolled in courses using traditional instructional methods at comprehensive high schools in the subtest areas of Induction, Deduction, Observation/Credibility, and Assumptions, as well as the total score.

4. There is no significant difference in critical thinking skills scores by age group of secondary students enrolled in vocational-technical programs utilizing educational technology delivery systems, secondary students enrolled in applied academic courses, and students enrolled in courses using traditional instructional delivery methods.

5. There is no significant difference in the personality type of students enrolled in vocational-technical programs utilizing educational technology as an instructional delivery system, students enrolled in applied academics courses at comprehensive high schools,

and students enrolled in courses utilizing traditional instructional methods at comprehensive high schools.

6. There is no significant difference in critical thinking skills gains by personality type of secondary students enrolled in vocational-technical programs using educational technology as an instructional delivery system and secondary students enrolled in courses utilizing traditional instructional methods at comprehensive high schools.

7. There is no significant difference in critical thinking skills gains by personality type of secondary students enrolled in applied academics courses at comprehensive high schools and secondary students enrolled in courses using traditional instructional methods at comprehensive high schools.

Conclusions

Although this study identified statistical differences in the groups in some areas, they also identified questions which prevent sound conclusions about the effect of educational technology and applied academics on the development of critical thinking skills. The following conclusions should be interpreted with caution until additional research is conducted that will provide investigation of areas targeted by the questions. Based on the study's findings, the following conclusions were derived:

1. Depending upon the area of critical thinking skills, secondary students enrolled in vocational-technical programs utilizing an educational technology delivery system can achieve

gains at a level equal to or greater than secondary students
enrolled in courses using traditional instructional methods. Based
on the finding without consideration to cost, it can be concluded
that educational technology delivery systems should be incorporated
into vocational-technical programs to increase certain critical
thinking skills.

2. Based on the finding that no difference exists between
applied academics, educational technology, and traditional
instructional delivery systems concerning the development of
students' critical thinking skills, it can be concluded that applied
academics courses and the use of educational technology in
vocational-technical programs develops students' critical thinking
skills at levels at least equal to traditional instructional methods
and therefore should be considered as alternative delivery systems
for teaching similar content.

3. It was found that no relationship exists between student
personality type and educational technology delivery systems in
vocational-technical programs, applied academics courses in
comprehensive high schools, or courses utilizing traditional
instructional methods in comprehensive high schools as they relate
to student critical thinking skill development. Based on this
finding, instructional delivery methods for critical thinking skills
development should not necessarily be different for varying
personality types.

4. It was found that no relationship exists between age and
critical thinking skills development. Based on the finding, it can

be concluded that maturation has no effect on critical thinking skills development, therefore, factors other than age may influence critical thinking skills development.

5. Based on the finding that no difference exists between the personality type of students enrolled in vocational-technical programs utilizing educational technology, applied academics courses at comprehensive high schools or courses at comprehensive high schools utilizing traditional instructional methods, it can be concluded that student placement into courses utilizing different instructional delivery systems should be based on factors other than individual personality type.

Recommendations

The state of Oklahoma has 162,561 secondary students enrolled at comprehensive high schools of which 14,745 are cooperatively enrolled at area vocational-technical centers. The efforts of these schools to prepare individuals for the world of work is being continually challenged by increased skill demands, changing technology, and shifts in production orientations. This study holds some implications for the continuation of efforts by area vo-tech schools and comprehensive high schools to meet these rising workplace demands as well as efforts for additional research.

First, it is recommended that area vo-tech schools develop strategies to implement educational technology delivery systems in all vocational-technical programs. Based on the data in this study supporting the use of educational technology for the development of

critical thinking skills such as induction and credibility/ observation skills, and because other studies have shown that a positive relationship exists between the use of educational technology and the development of critical thinking skills, area vo-tech schools should consider the implementation of educational technology delivery systems into all vocational-technical program areas.

Second, comprehensive high schools should examine counseling and placement procedures regarding student enrollment in applied academics courses. Because data obtained in this study revealed that students enrolled in applied academics courses showed higher gain scores from pretest to posttest mean scores in critical thinking skills (Induction, Deduction, Observation/Credibility, Assumptions, and Total Score) than students enrolled in courses utilizing traditional instructional methods from the pretest to postest, and because other research has shown a positive relationship between applied academics and student academic achievement, it appears applied academic courses are effective for developing critical thinking skills and basic academic skills.

Third, area vo-tech schools and comprehensive high schools should explore methods, other than personality type, for assessing both college and non-college bound students for placement in courses or programs utilizing different instructional delivery systems. Because this study showed no significant difference existed in the personality type of students enrolled in vocational-technical programs utilizing educational technology, applied academic courses

at comprehensive high schools or courses using a traditional

instructional system at comprehensive high schools, alternate

assessment methods should be explored to identify individual

differences as they relate to instructional delivery methods and

student performance.

Fourth, area vo-tech schools and comprehensive schools should

continually assess students concerning the development of critical

thinking skills. Because the results of this study showed gain

scores on the total critical thinking skills test for all three

groups from the pretest to the posttest and the review of literature

indicated critical thinking skills are vital in facilitating worker

and company productivity, it is imperative that instructional

delivery systems be examined for effectiveness in the development of

critical thinking skills.

Recommendations for Further Research

The findings of this study revealed topic areas where

additional research could assist in providing information to be used

in the efforts of vocational education and comprehensive schools for

the preparation of individuals for the workplace. The findings of

this study would be greatly enhanced if further research was

conducted in the following areas:

1. The findings of this study showed that students in the

applied academics group showed higher overall gains in all areas of

critical thinking skills than students in the group receiving

traditional instruction methods, but had lower pretest and posttest

mean scores on all areas of critical thinking skills. Further
research is needed to determine what other factors may have
influenced the test scores of the applied academics students.
Factors that could be studied include the ability levels of students
placed in applied academics courses, teacher education regarding
applied academic instructional methods, and student attitudes toward
applied academics.

2. Additional research is recommended that would determine the
effectiveness of educational technology in vocational-technical
programs on the skills of induction and credibility/observation.
This study showed statistical significance in the critical thinking
skills subtest areas of Induction and Credibility/Observation.
Factors that could be studied include the type of educational
technology (i.e. computer-based instruction and simulation),
curriculum incorporated into the educational technology delivery
system, and learning activities used to support the educational
technology delivery system.

3. Further research is recommended on the effectiveness of
applied academics to the development of basic academic skills as
compared to traditional methodology. The review of literature
revealed some evidence of research that compared student academic
achievement in applied academics courses to student achievement in
courses utilizing traditional instructional methods. Although the
study did not look at academic achievement, if additional research
concludes that applied academic methods are more positively related
to academic achievement as compared to traditional methodology, the

structure of advising and placing students would be greatly
impacted.

4. Further research on the effectiveness of applied academics
on the development of critical thinking skills is recommended. This
study focused on the Applied Mathematics courses while information
is also needed concerning the effectiveness of other applied
courses. Courses that could be studied include Principles of
Technology, Applied Biology/Chemistry, and Applied Communications.

5. Further research is recommended concerning the difference
in personality type of students enrolled in vocational-technical
programs and students not enrolled in vocational-technical programs.
The study showed no difference in the personality type of students
enrolled in vocational-technical programs utilizing an educational
technology delivery system, students enrolled in applied academics
courses, and students enrolled in courses using a traditional
instructional delivery system. This finding contradicts previous
research (Soliday, 1992) that showed a significant difference in the
personality type of students enrolled in vocational programs and
students not enrolled in vocational programs. This may be due to
the use of different vocational-technical programs in the two
studies. Additional research in this area would provide
substantiating evidence concerning student advisement/placement, as
well as the need to vary teaching strategies and methodology because
of differing student personality type.

The researcher holds the opinion that findings from the above
recommendations would provide information that would assist both

vocational and comprehensive education in their efforts to prepare students for the workplace. Vocational and comprehensive education must work cooperatively to develop strategies that meet the skill demands of the workplace. Such efforts must be successful in order to maintain and improve our nation's economic well-being, promote individual productivity, and advance society in general. It is hoped that the results of this study will promote further research in the recommended areas in an effort to address education's responsibility for developing skills needed in an ever changing workplace.

BIBLIOGRAPHY

Association for Educational Communications and Technology Task Force
on Definition and Terminology. The Definition of Educational
Technology. Washington, DC: U.S. Government Press, 1977.

American Vocational Association, Guide to the Carl D. Perkins
Vocational and Applied Technology Act of 1990. Alexandria, VA:
American Vocational Association, 1990.

Bell, James. Evaluating Psychological Information and Sharpening
Your Critical Thinking Skills. Boston, MA: Allyn and Bacon,
Inc., 1991.

Berger, Dale E., Kathy Pezdek, and William P. Banks. Applications
of Cognitive Psychology and Problem Solving Education and
Computing. Hillsdale, NJ: Lawrence Erlbaum Associates
Publishers, 1987.

Berryman, S. F. "Education and the Economy: What Should We Teach?
When? How? To Whom?" Occasional Paper 4. National Center on
Education and Employment, Columbia University. (Presentation at
City University of New York, 1988).

Beyer, Barry K. Practical Strategies for the Teaching of Thinking.
Boston, MA: Allyn and Bacon, Inc., 1987.

Bishop, J. H. "Why U.S. Students Need Incentives to Learn."
Educational Leadership Vol. 49(6), (March, 1992), pp. 15-18.

Bottoms, G. "High Schools That Work." (Presentation for Oklahoma
Department of Vocational and Technical Education. Oklahoma
City, OK. January 25 & 26, 1993).

Bottoms, Gene. Redesigning and Refocusing High School Vocational
Studies. Atlanta, GA: Southern Regional Education Board,
1993.

Burton, Andrew and John Radford. Thinking in Perspective. London:
Methuen and Company, Ltd., 1978.

Byrne, S. M., A. Constant, and G. Moore. "Making Transitions from
School to Work." Educational Leadership. Vol. 49(6), (March,
1992), pp. 23-26.

Calhoun, Calfrey C. and Alton V. Finch. Vocational Education:
Concepts and Operations. Belmont, CA.: Wadsworth Publishing
Company, 1982.

Campbell, Donald T. and Jullian C. Stanley. Experimental and Quasi-Experimental Designs for Research. Chicago, IL: Rand McNally Company, 1963.

Carnavale, Anthony, Leila J. Gainer, and Ann S. Meltzer. Workplace Basics: The Skills Employers Want. Washington, DC: U.S. Department of Labor and The American Society for Training and Development, 1988.

Center for Occupational Research and Development. Report on the Attainment of Algebra I Skills by Completers of Applied Mathematics 1 & 2. Waco, TX: Center for Occupational Research and Development, July 1993.

Collins, C. "Don Your Critical Thinking Caps: Ways to Help Students Think Better." School Administrator. Vol. 48(1), (April, 1991), pp. 9-13.

D'Angelo, Edward. The Teaching of Critical Thinking. Amsterdam: B.R. Gruner N.V., 1971.

Douglas, A.M. "Mending the Rift Between Academic and Vocational Education." Educational Leadership. Vol. 49 (6), (March, 1992), pp. 42-43.

Eisele, James E. and Mary E. Eisele. Educational Technology: A Planning and Resource Guide Supporting Curriculum. New York, NY: Goodlad Publishing, Inc., 1990.

Ennis, Robert H. "Goals for a Critical Thinking Curriculum." in In Developing Minds: A Resource Guide for Teaching Thinking by Arthur L. Costa (Ed.). ASCD, 1985, pp. 54-57.

Ennis, Robert H., Jason Millman, and Thomas N. Tomka. Cornell Critical Thinking Tests Manual. Pacific Grove, CA: Midwest Publications, 1985.

Halpern, Diane F. Thought and Knowledge: An Introduction to Critical Thinking. Hillsdale, NJ: Lawrence Erlbaum Associates Publishers, 1984.

Harper, Dennis O. "Its Creation, Development and Cross-Cultural Transfer." in The Creation and Development of Educational Computer Technology by R. Murray Thomas and Victor N. Kobagosh (Ed.). New York, NY: Pergamon Press, 1987, pp. 35-64.

Hayes, J.R. The Complete Problem Solver. Philadelphia, PA: The Franklin Institute, 1981.

Heiman, Marcia and Joshua Slomianko. Critical Thinking Skills. Washington, DC: National Education Association, 1985.

Heinrich, Robert, Michael Molenda, and James D. Russell.
    Instructional Media and the New Technologies of Instruction.
    New York, NY: Macmillan Publishing Company, 1989.

Heyman, G. A. and E. R. Daly. "Teaching Critical Thinking in
    Vocational-Technical and Occupational Classes." New Directions
    for Community Colleges, Vol. 77 (Spring, 1992), pp. 103-108.

Hull, Daniel M. "Tech Prep/Associate Degree." (Presentation to the
    Oklahoma Department of Vocational and Technical Education.
    Stillwater, Ok. January 16, 1991).

Johnston, William B. and Arnold H. Packer. Workforce 2000.
    Indianapolis, IN: Hudson Institute, 1987.

Kerlinger, Fred N. Foundations of Behavioral Research. Fort Worth,
    TX: Holt, Rinehart, and Winston, Inc., 1986.

Kidder, Louise H. and Charles M. Judd. Research Methods in Social
    Relations. New York, NY: Holt, Rinehart and Winston, 1986.

Lawrence, Gordon. People Types and Tiger Stripes. Gainesville, FL:
    Center for Application of Psychological Type, Inc., 1982.

Leftwich, K. "Outlook: Where the Jobs Are." Vocational Education
    Journal, Vol. 67 (February, 1992), pp. 18-20.

Maiorana, Victor P. "Critical Thinking Across the Curriculum:
    Building the Analytic Classroom." ERIC Clearinghouse on
    Reading and Communication Skills. Bloomington, Indiana, 1992,
    (ED 307 152).

Mamchur, Carolyn M. Insights: Understanding Yourself and Others.
    Toronto, Ontario: The Ontario Institute for Studies in
    Education, 1984.

Mayer, Richard E. Thinking, Problem Solving, Cognition. New York,
    NY: W. H. Freeman and Company, 1983.

Matsumoto, Carolee. "The Potential of Computers for Teaching
    Thinking." in Developing Minds: A Resource Guide for Teaching
    Thinking. by Arthur L. Costa (Ed.), ASCD, 1985, pp. 249-254.

Mauter, Margaret A. "Teaching Higher Order Thinking Skills:
    Implications for Vocational-Technical Education." Ohio State
    Council on Vocational Education, Westerville, 1988, (ED 298
    312).

McCaulley, Mary H. and Frank 1. Natter. Psychological Type
    Differences in Education. Gainesville, FL: Center for
    Applications of Psychological Type, Inc., 1980.

McGuigan, Frank J. Experimental Psychology. Englewood Cliffs,
     NJ: Prentice-Hall, Inc., 1990.

McPeck, John E. Critical Thinking and Education. New York, NY: St.
     Martin's Press, 1981.

Miller, C. "Higher Order Thinking Skills: An Integrated Approach
     for Your Classroom." Vocational Education Journal, Vol. 65
     (October, 1990), pp. 26-27 and 69.

Myers, Isabel B. Gifts Differing. Palo Alto, CA: Consulting
     Psychological Press, Inc., 1980.

Myers, Isabel B. and Mary H. McCaulley. Manual: A Guide to the
     Development and Use of the Myers-Briggs Type Indicator.
     Palo Alto, CA: Consulting Psychological Press, Inc., 1985.

National Center on Educational Statistics. Study on Adult Literacy
     Levels. In The Daily Oklahoman. (September 9, 1993, pp. 1-2.)

National Commission of Excellence in Education. A Nation at Risk:
     The Imperative for Educational Reform. Washington, DC: U. S.
     Government Printing Office, 1983.

National Educational Goals Panel. Third Annual Report. In The
     Daily Oklahoman (October 1, 1993), pp. 1-2.

Norris, C., L. Jackson, and J. Poirot. "The Effect of Computer
     Science Instruction on Critical Thinking." Journal of Research
     on Computing in Education, Vol. 24 (Spring, 1992), pp. 329-333.

Norris, Stephen P. and Robert H. Evaluating Critical Thinking.
     Pacific Grove, CA: Midwest Publishers, 1987.

O'Neil, J. "Preparing for a Changing Workplace." Educational
     Leadership, Vol. 49(6), (March, 1992), pp. 6-9.

Packer, A.H. "Taking Action on the SCANS Report." Educational
     Leadership, Vol. 49(6), (March, 1992), pp. 27-31.

Parnell, Dale. "Every Student A Winner: The Case for TPAD."
     in Tech Prep Associate Degree: A Win/Win Experience by Dan Hull
     and Dale Parnell (Ed.). Waco, TX: Center for Occupational
     Research and Development, 1991, pp. 1-30.

Pauker, Robert A. Teaching Thinking and Reasoning Skills: Problems
     and Solutions. Arlington, VA: American Association for School
     Administrators, 1987.

Paul, R. "Critical Thinking: What, Why and How." New Directions
     for Community Colleges, Vol. 77 (Spring, 1992), pp. 3-24.

Pea, Roy D. "Putting Knowledge to Use." in _Technology in Education: Looking Toward 2020_. by Raymond S. Nickerson and Phillip P. Zodhiates (Ed.). Hillsdale, NJ: Lawrence Erlbaum Associates Publishing, 1988, pp. 169-212.

Pedrotti, Leno and Darrell Parks. "A Solid Foundation: The Role of Applied Academics." in _Tech Prep Associate Degree: A Win/Win Experience_ by Dan Hull and Dale Parnell (Ed.). Waco, TX: Center for Occupational Research and Development, 191, pp. 63-86.

Percival, Fred and Henry Ellington. _A Handbook of Educational Technology_. New York, NY: Hogan, Page and London/Nichols Publishing Company, 1988.

Pfieffer, Kenneth, Gregory Feinberg, and Steven Gelber. in _Applications of Cognitive Psychology_. Hillsdale, NJ: Lawrence Erlbaum Associates Publishing, 1987.

Reich, Robert. _The Work of Nations: Preparing Ourselves for the 21st Century Capitalism_. New York, NY: Knopf Publishing, 1991.

Reynolds, Angus and Ronald H. Anderson. _Selecting and Developing Media for Instruction_. New York, NY: Van Nostrand and Reinhold, 1992.

Riding R. J. and C. F. Buckle. "Computer Development and Educational Psychology." _Educational Psychology_, Vol. 7 (1987), pp. 5-11.

Rollins, Timothy J. "Level of Critical Thinking of Iowa Secondary Agriculture Students." (Unpub. Doctoral Dissertation Iowa State University. 1988.)

Rowe, Helga A.H. _Problem Solving and Intelligence_. Hillsdale, NJ: Lawrence Erlbaum Associates Publishing, 1985.

Saettler, Paul. _The Evolution of American Educational Technology_. Englewood, CO: Libraries Unlimited, Inc., 1990.

Shapiro, B. C. "Two Plus Two: The High School/Community College Connection." _National Association of Secondary School Principals_, Vol. 70 (December, 1986), pp. 489-497.

Shavelson, Richard J. _Statistical Reasoning for the Behavior Sciences_. Needham Heights, MA: Allyn and Bacon, Inc., 1988.

Soliday, Sarah F. "A Study of Personality Types/Learning Styles of Secondary Vocational Technical Education Students." (Unpub. Doctoral Dissertation Oklahoma State University. 1992.)

Stewart, W.J. "Secondary School Imperatives for the 90's." National Association of Secondary School Principals, Vol. 74 (March, 1990), pp. 70-74.

Striler, Raymond J. "Effects of High School Basic Programming on Critical Thinking." (Unpub. Doctoral Dissertation United States International University. 1989.)

Summers, J.A. "Effect of Interactivity Upon Student Achievement, Completion Intervals, and Affective Perceptions. Journal of Educational Technology Systems, Vol. 19 (1990-91), pp. 53-56.

Wagner, W. "Educational Technology: A Broader Vision." Education and Urban Society, Vol. 24 (August, 1992), pp. 454-465.

Widerhold, Chuck. "Use of Computers for Teaching Thinking." in In Developing Minds: A Resource Guide for Teaching Thinking. by Arthur L. Costa (Ed.). ASCD, 1985, p. 255.

Wirth, Arthur G. Education and Work for the Year 2000: Choices We Face. San Francisco, CA: Jossey-Bass Publishers, 1992.

APPENDIXES

APPENDIX A

INSTITUTIONAL REVIEW BOARD STUDY

APPROVAL FORM

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
FOR HUMAN SUBJECTS RESEARCH

Date: 06-29-93   **IRB#:** ED-93-105

Proposal Title: ANALYSIS OF THE RELATIONSHIP BETWEEN THE USE OF
EDUCATIONAL TECHNOLOGY AND APPLIED ACADEMICS CURRICULUM AND THE
DEVELOPMENT OF CRITICAL THINKING SKILLS

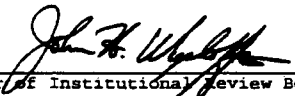**Principal Investigator(s):** Garry Bice, Terry Underwood

Reviewed and Processed as: exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW
BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A
CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR
BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO
BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for
Deferral or Disapproval are as follows:

Signature: Date: July 2, 1993
          Chair of Institutional Review Board

APPENDIX B

INITIAL CONFIRMATION LETTER TO

PARTICIPATING INSTITUTIONS

August 9, 1993

Ms. Camilla Riley
Canadian Valley Area Vo-Tech School
P.O. Box 579
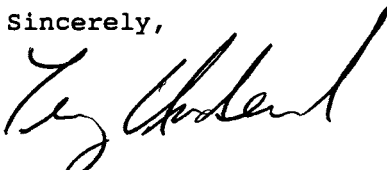El Reno, Oklahoma 73036

Camilla:

I am writing to confirm September 14, 1993 as the date for
pretesting students at Canadian Valley AVTS for my dissertation
study. I will arrive on campus around 9:30 a.m. with testing to
begin at 10:00 a.m. with morning students you will have identified
from the five program areas (Carpentry, Electronics, CAD, Office
Technology, and Computer Technology). Testing with your afternoon
students will begin at 12:45 p.m.

I have enclosed an information sheet that provides a description of
the study and informed consent forms for the participating students.
The informed consent forms need to be completed and signed by the
students' parents prior to the test date. I will collect the
informed consent forms on the test date. The pretest is expected to
take approximately one hour.

I will schedule the posttest and administration of the personality
type indicator with you in January, 1994. If you have any questions
about the enclosed information or any other matter, please contact
me.

Sincerely,

Terry Underwood

APPENDIX C

POSTTEST CONFIRMATION LETTER TO

PARTICIPATING INSTITUTIONS

March 15, 1994

Mr. Keith Harp
Autry Technology Center
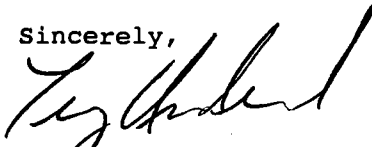1201 West Willow
Enid, Oklahoma 73703

Keith:

I am writing to confirm the scheduled date of April 26, 1994 for
posttesting students at Autry Technology Center that are
participating in my dissertation study. I will arrive on campus at
approximately at 8:30 a.m. and begin testing the morning students at
9:00 a.m. The test session for the afternoon students will begin at
12:40.

This test session will complete the collection of data at your
school for my study. The participation of Autry Technology Center
is greatly appreciated.

If you have any questions concerning the posttest session or the
scheduled date, please let me know. I am looking forward to being
on your campus on April 26, 1994.

Sincerely,

Terry Underwood

APPENDIX D

DESCRIPTIONS OF THE SIXTEEN PERSONALITY

TYPES AS MEASURED BY THE MYERS-BRIGGS

TYPE INDICATOR

Extraverted Thinking with Sensing (ESTJ)

ESTJ people use their thinking to run as much of the world as may be theirs to run. They like to organize projects and then act to get things done. Reliance on thinking makes them logical, analytical, objectively critical, and not likely to be convinced by anything but reasoning. They tend to focus on the job, not the people behind the job.

They like to organize facts, situations, and operations related to a project, and make systematic effort to reach their objectives on schedule. They have little patience with confusion or inefficiency, and can be tough when the situation calls for toughness.

They think conduct should be ruled by logic, and govern their own behavior accordingly. They live by a definite set of rules that embody their basic judgments about the world. Any change in their ways requires a deliberate change in their rules.

They like jobs where the results of their work are immediate, visible, and tangible. They have a natural bent for business, industry, production, and construction. They enjoy administration, where they can set goals, make decisions, and give the necessary orders. Getting things done is their strong suit.

Like other decisive types, ESTJs run the risk of deciding too quickly before they have fully examined the situation. They need to stop and listen to the other person's viewpoint, especially with people who are not in a position to talk back. This is seldom easy for them , but if they do not take time to understand, they may judge too quickly, without enough facts or enough regard for what other people may think or feel.

ESTJs may need to work at taking feeling values into account. They may rely so much on their logical approach that they overlook feeling values-what they care about and what other people care about. If feeling values are ignored too much, they may build up pressure and find expression in inappropriate ways. Although ESTJs are naturally good at seeing what is illogical and inconsistent, they may need to develop the art of appreciation. One positive way to exercise their feeling is to appreciate other peoples's merits and ideas. ESTJs who make it a rule to mention what they like, not merely what needs correcting, find the results worthwhile both in their work and in their private lives.

Extraverted Thinking with Intuition (ENTJ)

ENTJ people use their thinking to run as much of the world as may be theirs to run. They enjoy executive action and long-range planning. Reliance on thinking makes them logical, analytical, objectively critical, and not convinced by anything but reasoning. They tend to focus on the ideas, not the person behind the ideas.

They like to think ahead, organize plans, situations, and operations related to a project, and make a systematic effort to reach their objectives on schedule. They have little patience with confusion or inefficiency, and can be tough when the situation calls for toughness.

They think conduct should be ruled by logic, and govern their own behavior accordingly. They live by a definite set of rules that embody their basic judgements about the world. Any change in their ways requires a deliberate change in their rules.

They are mainly interested in seeing the possibilities beyond what is present , obvious, or know. Intuition heightens their intellectual interest, curiosity for new ideas, tolerance for theory, and taste for complex problems.

ENTJs are seldom content in jobs that make no demand upon their intuition. They are stimulated by problems and are often found in executive jobs where they can find and implement new solutions. Because their interest is in the big picture, they may overlook the importance of certain details. Since ENTJs tend to team up with like-minded intuitives who may also underestimate the realities of a situation, they usually need a person around with good common sense to bring up overlooked facts and take care of important details.

Like other decisive types, ENTJs run the risk of deciding too quickly before they have fully examined the situation. They need to stop and listen to the other person's viewpoint, especially with people who are not in a position to talk back. This is seldom easy for them, but if they do not take time to understand, they may judge too quickly, with enough facts or enough regard for what other people think or feel.

ENTJs may need to work at taking feeling values into account. Relying so much on their logical approach, they may overlook feeling values-what they care about and what other people care about. If feeling values are ignored too much, they may build up pressure and find expression in inappropriate ways. Although ENTJs are naturally good at seeing what is illogical and inconsistent, they may need to develop the art of appreciation. One positive way to exercise their feeling is through appreciation of other people's merits and ideas. ENTJs who learn to make it a rule to mention what they like, not merely what needs correcting, find the results worthwhile both in their work and in their private lives.

Extraverted Feeling with Sensing (ESFJ)

People with ESFJ preferences radiate sympathy and fellowship. They concern themselves chiefly with the people around them and place high value on harmonious human contacts. They are friendly, tactful, and sympathetic. They are persevering, conscientious, orderly even in small matters, and inclined to expect others to be the same. They are particularly warmed by approval and sensitive to indifference. Much of their pleasure and satisfaction comes from the warmth of feeling of people around them. ESFJs tend to concentrate on the admirable qualities of other people and are loyal to respected persons, institutions, or causes, sometimes to the point of idealizing whatever they admire.

They have the gift of finding value in other people's opinions. Even when these opinions are in conflict, they have faith that harmony can somehow be achieved and they often manage to bring it about. To achieve harmony, they are ready to agree with other's opinions within reasonable limits. They need to be careful, however, that they don't concentrate so much on the viewpoints of others that they lose sight of their own.

They are mainly interested in the realities perceived by their five senses, so they become practical, realistic, and down-to-earth. They take great interest in the unique differences in each experience. ESFJs appreciate and enjoy their possessions. They enjoy variety but can adapt well to routine.

ESFJs are at their best in jobs that deal with people and in situations where cooperation can be brought about through good will. They are found in jobs such as teaching, preaching, and selling. Their compassion and awareness of physical conditions often attracts them to health profession where they can provide warmth, comfort, and patient caring. They are less likely to be happy in work demanding mastery of abstract ideas or impersonal analysis. They think best when talking with people, and enjoy communicating. They have to make a special effort to be brief and businesslike and not let sociability slow them down on the job.

They like to base their plans and decisions upon known facts and on their personal values. While liking to have matters decided or settled, they do not necessarily want to make all the decisions themselves. They run some risk of jumping to conclusions before they understand a situation. If they have not taken time to gain first-hand knowledge about a person or situation, their actions may not have the helpful results they intended. For example, ESFJs beginning a new project or job may do things they assume should be done, instead of taking the time to find out what is really wanted or needed. They have many definite "shoulds" and "should nots," and may express these freely.

ESFJs find it especially hard to admit the truth about problems with people or things they care about. If they fail to face disagreeable facts, or refuse to look at criticism that hurts, they will try to ignore their problems instead of searching for solutions.

Extraverted Feeling with Intuition (ENFJ)

People with ENFJ preferences radiate sympathy and fellowship. They concern themselves chiefly with the people around them and place high value on harmonious human contacts. They are friendly, tactful, and sympathetic. They are persevering, conscientious, and orderly even in small matters, and inclined to expect others to be the same. ENFJs are particularly warmed by approval and are sensitive to indifference. Much of their pleasure and satisfaction comes from the warmth of feeling of people around them. ENFJs tend to concentrate on the admirable qualities of other people and are loyal to respected persons, institutions, or causes, sometimes to the point of idealizing whatever they admire.

They have the gift of being able to see value in other peoples's opinions. Even when opinions are in conflict, they have faith that harmony can somehow be achieved, and they often manage to bring it about. To bring harmony, they are ready to agree with other's opinions within reasonable limits. They need to be careful, however, not to concentrate so much on the viewpoints of others that they lose sight of their own.

They are mainly interested in seeing the possibilities beyond what is present, obvious, or known. Intuition heightens their insight, vision, and curiosity for new ideas. They tend to be interested in books and are moderately tolerant of theory. They are likely to have a gift of expression, but may use it in speaking to audiences rather than in writing. They think best when talking with people.

They are best in jobs that deal with people, and in situations that require building cooperation. ENFJs are found in jobs such as teaching, preaching, counseling, and selling. They may be less happy in work demanding factual accuracy, such as accounting, unless they find a personal meaning to their work. They have to make special effort to be brief and businesslike and not let sociability slow them down on the job.

They base their decisions on their personal values. While they like to have matters decided or settled, they do not necessarily want to make all the decisions themselves. ENFJs run the risk of jumping to conclusions before they understand a situation. If they have not taken the time to gain first-hand knowledge about a person or situation, their actions may not have the helpful results they intended. For example, ENFJs beginning a new project or job may do

things they assume should be done, instead of taking time to find
out what is really wanted or needed. They have many definite
"shoulds" and "should nots," and may express these freely.

ENFJs find is especially hard to admit the truth about problems with
people or things they care about. If they fail to face disagreeable
facts, or refuse to look at criticism that hurts, they will ignore
their problems instead of searching for solutions.

Extraverted Sensing with Thinking (ESTP)

People with ESTP preferences are friendly, adaptable realists. They
rely on what they see, hear, and know first-hand. They good-
naturedly accept and use the facts around them, whatever these are.
They look for a satisfying solution instead of trying to impose any
"should" or "must" of their own. They are sure a satisfying
solution will turn up once they have grasped all the facts.

They solve problems by being adaptable, and often can get others to
adapt, too. People generally like them well enough to consider any
compromise they suggest. They are unprejudiced, open-minded, and
tolerant of most everyone-including themselves. They take things as
they are and thus may be very good at easing a tense situation and
pulling conflicting factions together.

They are actively curious about objects, scenery, activities, food,
people, or anything new presented to their senses. Their expert
abilities in using their senses may show in: (a) a continuous
ability to see the need of the moment and turn easily to meet it,
(b) the ability to absorb, apply, and remember great numbers of
facts, (c) an artistic taste and judgment, or (d) the handling of
tools and materials.

With their focus on the current situation and realistic acceptance
of what exists, they can be gifted problem solvers. Because thy are
not necessarily bound by a need to follow standard procedures or
preferred methods, they are often able to see ways of achieving a
goal by "using" the existing rules, systems, or circumstances in new
ways, rather than allowing them to be roadblocks.

They make their decisions by using the logical analysis of thinking
rather than the more personal values of feeling. Their thinking
enables them to crack down when the situation calls for toughness.,
and also helps them grasp underlying principles. They learn more
from first-hand experience than from study or reading, and are more
effective in actual situations than on written tests. Abstract
ideas and theories are not likely to be trusted by ESTPs until they
have been tested in experience. They may have to work harder than
other types to achieve in school, but can do so when they see the
relevance.

ESTPs do best in careers needing realism, action, and adaptability. Examples are engineering, police work, credit investigation, marketing, health technologies, constructions, production, recreation, food services, and many kinds of troubleshooting.

ESTPs are strong in the art of living, they get a lot of fun out of life, which makes them good company. They enjoy their material possessions and take time to acquire them. They find much enjoyment in good food, clothes, music, and art. They enjoy physical exercise and sports, and usually are good at these.

How effective they are depends on how much judgment they acquire. They may need to develop their thinking so that they can use their principles to provide standards for their behavior, and direction and purpose in their lives. If their judgment is not developed enough to give them any character or stick-to-iveness, they are in danger of adapting mainly to their own love of a good time.

Extraverted Sensing with Feeling (ESFP)

ESFP people are friendly, adaptable realists. They rely on what they can see, hear, and know first-hand. They good-naturedly accept and use the facts around them, whatever these are. They look for a satisfying solution instead of trying to impose any"should" or "must" of their own. They are sure that a solution will turn up once they have grasped all of the facts.

They solve problems by being adaptable, and often can get others to adapt, too. People generally like them well enough to consider any compromise they suggest. They are unprejudiced, open-minded, and tolerant of most everyone-including themselves. They take things as they are and thus may be very good at easing a tense situation and pulling conflicting factions together.

With their focus on the current situation and realistic acceptance of what exists, they can be gifted problem solvers. Because they are not necessarily bound by a need to follow standard procedures or preferred methods, they are often able to see ways of achieving a goal by "using" the existing rules, systems, or circumstances in new ways, rather than allowing them to be roadblocks.

They are actively curious about people, activities, food, objects, scenery, or anything new presented to their senses. Their expert abilities in using their senses may show in: (a) a continuous ability to see the need of the moment and turn easily to meet it, (b) the skillful handling of people and conflicts, (c) the ability to absorb, apply, and remember great numbers or facts, or (d) an artistic taste and judgment.

They make their decisions by using the personal values of feeling
rather than the logical analysis of thinking. Their feeling makes
them tactful, sympathetic, interested in people, and especially good
at handling human contacts. They may be too easy in matters of
discipline. They learn far more from first-hand experience than
from books, and do better in actual situations than on written
tests. Abstract ideas and theories are not likely to be trusted by
ESFPs until they have been tested in experience. They have to work
harder than other types to achieve in school, but can do so when
they see the relevance.

ESFPs do best in careers needing realism, action, and adaptability.
Examples are health services, dales, design, transportation,
entertainment, secretarial or office work, food services,
supervising work groups, machine operations, and many kinds of
troubleshooting.

ESFPs are strong in the art of living. They get a lot of fun out of
life, which makes them good company. They enjoy their material
possessions and take time to acquire and care for them. They find
much enjoyment in good food, clothes, music, and art. They enjoy
physical exercise and sports, and are usually good at these.

How effective they are depends on how much judgment they acquire.
They may need to develop their feeling so that they can use their
values to provide standards for behavior, and direction and purpose
in their lives. If their judgment is not developed enough to give
them any character or stick-to-it-iveness, they are in danger of
adapting mainly to their own love of a good time.

Extraverted Intuition with Thinking (ENTP)

People with ENTP preferences are ingenious innovators who always see
new possibilities and new ways of doing things. They have a lot of
imagination and initiative for starting projects and a lot of
impulsive energy for carrying them out. They are sure of the worth
of their inspirations and tireless with the problems involved. They
are stimulated by difficulties and most ingenious in solving them.
They enjoy feeling competent in a variety of areas and value this in
others as well.

They are extremely perceptive about the attitudes of other people,
and can use this knowledge to win support for their projects. They
aim to understand rather than to judge people.

Their energy comes from a succession of new interests and their
world is full of possible projects. They may be interested in so
many different things that they have difficulty focusing. Their
thinking can help them select projects by supplying some analysis
and constructive criticism of their inspirations, and thus add depth

to the insights supplied by their intuition. Their use of thinking
also makes ENTPs rather objective in their approach to their current
project and to the people in their lives.

ENTPs are not likely to stay in any occupation that does not provide
new challenges. With talent, they can be inventors, scientists,
journalists, troubleshooters, marketers, promoters, computer
analysts, or almost anything that interests them to be.

A difficulty for people with ENTP preferences is that they hate
uninspired routine and find it remarkably hard to apply themselves
to the sometimes necessary detail unconnected with any major
interest. Worse yet, they may get board with their own projects as
soon as the major problems have been solved or the initial challenge
has been met. They need to learn to follow through, but are
happiest and most effective in jobs that permit one project after
another, with somebody else taking over as soon as the situation is
well in hand.

Because ENTPs are always being drawn to the exciting challenges of
new possibilities, it is essential that they develop their judgment.
If their judgement is underdeveloped, they may commit themselves to
ill-chosen projects, fail to finish anything, and squander their
inspirations on uncompleted tasks.

Extraverted Intuition with Feeling (ENFP)

People with ENFP preferences are enthusiastic innovators, always
seeing new possibilities and new ways of doing things. They have a
lot of imagination and initiative for starting projects, and a lot
of impulsive energy for carrying them out. They are stimulated by
difficulties and are most ingenious in solving them. ENFPs can get
so interested in their newest project that they have time for little
else. Their energy comes from a succession of new enthusiasms and
their world is full of possible projects. Their enthusiasm gets
other people interested too.

They see so many possible projects that they sometimes have
difficulty picking those with the greatest potential. Their feeling
can be useful at this point to help select projects by weighing the
values of each. Their feeling judgment can also add depth to the
insights supplied by their intuition.

The ENFP's feeling preference shows in a concern for people. They
are skillful in handling people and often have remarkable insight
into the possibilities and development of others. They are
extremely perceptive about the attitudes of others, aiming to
understand rather than judge people. They are much drawn to
counseling, and can be inspired and inspiring teachers, particularly
where they have freedom to innovate. With talent, they can succeed

in almost any field that captures their interest-art, journalism, science, advertising, sales, the ministry. advertising, sales, or writing, for example.

A difficulty for ENFPs is that they hate uninspired routine and find it remarkably hard to apply themselves to sometimes necessary detail unconnected with any major interest. Worse yet, they may get bored with their own projects as soon as the main problems have been solved or the initial challenge has been met. They may need to learn to follow through and finish what they have begun, but are happiest and most effective in jobs that permit one project after another, with somebody else taking over as soon as the situation is well in hand.

Because ENFPs are always being drawn to the exciting challenges of new possibilities, it is essential that they develop their feeling judgment. If their judgment is underdeveloped, they may commit themselves to ill-chosen projects, fail to finish anything, and squander their inspirations by not completing their tasks.

Introverted Thinking with Sensing (ISTP)

People with ISTP preferences use their thinking to look for the principles underlying the sensory information that comes into awareness. As result, they are logical, analytical, and objectively critical. They are not likely to be convinced by anything but reasoning based on solid facts.

While they like to organize facts and data, they prefer not to organize situations or people unless they must for the sake of their work. They can be intensely but quietly curious. Socially they may be rather shy except with their best friends. They sometimes become so absorbed with one of their interests that they can ignore or lose track of external circumstances.

ISTPs are somewhat quiet and reserved, although they can be quite talkative on a subject where they can apply their great storehouse of information. In everyday activities they are adaptable, except when one of their ruling principles is violated, at which point they stop adapting. They are good with their hands, and like sports and the outdoors, or anything that provides a wealth of information for their senses.

If ISTPs have developed their powers of observing the world around them, they will have a firm grasp on the realities of any situation, and show a great capacity for the important and unique facts of a situation. They are interested in how and why things work and are likely to be good at applied science, mechanics, or engineering. ISTPs who do not have technical or mechanical interests often use

their talents to bring order out of unorganized facts. This ability can find expression in law, economics, marketing, sales, securities, or statistics.

ISTPs may rely so much on the logical approach of thinking that they overlook what other people care about and what they themselves care about. They may decide that something is not important, just because it isn't logical to care about it. If ISTPs always let their thinking suppress their feeling values, their feeling may build up pressure and find expression in inappropriate ways. Although good at analyzing what is wrong, ISTPs sometimes find it hard to express appreciation. But if they try, they will find it helpful on the job as well as in personal relationships.

ISTP people are in some danger of putting off decisions or failing to follow through. One of their outstanding traits is economy of effort. This trait is an asset if they judge accurately how much effort is needed; then they do what the situation requires without fuss or lost motion. If they cannot judge accurately, or if they just don't bother, then nothing of importance gets done.

Introverted Thinking with Intuition (INTP)

People with INTP preferences use their thinking to find the principles underlying whatever ideas come into their awareness. They rely on thinking to develop these principles and to anticipate consequences. As result, they are logical, analytical, and objectively critical. They are likely to focus more on the ideas than the person behind the ideas.

They organize ideas and knowledge rather than situations or people, unless they must for the sake of their work. In the field of ideas they are intensely curious. Socially, they tend to have a small circle of close friends, and like being with others who enjoy discussing ideas. They can become so absorbed with an idea that they can ignore or lose track of external circumstances.

INTPs are somewhat quiet and reserved, although they can be quite talkative on a subject to which they have given a lot of thought. They are quite adaptable so long as their ruling principles are not violated, at which point they stop adapting. Their main interest lies in seeing possibilities beyond what is present, obvious, or known. They are quick to understand and their intuition heightens their insight, ingenuity, and intellectual curiosity.

Depending on their interests, INTPs are good at pure science, research, mathematics, or engineering; they become scholars, teachers, or abstract thinkers in fields such as economics, philosophy, or psychology. They are more interested in the challenge of reaching solutions to problems than of seeing the solutions put to practical use.

Unless INTPs develop their perception, they are in danger of gaining too little knowledge and experience in the world. Then their thinking is done in a vacuum and nothing will come of their ideas. Lack of contact with the external world may also lead to problems in making themselves understood. They want to state exact truth, but often make it so complicated that not everyone can follow them. If they can learn to simplify their arguments, their ideas will be more widely understood and accepted.

INTPs may rely so much on logical thinking that they overlook what other people care about and what they themselves care about. They may decide that something is not important, just because it isn't logical to care about it. If INTPs always let their logic suppress their feeling values, their feeling may build up pressure until it is expressed in inappropriate ways.

Although they excel at analyzing what is wrong with an idea, it is harder for INTPs to express appreciation. But if they try, they will find it helpful on the job as well in personal relationships.

Introverted Feeling with Sensing (ISFP)

People with ISFP preferences have a great deal of warmth, but may not show it until they know a person well. They keep their warm side inside, like a fur-lined coat. When they care, they care deeply, but are far more likely to show their feeling by deeds rather than words. They are very faithful to duties and obligations related to things or people they care about.

They take a very personal approach to life, judging everything by their inner ideals and personal values. They stick to their values with passionate conviction, but can be influenced by someone they care deeply about. Although their inner loyalties and ideas govern their lives, ISFPs find these hard to talk about. Their deepest feeling are seldom expressed; their inner tenderness is marked by a quiet reserve.

In everyday activities they are tolerant, open-minded, flexible, and adaptable. If one to their inner loyalties is threatened though, they will not give an inch. They usually enjoy the present moment, and do not like to spoil it by rushing to get things done. They have little with to impress or dominate. The people they prize the most are those who take the time to understand their values and the goals they are working toward.

They are interested mainly in the realities brought to them by their senses, both inner and outer. They apt to enjoy fields where taste, discrimination, and a sense of beauty and proportion are important. Many ISFPs have a special nature and a sympathy with animals. They often excel in craftsmanship, and the work of their hands is usually more eloquent than their words.

They are twice as good when working at a job they believe in, since their feeling adds energy to their efforts. They see the needs of the moment and try to meet them. They want their work to contribute to something that matters to them—human understanding, happiness, or health. They want to have a purpose beyond their paycheck, no matter how big the check. They are perfectionists whenever they care deeply about something, and are particularly suited for work that requires both devotion and a large measure of adaptability.

The problem for some ISFPs is that they may feel such a contrast between their inner ideals and their actual accomplishments that they burden themselves with a sense of inadequacy. This can be true even when they are being as effective as others. They take for granted anything they do well and are the most modest of all types, tending to underrate and understand themselves.

It is important for them to find practical ways to express their ideals; otherwise they will keep dreaming of the impossible and accomplish very little. If they find no actions to express their ideals, they can become too sensitive and vulnerable, with dwindling confidence in life and in themselves. Actually, they have much to give and need only to find the spot where they are needed.

Introverted Feeling with Intuition (INFP)

People with INFP preferences have a great deal of warmth, but may not show it until they know a person well. They keep their warm side inside, like a fur-lined coat. They are very faithful to duties and obligations related to ideas or people they care about. They take a very personal approach to life, judging everything by their inner ideals and personal values.

They stick to their ideals with passionate conviction. Although their inner loyalties and ideals govern their lives, they find these hard to talk about. Their deepest feelings are seldom expressed; their inner tenderness is masked by a quiet reserve.

In everyday matters they are tolerant, open-minded, understanding, flexible, and adaptable. But if their inner loyalties are threatened, they will not give an inch. Except for their work's sake, INFPs have little wish to impress or dominate. The people they prize the most are those who take the time to understand their values and the goals they are working toward.

Their main interest lies in seeing the possibilities beyond what is present, obvious, or known. They are twice as good when working at a job they believe in, since their feeling puts added energy behind their efforts. They want to contribute to something that matters to them—human understanding, happiness, or health. They want to have a purpose beyond their paycheck, no matter how big the check. They are perfectionists whenever they care deeply about something.

INFPs are curious about new ideas and tend to have insight and long-range vision. Many are interested in books and language and are likely to have a gift of expression; with talent they may be excellent writers. They can be ingenious and persuasive on the subject of the enthusiasms, which are quiet but deep-rooted. They are often attracted to counseling, teaching, literature, art, science, or psychology.

The problem for some INFPs is that they may feel such a contrast between their ideals and their actual accomplishments that they burden themselves with a sense of inadequacy. This can happen even when, objectively, they are being as effective as others. It is important for them to use their intuition to find ways to express their ideals; otherwise they will keep dreaming of the impossible and accomplish very little. If they find no channel for expressing their ideals, INFPs may become overly sensitive and vulnerable, with dwindling confidence in life and in themselves.

Introverted Sensing with Thinking (ISTJ)

People with ISTJ preferences are extremely dependable and have a complete, realistic, and practical respect for the facts. They absorb, remember, and use any number of facts and are careful about their accuracy. When they see something needs to be done, they accept the responsibility, often beyond the call of duty. They like everything clearly stated.

Their private reactions, which seldom show in their faces, are often vivid and intense. Even when dealing with a crisis they look calm and composed. Not until you know them very well do you discover that behind their outer calm that they are viewing the situation from an intensely individual angle. When ISTJs are "on duty" and dealing with the world, however, their behavior is sound and sensible.

ISTJs are thorough, painstaking, systematic, hard-working, and careful with particulars and procedures. Their perseverance tends to stabilize everything with which they are connected. They do not enter into things impulsively, but once committed, they are very hard to distract or discourage.

ISTJs often choose careers where their talents for organization and accuracy are rewarded. Examples are accounting, civil engineering, law, production, construction, health careers, and office work. They often move into supervisory and management roles.

If they are in charge of something, their practical judgment and valuing of procedure makes them consistent and conservative, assembling the necessary facts to support their evaluations and decisions. They look for solutions to present problems in the

successes of the past. With time they become masters of even the
smallest elements of their work, but don't give themselves any
special credit for this knowledge.

They may encounter problems if they expect everyone to be as logical
and analytical as they are. They then run the danger of
inappropriately passing judgement on other or overriding less
forceful people. A useful rule is for them to use their thinking to
make decisions about inanimate objects or their own behavior, and to
use their senses to see what really matters to others, so that it
becomes a fact to be respected, they may go to generous lengths to
help.

Another problem may arise if the ISTJ's thinking remains
undeveloped. They may retreat, becoming absorbed with their inner
reactions to sense-impressions, with nothing of value being
produced. They may also tend to be somewhat suspicious of
imagination and intuition, and not take it seriously enough.

Introverted Sensing with Feeling (ISFJ)

People with ISFJ preferences are extremely dependable and devotedly
accept responsibilities beyond the call of duty. They have a
complete, realistic, and practical respect for the facts. When they
see from the facts that something needs to be done, they pause to
think about it. If they decide that action will be helpful, they
accept the responsibility. They can remember and use any number of
facts, but want them all accurate. They like everything clearly
stated.

Their private reactions are often vivid and intense, and sometimes
quite unpredictable to others. These private reactions seldom show
in their faces, and even when dealing with a crisis, they can look
calm and composed. Not until you know them very well do you
discover that behind their outer calm they are looking at things
from an intensely individual angle, often a delightfully humorous
one. When ISFJs are "on duty" and dealing with the world, however,
their behavior is sound and sensible.

ISFJs are thorough, painstaking, hard-working, and patient with
particulars and procedures. They can and will do the "little"
things that need to be done to carry a project through to
completion. Their perseverance tends to stabilize everything with
which the are connected. They do not enter into things impulsively,
but once in, they are very hard to distract or discourage. They do
not quit unless experience convinces them they are wrong.

ISFJs often choose careers where they can combine their careful
observation and their caring for people, as in the health
professions. Other fields attractive to ISFJs are teaching, office
work, and occupations that provide services or personal care. ISFJs

show their feeling preference in their contacts with the world.
They are kind, sympathetic, tactful, and genuinely concerned; traits
that make them very supportive to persons in need.

Because of their concern for accuracy and organization, ISFJs often
move into supervisory roles. If they are in charge of something,
their practical judgment and appreciation of what works make them
conservative and consistent. They take care to collect the facts
necessary to support their evaluations and decisions. As they gain
experience, they compare the present problem to past situations.

For an ISFJ, problems may arise if their judgement is not developed.
If their feeling preference remains undeveloped, they will not be
effective in dealing with the world. They may instead retreat,
becoming silently absorbed in their inner reactions to sense-
impressions. Then nothing of value is likely to come out. Another
potential problem is that they tend to be somewhat suspicious of
imagination and intuition and not take it seriously enough.

Introverted Intuition with Thinking (INTJ)

People with INTJ preferences are relentless innovators in thought as
well as action. They trust their intuitive insights into the true
relationships and meanings of things, regardless of established
authority of popularly accepted beliefs. Their faith in their inner
vision can move mountains. Problems only stimulate them-the
impossible takes a little longer, but not much. They are the most
independent of all the types, sometimes to the point of being
stubborn. They place a high value on competence-their own and
others'.

Being sure of the worth of their inspirations, INTJs want to see
them worked out in practice, applied and accepted by the rest of the
world; they are willing to spend any time and effort to that end.
They have determination, perseverance, and will drive others almost
as hard as they drive themselves. Although their preference is for
intuition, they can, when necessary, focus on the details of a
project to realize their vision.

INTJs often value and use confidently their intuitive insights in
fields such as science, engineering, invention, politics, or
philosophy. The boldness of their intuition may be of immense value
in any field, and should not be smothered in a routine job.

Some problems may arise from the INTJ's single-minded concentration
of goals. They may see the end so clearly that they fail to look
for other things which might conflict with the goal. Therefore they
need to actively seek the viewpoint of others.

INTJs may neglect their feeling values to the point of ignoring other people's feelings and values. If they do, they may be surprised by the bitterness of their opposition. An INTJ's own feeling values have to be reckoned with also, for if too much suppressed, they may build up pressure and find expression in inappropriate ways. Their feeling needs to be used constructively, such as through appreciation of other people. Given their talent for analysis, appreciation may be hard for INTJs, but they will find it helpful on the job as well as in personal relationships.

To be effective, INTJs must develop their thinking to supply needed judgment. If their judgment is underdeveloped, they will be unable to criticize their own inner vision, and will not listen to the opinions of others. They will therefore be unable to shape their inspirations into effective action.

Introverted Intuition with Feeling (INFJ)

People with INFJ preferences are great innovators in the field of ideas. They trust their intuitive insights into the true relationships and meanings of things, regardless of established authority or popularly accepted beliefs. Problems only stimulate them-the impossible takes a little longer, but not much.

They are independent and individualistic, being governed by inspirations that come through intuition. These inspirations seem so valid and important that they sometimes have trouble understanding why everyone does not accept them. Their inner independence is often not conspicuous because INFJs value harmony and fellowship; they work to persuade others to approve of and cooperate with their purposes. They can be great leaders when they devote themselves to carrying out a sound inspiration, attracting followers by their enthusiasm and faith. They lead winning (rather than demanding) acceptance of their ideas.

They are not content in work that satisfies both their intuition and feeling. The possibilities that interest them most concern people. Teaching particularly appeals to them, whether in higher education, or through the arts or the ministry. Their intuition provides insight into the deeper meanings of the subject and they take great satisfaction in aiding the development of individual students.

When their interests lie in technical fields, INFJs may be outstanding in science, or research and development. Intuition suggests new approaches to problems and feeling generates enthusiasm that sparks their energies. Intuition powered by feeling may be of immense value in any field if not smothered in a routine job.

Some problems may result for the INFJ's single-minded devotion to inspirations. They may see the goal so clearly that they fail to look for other things that might conflict with the goal. It is also important that their feeling is developed, since this will supply necessary judgment. If their judgment is underdeveloped, they will be unable to evaluate their own inner vision and will not listen to feedback from others. Instead of shaping their inspirations into effective action, they amy merely try to regulate everything (small matters as well as great ones) according to their own ideas, so that little is accomplished.

Myers and McCaulley (1985)

VITA $\mathcal{V}$

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Thesis: THE RELATIONSHIP OF EDUCATIONAL TECHNOLOGY AND APPLIED
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