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By

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ABSTRACT

THE RELATIONSHIP BETWEEN CRITICAL THINKING SCORES, ACHIEVEMENT, AND GRADE POINT AVERAGE IN THREE DIFFERENT DISCIPLINES

By

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This investigation was undertaken to measure the critical thinking scores of students in a Canadian community college and to determine whether there is correlation between the critical thinking scores and (1) the academic achievement scores and (2) the grade point averages of students in three different disciplines, business, music, and nursing. The Cornell Critical Thinking Test was used to determine the critical thinking scores. The achievement scores and grade point average of the students were obtained from official records. Achievement score was the grade assigned by the instructor in the student's major course of study, and grade point average was the average of all the student's courses including the major in the semester that the testing was completed. Variables such as gender, age, and English as a second language were also reported by the students.

There was no difference in the critical thinking scores of the students in the three disciplines. There was no correlation between the critical thinking scores and the achievement scores of the groups. There was a low correlation between critical thinking scores and GPA in the music students but not in the business or nursing students. There was no significant difference between the critical thinking scores of the males and the females. Critical thinking scores did not correlate with age and did not correlate with

English as a second language.

Implications of the study findings were discussed and recommendations made.

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TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

INTRODUCTION

Background

Many segments of Canadian society are demanding that educators be held accountable for the effectiveness of the teaching-learning services they provide. Parents, educators, and business leaders recognize the connection between education and global competitiveness. The Organization for Quality Education, which assembles the data describing the success of students in various countries of the world, has found that Canadian students, age 13 years and in the eighth grade, do not perform as well as students in many other countries although Canada spends more money on education than other countries (Nikiforuk 1993). There also appears to be a strongly felt need to improve the learning outcomes for college students. Critical thinking has an intrinsic importance that impacts on the teaching-learning environment.

A great deal has been written in the popular press and in educational literature about the need for students to develop critical thinking skills (Seigel 1980, Sagan 1987, Nikiforuk 1993) but the research to determine the relationship between critical thinking scores and achievement scores of college students has not been conclusive (Beck et al 1992). At every level of education, instructors recognize the need to help students think critically (Chaffee 1992, Norris 1985, Seigel 1989). It is unclear whether the usual didactic method of instruction encourages the development of critical thinking (Paul 1988, Mayer 1983, de Bono 1976) and it is not clear whether critical thinking correlates well with academic achievement (Frederickson 1979, Berger 1984, Waite 1989, Kokinda 1989).

Canadian college students are dealing with contemporary realities which are very

different from the realities of the past. Some of these realities include: rapid changes in technology, the information explosion, the aging of the population, ethnic diversity, the globalization of business, new economic pressures, the changing labour market, chronic high unemployment, and cutbacks in health and education budgets. Students will have a better chance of dealing effectively with these new realities if they have developed good critical thinking skills. Critical thinking skills support high-level cognitive processes, ordered thinking, and reasoning abilities, thereby assisting the individual to make more rational decisions (Paul 1993).

Definitions of Critical Thinking

Several educators and researchers have provided different definitions of critical thinking. McPeck (1981) characterized critical thinking as "the appropriate use of reflective skepticism within the problem area under investigation"(p.7). McPeck believes that the criteria for correct application of critical thinking varies with specific areas of expertise and knowledge, a belief that is not shared by some of the other scholars of critical thinking.

Ennis (1985) defined critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do" (p.45). McPeck's idea of critical thinking questions the ideas of Ennis (1962) and D'Angelo (1971) who both discuss "aspects," "skills," and "attitudes" (p.59) in their definitions of critical thinking. Other proponents of critical thinking believe that there is a pattern of skills that can be itemized (Dressel & Mayhew 1957, Kemp 1963).

Lipman (1992) with the advantage of having several definitions to make

comparisons defined critical thinking as "self correcting, sensitive to context, guided by criteria, and conducive to judgment "(p.65). Paul (1993) stated that "critical thinking is a unique kind of purposeful thinking in which the thinker systematically and habitually imposes criteria and intellectual standards upon the thinking" (p.21). This definition implies a high level of reflective thinking which is directed by the subject matter.

Ennis (1985) and Siegel (1988) appear to equate critical thinking with rational thinking, without elaboration or explanation, and in fact the two terms are used interchangeably by many authors. Another weakness in their definitions is that they do not capture the term critical. In many of the definitions, critical is equated with such terms as rational, reflective, skillful, responsible, and disciplined. In addition, none of the definitions emphasizes the importance of the evaluation of outcomes (that is, individuals determining the quality of their own thought processes).

Many reseachers working in the field of critical thinking have contributed their definitions of critical thinking. Clearly, critical thinking has been defined in a variety of ways but there appear to be some commonalities in the definitions. All these definitions include the idea of purposeful thought based on knowledge which leads to considered conclusions or solutions.

Ennis' (1985, p.45) definition of critical thinking " reasonable reflective thinking that is focused on deciding what to believe or do," was selected in this study because it seemed closest to the ideals of the learning outcomes described by the Humber College Course Outlines. Additionally, Ennis with colleagues constructed the Cornell Critical Thinking Test which is an instrument that can be used to determine the critical thinking scores of college students.

The operational definition of critical thinking for this study is "reasonable reflective thinking that is focused on deciding what to believe or do (Ennis 1985, p.45).

Statement of Problem and Purpose

There have been no published studies of students' critical thinking in Canadian community colleges. A study that would give a data base on the critical thinking scores of college students would assist instructors in understanding the size of the task they are facing. There is also no information about the relationship between critical thinking and achievement scores or overall grade point averages in Canadian colleges. The role of community colleges is to prepare students for employment and citizenship, and critical thinking ability is considered important for both.

The purposes of this study are:

1. To measure critical thinking scores of business, music, and nursing students in a Canadian community college, and to determine whether students in different programs have different critical thinking scores.
2. To investigate the relationship between critical thinking scores, academic achievement scores and grade point average (GPA) of business, music, and nursing students.

Business, music, and nursing students were selected to be subjects in the study. These particular disciplines were chosen because they are three-year courses and they all have a high completion rate so that the population of the study should remain stable. These different disciplines require very different skills and address very different areas of knowledge. Although there have been several studies in critical thinking on nursing students, little such research was found in the literature on business students or music

students. Administration and faculty in these courses were co-operative and interested in having this research conducted because they were interested in their students' critical thinking scores.

Significance of the Study

Frequently, articles in our national newspaper report the distress of parents and employers over the college graduate's inadequate thinking skills. Parents and employers worry that students are not prepared for a world of accelerating change and complexity. It is considered important that students develop critical thinking, be able to analyse decisively and be prepared to seek out solutions on their own. In a world of rapidly changing technology and frequently changing employment opportunities, knowledge of facts loses importance compared to knowledge of how to think critically.

Many educators profess that the educational process is designed to produce citizens who are self-directed, autonomous and able to think independently (McPeck 1981, Frederickson 1979). A stated aim of formal education has been the development of intellectual and critical thinking. Critical thinking has been described as a fundamental ingredient for a free society (Seigel 1988). Good citizenship requires an ability to think critically about issues that are complex and controversial.

The selection of critical thinking for this study occurred as a result of the curiosity of the investigator. Many educators believe in the positive advantages of critical thinking and many course outlines list critical thinking as a learning outcome, but there appears to have been little effort to determine whether our teaching is making a positive impact on the critical thinking scores of our students. Additionally, this study

has the potential to show whether some programs are more successful than others in developing the critical thinking skills of their students. This study could provide part of the information needed to improve teaching methods. Student admission selection, counseling, and retention might also be improved with this new information about critical thinking.

The study was undertaken in order to improve, ultimately, the quality of education. If one adheres to the belief in the benefits of critical thinking, the findings of this study can be expected to be of value to students and society.

The study was carried out on three groups of college students in three different programs, namely business, music, and nursing. The information acquired from the study will be helpful in determining whether improved critical thinking ability in college students would lead to improved scholastic performance. In addition, the common interest in critical thinking may facilitate communication across the three disciplines in the college.

The idea of teaching thinking skills is not new. The writings of Plato, Aristotle, Dewey, Piaget and Thorndike refer to the concept of teaching thinking (Mayer 1983). Presently, many educators are attempting to implement innovative techniques for teaching thinking skills in the classroom in order to increase students' critical thinking abilities. A better understanding of the critical thinking process might also increase the effectiveness of teaching and learning. This will provide a part of the answer to the question, "Are critical thinking skills related to achievement scores or GPA in business music or nursing students in a Canadian community college?"

Limitations

Limitations of this study are that:

1. All participants are from the same college and in the second year of their program. It is possible that the students who self-selected themselves to the college at this time are not representative of college students in general.
2. All tests have limited validity and reliability.
3. Participation in the study was voluntary and the students could withdraw at any time. Volunteers might have characteristics that are different from the general population.
4. Results cannot be generalized beyond the population studied.

Operational Definitions

The following terms are used in this study.

Critical thinking is "reasonable reflective thinking that is focused on deciding what to believe or do"(Ennis 1985, p.45). Cognitive skills for critical thinking include: induction, deduction, observation, ability to judge credibility of information, assumptions, and meanings.

Achievement tests are those tests which educators develop to determine the degree or amount of knowledge, ability or skill the student has achieved in a specific subject or course. The final grade for the semester in the course of the students' major area of study will be used as the achievement test score.

Critical Thinking Tests in this study refer to commercially produced tests of established validity and reliability. They measure aspects of the ability to think critically.

There are at least four critical thinking tests which are suitable for testing students at a community college level of education. They are: (1) California Critical Thinking Skills Test (CCTST), (2) Watson-Glaser Critical Thinking Appraisal (WGCTA), (3) Ennis Weir Thinking Essay Test (EWTET), and (4) Cornell Critical Thinking Test (CCTT) Level Z.

Scores of three types were used. The critical thinking score was simply the number of questions answered correctly. The achievement score was the final grade in the second year course of the major subject in business administration, music, or nursing. The grade point average was based on all the courses studied in the second year of the respective programs including the major subject.

Organization of the Study

This study is presented in five chapters.

Chapter I contains an introduction to the study, definitions of critical thinking, significance of the study, statement of problem and purpose, operational definitions, limitations and organization of the study.

Chapter II contains a review of the literature on critical thinking with a discussion on development and conceptualization, commercially prepared critical thinking tests, and studies involving critical thinking of college students. Research on critical thinking of students in business, music, and nursing is also examined.

Chapter III contains the research questions, the hypotheses, a description of the research design and methodology. The population of the study, the results, and the statistical analysis of the data are documented in this chapter.

Chapter IV contains a discussion of the findings.

Chapter V contains the summary, conclusions, recommendations, and implications for further study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Introduction

This study was focussed on the critical thinking scores of business, music, and nursing students in a Canadian community college in order to determine if there were any differences in their scores and to examine the relationship of the critical thinking scores to the students' achievement scores and the grade point averages. Literature was reviewed regarding the development and conceptualization of critical thinking, the development of critical thinking tests, the investigation of critical thinking and college students, and studies of critical thinking, achievement scores and grade point average.

The Concept of Critical Thinking

To be critical means to be sceptical, to question, to analyse, to make sense of. Critical is sometimes thought of in a negative, fault finding sense but when describing thinking the word most frequently connotes a positive quality of the thinking, a quality of reason, precision and effectiveness. Researchers and educators have differed concerning the precise meaning of the concept of critical thinking and this has led to difficulties in measuring it.

Critical thinking is not so much a linear operation as a filing system from which one may select specific thinking skills in order to determine the strengths and weaknesses of particular arguments. Students critically think when they question the credibility of the source and when they question assumptions. The critical thinker sets criteria, searches the information to find evidence that satisfies the criteria, and then

judges whether the evidence is congruent with the criteria (Ennis 1962).

Ennis (1985) identifies attitudes or dispositions that assist and guide critical thinking. He mentions a propensity to evaluate information, an ability to question opinions, and an openness to consider all views. Paul (1993) elaborates on these attitudes and dispositions described by Ennis, and he also discusses clarity, fair mindedness, a desire for getting to the bottom of things, seeking evidence, a dislike of inconsistent application of standards, a steadfast desire for truth, a willingness to question what is believed and an ability to abandon long held beliefs. Critical thinking not only involves when and what to ask but a desire to ask.

Watson and Glaser (1964) concluded that critical thinking is an attitude of being thoughtful when considering arguments and problems in one's experience. Knowledge of the methods of logical inquiry, reasoning, and skills in applying these methods are necessary for critical thinking. Halpern (1992) added that critical thinking is directed thinking, thinking that is purposeful and goal oriented. Non directed thinking is routine and guides our daily routines, for example eating breakfast or driving a car. Facione (1984) distinguished between reasoning and critical thinking stating, "Reasoning is a broader concept; all critical thinking is good reasoning, but not all good reasoning is critical thinking." Facione operationally defined critical thinking as " the development and evaluation of arguments" (p.255).

To think critically the individual must be able to examine and judge observations, statements, problems, issues, beliefs, social constructs, thoughts, reflections, and reasoning. The individual must also evaluate the results of actions contemplated and, later, actions implemented. Critical thinking involves complex skills such as listening,

reading, evaluating information, looking for hidden assumptions and reaching effective conclusions. It is with practice that the individual achieves critical thinking skills of a high calibre.

Recent Developments in Critical Thinking

Although one can trace the intellectual roots of critical thinking to the teaching practice of Socrates who used probing questions in his quest for knowledge, this review of literature will be restricted to the development of critical thinking concepts in the 20th century. Dewey (1933) was one of the early scholars who advocated the restructuring of education with emphasis on inquiry and reasoning. Dewey believed that until students were converted into inquirers the problems of society would be insolvable. "To many in the critical thinking movement today, it was Dewey's emphasis on reflective thinking that was the true harbinger of critical thinking in this century" (Lipman 1992, p.106).

Edward Glaser (1941) published *An Experiment in the Development of Critical Thinking* and with Watson developed the Watson-Glaser Critical Thinking Appraisal (WGCTA). These authors described critical thinking as consisting of attitudes, knowledge, and skills. Attitudes include the willingness to acknowledge problems, and the recognition of the need for evidence to support what is considered the truth. Knowledge includes the comprehension of abstractions, generalizations and inferences. The relevant skills are the abilities to apply attitudes and knowledge. The Watson-Glaser Critical Thinking Appraisal provided an estimate of a subject's abilities on five subtests of critical thinking. The work of Watson and Glaser was very important to the development of the modern understanding of critical thinking.

In 1962, Robert Ennis published "A Definition of Critical Thinking". This article had a strong influence on the developing concept of education for thinking. Ennis continued to refine his definition of critical thinking and finally viewed it as "reflective and reasonable thinking that is focused on deciding what to believe or do" (Ennis 1985, p. 45). Ennis classifies critical thinking abilities into five main types: elementary clarity-related abilities, advanced clarity-related abilities, inference-related abilities, abilities related to establishing a sound basis for inference, and abilities of orderly and useful decision making. Ennis holds that when critical thinking skills are combined with critical thinking dispositions, there is a resulting comprehensive process that guides the individual in his or her thinking. Critical thinking stresses that all assumptions are open to question, divergent views are sought, and the inquiry does not favour a particular solution. The works of Ennis have played a significant role in the development of critical thinking.

Strong political and societal pressures have forced educators to think seriously about how they teach and encourage teaching of critical thinking in many areas of post secondary education (Lipman 1992). "In 1981, the massive 19-campus California State University instituted a graduation requirement in critical thinking intended to achieve: ...an understanding of the relationship of language to logic, leading to the ability to analyse, criticize, and advocate ideas, to reason inductively and deductively, and to reach factual or judgmental conclusions based on sound inferences drawn form unambiguous statements of knowledge or belief." (Paul 1993, pp.37,38). By 1983 the even larger California community college system had instituted a similar requirement.

In Ontario in 1988, a study was mandated by the provincial government in which the future of education in the community colleges was contemplated and the report that resulted was called "Vision 2000: With the Future in Mind". In the report the writer says "Steering Committee members were of the opinion that problem solving approaches to education would become predominant". Achieving excellence in education is a goal sought by all educators, and many educators have now taken a serious look at the importance of critical thinking.

During the 1980's there was frequent criticisms of the educational process from many sectors of society. As a result several educators responded by producing journal articles, books, and dissertations with a focus on critical thinking. In the 1990's strong pressures are being placed on educators to reduce costs and increase productivity. Many groups have recognized that the exaggerated use of rote memorization and recall of facts does not serve students well in this age of rapid change. Teaching for critical thinking stresses active participation in learning. Again, educators are searching for solutions.

In summary, the progression of the concept of critical thinking in education has a long tradition. Presently, critical thinking is receiving renewed attention as teachers increasingly reflect on their own practice, in response to pressures from a rapidly changing society seeking improved methods of teaching and learning.

Developing Critical Thinkers

Piaget (1924) developed his well accepted theory of children's thinking after observing and interviewing children. In his book Piaget described discrete individual stages of child development. He suggested that concrete thought processes in the early

years allow the child to perform only memory tasks. Later investigators questioned the stages of development finding them more continuous than discrete, and also observing that not all children experience all the stages. Piaget believed the aim of education was to transmit knowledge, and this belief was not conducive to the teaching of critical thinking to children. Since the 1970's the aim of education has begun to shift from the acquisition of knowledge to the grasp of relationships within subjects (Lipman 1992). Educators have recognized the futility of teaching facts alone and have turned their attention to incorporating more reflection and thinking into their curricula. Teachers and professors from kindergarten through postgraduate studies have worked to develop stronger critical thinking skills in their students (Young 1980, Stice 1987, Paul 1993). It is unusual to read any discussion of educational theory which does not mention critical thinking.

Critical Thinking Tests

Although there are twelve commercially available critical thinking tests, only four of these tests are suitable for students at the college level. Following is a description of the tests considered for this study.

The **California Critical Thinking Skills Test** (CCTST) examines the cognitive dimension of critical thinking, that is, it intellectually challenges one's cognitive skills using a multiple choice test which focuses on elements of thinking. Six scores can be obtained from the CCTST: (1) an overall score of critical thinking skills, and (2) five subscales: analysis, evaluation, inductive reasoning, deductive reasoning and inference. This test of 34 items requires 45 minutes to complete. This test is easy to mark, but

some questions seem to have more than one correct response.

To test for reliability, items on the CCTST were scored dichotomously. The reliability of the published version of the CCTST, computed separately by pretest and posttest ranged from .68 to .70 for the 34 item instrument. Construct validity for CCTST is still being tested. Correlations with I.Q. scores were not reported but a correlation between the Nelson Denny Reading test and critical thinking score was 0.49. There is not a great deal of published research that has used the California Critical Thinking Skills Test (Facione 1992).

The **Watson-Glaser Critical Thinking Appraisal** (WGCTA) was revised in 1980 to evaluate the ability to think critically about life situations. It is based on the concept of critical thinking as defined by Dressel and Mayhew (1954) . This concept includes the following abilities: the ability to (1) define a problem; (2) select pertinent information for the solution of a problem; (3) recognize stated and unstated assumptions; (4) formulate and select relevant and promising hypotheses; (5) draw valid conclusions and (6) judge the validity of inferences. This is an 80 item test requiring 40 minutes to complete. Reliability was assessed using, estimates of the test's internal consistency, the stability of tests scores over time, and the correlation between scores on alternate forms. Split- half reliability coefficients ranged from .69 to .85. Means and standard deviations were virtually identical when the WGCTA was administered twice to a group of 96 college students with an interval of three months between testing periods. Correlations between Otis-Lennon Mental ability and critical thinking scores was 0.61 to 0.70.

Programs which are designed specifically to develop critical thinking skills should demonstrate changes in WGCTA performance over time. Studies by Fogg and

Calia (1967) and Burns (1974) demonstrated such changes in WGCTA scores. Mitchell (1985) suggested that the WGCTA is too narrow and has a combination of controversial and neutral content that is difficult to identify. Reliability, although adequate, is not as high as in some cognitive tests, and construct validity is not as standardized as it could be. Although the format is good, the content and constructs are quite dated. The WGCTA is currently under revision to make it more contemporary and will not be ready for testing for another year (Paul 1995).

The Ennis Weir Thinking Essay Test (EWTET) is used in grades seven through college. It assesses getting the point, seeing the reasons and assumptions, stating one's point, offering good reasons, seeing other explanations, understanding, overgeneralization, and using emotive language to persuade. This test requires written responses to nine paragraphs and a time limit of 40 minutes is suggested. Content validity has been examined and interrater reliability on the essays is .82. This test requires interrater reliability and scoring interpretation which this investigator felt might lead to scoring problems.

The **Cornell Critical Thinking Test** (CCTT) Level Z is a multiple choice test of 52 items which takes 50 minutes to complete. This critical thinking test is based upon the definition, "Critical thinking is the process of reasonably deciding what to believe and do" (Ennis 1962, p.81). It measures aspects of critical thinking such as induction, deduction, observation, assumptions, and meaning. In a perfect situation, attitudes of critical thinking such as open-mindedness and regard for being well-informed should be tested. Since it is very difficult to test attitudes, it was not attempted to test them. Value judgment was not tested in order to avoid penalizing students for political, social or

economic values held. Induction, deduction and assumptions are strongly weighted in the Level Z test and the interdependent aspects of critical thinking are recognized in the scoring of this critical thinking test.

The Cornell Critical Thinking Test, Form Z, was constructed for advanced and gifted high school students, college students, and adults. The population of this study falls within this category. The CCTT manual (Ennis, Millman, Tomko,1985) explains that this test is designed to detect differences in critical thinking between groups. The test is easy to administer and score. Examination of the subsets of the test may also explain similarities and differences between groups; for example, one group may have higher scores on the subtest of deduction than the other groups . The revised CCTT has been used extensively since 1985 for assessment, evaluation, and placement. The psychometric properties, e.g. validity and reliability of this test are discussed in chapter three as this was the instrument used in this study to obtain critical thinking scores.

Critical Thinking and College Education

There is a large and ever increasing volume of literature on critical thinking in college curricula. Since a major focus of this study is to determine the relationship between critical thinking and both achievement scores and grade point averages, a review of some of the literature on critical thinking at the college level is appropriate. These studies fall into three areas, 1. studies using specific instructional strategies, 2. studies of how specific courses could affect critical thinking, and 3. studies that investigate the impact of extensive use of critical thinking throughout entire college programs.

1. The studies using specific instructional strategies failed to support the idea that

a specific educational technique will enhance the students' critical thinking. Possibly the period of one semester was too short to produce a measurable increase in critical thinking abilities, and possibly the measures in the studies needed to be more curriculum specific. The small numbers of subjects in the studies might also have contributed to the negative findings (McMillan 1987).

2. Several studies have examined the impact of taking specific courses or programs on critical thinking. Williams (1951) measured critical thinking scores before and after participation in college debates, and found no significant difference. Lyle (1958) studied the effect of a special psychology course designed to enhance critical thinking and reported that no significant change in critical thinking occurred. Gressler (1976) investigated the effect on critical thinking of a research course and found no significant difference between the scores before and after the course; a control group of students who did not take the research course similarly showed no change in scores.

Beckman (1956) studied the effects of courses in argumentation and discussion in several colleges and found improved critical thinking. There were greater improvements in some colleges than in others, but within a college there was no significant differences between the performances of different classes. Jackson (1961) compared gains in critical thinking in college debaters to comparable control groups. He reported that in five colleges, debate students experienced significantly higher gains than control students, but in four colleges the control group experienced larger gains than the debaters. Dressel and Mayhew (1954) studied science reasoning and reported no differences between the science reasoning ability of students who were taking a science course and students not taking a science course.

One study examined the effect of specific courses or programs on critical thinking. Dressel and Mayhew (1954) found a significant gain in critical thinking for freshman enrolled in a social science course. The question arises as to how all the variables of college were controlled. Is the gain a result of the social science course or is it a result of another variable?

3. Studies have examined the effects of participation in college programs that include critical thinking in essentially all the courses. A study by Tomlinson-Feasey, Williams and Eisert (1977) evaluated the impact of the first year of such a college program on critical thinking in freshman and found no significant differences between the treatment group and two comparison groups. Whitla (1977) assessing changes in the cognitive abilities of students during undergraduate work found senior students composed more forceful and logical essays than freshmen students. Again many variables may have accounted for this finding. Kokinda's (1989) study in critical thinking did not support Whitla's study. Kokinda found the measurement of critical thinking abilities with WGCTA did not demonstrate any significant gains in test scores between freshman and senior nursing students.

McMillan (1987) makes an interesting comment regarding the program of Alverno College:

> Alverno College is perhaps the best example of an entire college devoted to teaching and measuring critical thinking... The curriculum is built around a theoretical framework of critical thinking, which allows for multiple perspectives within a broad definition. (p.9).

Results from longitudinal and cross-sectional studies with a number of established measures of critical thinking at this college indicated no significant differences between freshmen and seniors.

It is evident in reviewing the literature that many studies have attempted to determine how students best acquire critical thinking skills. Deliberate attempts to improve critical thinking skills have not met with notable success.

Readiness for Critical Thinking

Educators have debated the question of when critical thinking is best taught to students. The Critical Thinking Movement at Sonoma University in California have prepared curricula beginning in kindergarten and continuing through to grade 12. Generally it is considered advantageous that an awareness of critical thinking is introduced no later than the middle grades of elementary school. Most students have had some exposure to critical thinking before arrival at college.

Brookfield (1987) expresses the idea of critical thinking being a lifelong learning experience and he suggested that critical thinking cannot be fully achieved until adulthood. He felt that all adults critically think but that the frequency and effectiveness varies from person to person. Brookfield stated that the ability to think critically is crucial "to understanding ourselves, to developing productive workplaces, and to becoming politically sophisticated" (p.51).

Twentieth century critical thinkers believe that we must not teach students what to think but how to think. This idea is especially pertinent in the light of the rapid changes and the complexity of the information society in which we find ourselves (Kurfiss 1988).

Critical Thinking and Business Education

Business and industry are responding to increased pressures to be competitive by seeking workers with higher order thinking skills. Colleges have a responsibility to provide their students with the opportunity to develop these thinking skills. A search of the *Business Education Index* and *ERIC* revealed only a limited number of articles related to critical thinking and business education. Morrison (1993) described how electronic dialogue was used to promote critical thinking. Stallard (1992) described a strategy for teaching critical thinking skills in business communication.

In Australia, 415 business management students completed the Watson-Glaser Critical Thinking Appraisal. The results corresponded reasonably closely to the Watson-Glaser studies of United States business students with roughly equivalent educational standings. The mean scores for three groups of U.S. business students were 53.2, 55.3 and 59.5 and for three comparable groups of Australian business students were 55.3, 55.7 and 60.4. These Australian researchers also retested the critical thinking scores of the same students after an eight week period of exposure to critical thinking instruction. The results did not demonstrate any significant gain in scores. "The correlation coefficient based on 36 subjects tested eight weeks apart, of 0.77, shows a reasonable consistency of response" (Hicks and Southey 1990, p.75). It seems that eight weeks of instruction with critical thinking techniques is insufficient to create measurable increases in critical thinking abilities in business students.

Critical Thinking and Music Education

The literature describing critical thinking and music education is not very extensive. Erbes (1988) stated that critical thinking is a vital part of music education. He describes eight critical thinking skills (focussing, information gathering, remembering, organizing, analysing, generating, integrating, and evaluating) as goals of music education. In an article published in Music Educator Pogonowski (1989) stated that dialogue that involves students in analysis can help them become better listeners and musicians. She believes that learning is enhanced by classroom interactions that encourage analysis, synthesis, and evaluation of content.

The literature did not reveal any studies that reported music students' critical thinking scores. Presumably those scores have not been measured or they are unpublished.

Critical Thinking and Nursing Education

Presently critical thinking is considered a necessary learning outcome in most Canadian nursing education programs. Nursing has identified critical thinking as a set of cognitive skills that health professionals require in order to carry out their professional responsibilities. Critical thinking skills are necessary when working with patients and families, when caring for newborns or the elderly, and when monitoring vital signs with complex technological equipment. Nurses need to be critical thinkers and they must also teach certain critical thinking skills to patients and their families.

Several nursing studies have reported the relationship between critical thinking skills and academic achievement. Frederickson's (1979) pilot study of WGCTA scores,

and student's GPA, in a baccalaureate nursing program concluded that there was no relationship between the critical thinking and the GPA of students at the beginning of the nursing courses. However, there was a positive relationship between critical thinking scores and GPA nursing scores at the end of the program. Students with higher critical thinking scores had higher GPA's than students with low critical thinking scores (0.05 level). Frederickson did not report raw scores, or means. The participants were volunteers and the sample studied was not necessarily representative of the total group. This was one of the earliest published studies on critical thinking and GPA and the results suggested that critical thinking had a positive relationship to the GPA of the students completing the tests. The results of the present study did not coincide with Frederickson's study of critical thinking scores and GPA.

Berger (1984) found no significant correlation between critical thinking scores on the WGCTA and nursing GPA ($r = .14$) in a sample of 137 baccalaureate nursing students. It was noted in Berger's study that critical thinking scores increased as students progressed from the second to fourth year of their nursing education. The mean WGCTA score in second year was 77 and the range was 50 to 96. When this same group was tested in their final year, the mean WGCTA was 80 and the range was 55 to 95. This was a statistically significant increase ($t=3.98$, $p < 0.05$). No information was given on the method of selection of nursing students. The study found an increase in critical thinking scores over a two year period but the critical thinking score did not correlate significantly with the GPA score of the student. Berger found no significant gender differences.

Gross, Takazawa & Rose (1987) in a study using WGCTA with a convenience

sample of 120 Bachelor of Science of Nursing students found a "slight correlation" between critical thinking scores and GPA at graduation ($r=.20$, $p<.05$). Also, there were highly significant increases in mean critical thinking scores from entry to graduation. Entry mean score was 45.0, graduation mean score was 56.4, ($t=9.05$, $p<0.00$). Sample size because of attrition was 71. This study found a larger increase in critical thinking scores but the time period was four years as compared to two years in the Berger study.

A study of a sample of 159 volunteer students in a Bachelor of Science of Nursing program, by Bauwen & Gerhart (1987), found that pre nursing GPA was strongly correlated with the nursing cumulative average ($r=0.62$, $p<.005$). The entry WGCTA scores accounted for 28% of the variance in the graduation WGCTA score. These findings suggest that critical thinking is a good predictor of successful grades in nursing. They found no significant differences between entry and graduation critical thinking scores. This finding implies that nursing education does not produce gains in critical thinking as measured by the WGCTA . Only 52 students from the sample took the WGCTA just before graduation, and the volunteers were perhaps unlike those who did not write the test; the interpretation of the findings should be viewed with caution.

Waite (1989) and Kokinda (1989) indicate that critical thinking abilities as measured by the WGCTA are positively associated with students' GPA . In the Waite study the critical thinking scores showed "no significant differences were noted in student characteristics of age, sex, educational experience, or work experience, but GPA was significant at the ($p<.05$)." p.58). Kokinda found correlation of WGCTA and GPA in her second level (Sophomore) students ($r=.71$, $p<.02$). The results of a correlation between WCGTA and GPA of first year students was very different ($r=-.03$, $p=.93$).

When the same variables were calculated for third year students (r=.44, p= 0.10) and fourth year students (r=.15, p=.60). The results were quite varied in the different years. The students in second year had the highest critical thinking scores and also the highest correlation with their GPA. Kokinda explains that these students were studying from a new structurally reformed curriculum which integrated theory and practice.

Miller (1992) found no relationship between WGCTA and GPA in general education courses but there was a low significant correlation between WGCTA and nursing GPA (r=.20, $p<0.05$). This suggests a negligible relationship between critical thinking scores and nursing scores and between critical thinking scores and scores in general education courses.

There are some differences in the results of the studies, possibly because the studies examined students with different characteristics. Also, several of the items in the WGCTA are of a political or legal nature which may have been interpreted somewhat differently by students in different geographical areas. The method of calculating the grade point average may have varied in the different studies; that is, some studies may have considered GPA as the average of the nursing subjects only and other studies may have averaged the general education subjects with the nursing subjects.

Summary

This chapter has examined some of the published knowledge about critical thinking. The development of critical thinking and the emergence of the critical thinking movement were examined. Critical thinking research related to business, music, and nursing education was described. Studies of critical thinking and business education

have been few, and the same is true for critical thinking and music education. There have been more studies of critical thinking and nursing education, but there is no consensus about the relationship between critical thinking and academic achievement.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

Introduction

The purpose of this study was (1) to measure the critical thinking scores of business, music, and nursing students in a Canadian community college, and (2) to determine if there is a relationship between critical thinking, academic achievement in the major subject area as measured by the numerical final grade of the students, and overall grade point average (GPA). In this chapter the student subjects are described and the procedures used to collect the data, and the statistical procedures used to analyse the data, are explained.

Research Questions

The study generated the following questions:

1. Are critical thinking scores significantly different among business, music, and nursing students?
2. Is the relationship between critical thinking scores and achievement scores different among business, music, and nursing students?
3. Is the relationship between critical thinking scores and GPA different among business, music, and nursing students?
4. What are the relationships of age, gender and English as the first language spoken to critical thinking scores of business, music, and nursing students?

Hypotheses

The hypotheses tested in this study were:

1. There is no significant difference among the mean critical thinking scores of business, music, and nursing students.
2. There is no significant relationship between critical thinking scores and achievement scores in business, music, or nursing students.
3. There is no significant relationship between critical thinking scores and GPA scores in business, music, or nursing students.
4. There is no significant relationship between critical thinking scores and age.
5. There is no significant difference between critical thinking scores of the men and women.
6. There is no significant difference between critical thinking scores of students whose first language is English and students whose first language is not English.

Authorization and Informed Consent

Permission for this study was obtained from the University Committee on Research Involving Human Subjects at Michigan State University. The Vice-President (Academic) of Humber College, Toronto, Ontario, Canada, the Associate Vice President of the Lakeshore Campus, and the Chair of Nursing at Humber College consented to the subjects participating in the research.

A consent form (Consent Form, Appendix A) was developed and each student signed the consent before participating in the study. Anonymity for individuals was maintained when reporting the data of the study.

Participants of the Study

The participants were volunteers from the 1996 second year students in business administration, music, and nursing at Humber College of Applied Arts and Technology, Toronto, Ontario, Canada. This college is one of the five community colleges in metropolitan Toronto. The college is located on three campuses, North, Lakeshore, and Keelesdale. The North Campus has approximately 6500 students; Lakeshore has 2000 students, and Keelesdale provides programs for 600 full and part time students. The college offers 135 full time diploma and certificate programs at the post secondary level. There are eight major divisions: arts and performance, business, community and social services, engineering technology, health care and human services, tourism and leisure, liberal arts, and media arts.

A survey of Humber College students (Dietsche 1996) reveals that the students' ages range from 17 to over 40 with 83% of them being between 17 and 24 years of age. Eighty-eight per cent of the students are single, and eighty-five per cent have no dependants. Sixty-two per cent of the students were born in Canada, and 14 % are naturalized Canadians. The remainder of the students are landed immigrants, refugees, or visa students. There are over twenty different cultural groups represented by the students with English, Irish, and Scottish the majority at 43% and Italian next at 13%. English is spoken " always" or "sometimes" in 89% of the homes and no English is spoken in the home by 11% of the students. Although ninety per cent of the students attended secondary school in Ontario, because of the large number of immigrants now attending community colleges it was thought that the level of ability to speak English might influence the scores on the test that is written in English.

The college admission requirements include an Ontario Secondary School Diploma (Grade 12) at or above the general level, or equivalent, or "mature student status". To obtain a diploma at the general level the student is required to complete thirty credits with a minimum grade of 50%. Subjects such as English, Mathematics, History, Geography, Science, Social Studies, and Family Studies are required. A mature student is an individual 19 years or older who has not attended school for at least one year. In addition to the general admission requirements, the business administration students must have completed Grade 12 English and Mathematics at or above the general level. The music applicants must meet the general admission requirements and must also audition on one major musical instrument. The nursing students must complete two different science courses at the general level such as chemistry, physics or biology as well as the general admission requirement. Prior to admission, nursing students are tested for reading and mathematical skills. This testing is not done for either business or music students; it is done for the nursing students as a selection procedure because of the large numbers of students applying to the program.

Students in the second year of the business, music, and nursing programs were invited to participate in this study. Second year students were selected because they had completed the elementary part of their program and were studying the major theory content of their individual course programs. It was thought that students in second year may have increased their critical thinking skills because of their college studies. Not all the programs at Humber college required three years of study to completion, but programs of equal length were considered desirable for this study in order to have a more comparable sample. Third year students are difficult to access for testing because a

great deal of their work is in clinical practice or field work away from the campus.

The Business administration program is a three year program of 36 courses over six semesters. The students study all of the basic business subjects in the first year of the program. Second and third year students can choose electives in the area of particular interest to them. There is a total of 540 students in the program, with 189 in the second year. Of the 189 second year students, 56 (29%) participated. Approximately 49% of the 540 business students are female.

One of the goals listed in the School of Business Course Outline 1995-1966 states that the students will be "learning to solve problems by using critical thinking and a systematic problem solving approach". The achievement score for the business students was the final grade in the second year business theory course.

The Music diploma program is unique in Canada and has international status. Students from this program graduate with a music diploma because community colleges in Canada do not have authorization to grant degrees. The music program is a three year program of 38 courses over six semesters. All the students take the *same* ten courses in their first year (total of 23 hours per week). They then choose either composing, performing, or a combination of both for the next two years of the program. Instruction in synthesis, midi and computer-assisted score production are given to students to keep them abreast of recent advances in music technology. There is a total of 263 students with 85 students in the second year of the program. There were 57 music students who completed the critical thinking test which was 67% of the second year music students. Approximately 20% of the music students are female.

The achievement score for the music students was obtained from their final grade

in the second year music theory course. The goal of the music theory course is to introduce the student to melody, harmony, rhythm , and symbolization. Emphasis is given to writing, reading, and improvising music. Throughout the course students are required to explain and demonstrate various aspects of writing and improvising music. Numeracy, literacy, problem solving and professional skills are taught using critical thinking strategies in order to achieve high standards of performance. (School of Performing Arts Course Outline 1995-1996).

The Nursing diploma program is a three year program with 33 courses over six semesters. Students study basic nursing subjects, as well as bioscience, psychology and sociology in their first year. Nursing theory, pathophysiology, pharmacology, leadership, computers in health care, and an elective are studied in the second and third years of the program. In addition, 1,250 hours of supervised nursing practice are required in a hospital clinic to meet the provincial nursing standards.

A theme throughout the nursing curriculum is "nursing process". Nursing process is a set of procedures used to determine nursing care. Nursing process includes assessment of the patient, nursing diagnosis, and the planning, implementing, and evaluating of nursing care. This process involves critical thinking, and critical thinking is considered essential for the practising nurse (Miller and Babcock 1996). Another learning outcome states "demonstrates a willingness to listen and accept opposing points of view and appreciate the merit in new/different points of view" (School of Health Science Course Outline 1995-1996). This goal also refers to elements of critical thinking which the faculty desire to impart to the nursing student.

The total enrollment of nursing students is 614 with 223 students in the second

year of the program. There were 68 participants, or 31% of the second year nursing students completed the study. Ninety per cent of the students in the nursing program are female.

Instrument

The Cornell Critical Thinking Test, Level Z, was administered as described in the manual (Ennis, Millman , Tomko, 1985). This test is considered appropriate for college and adult populations. The CCTT, Level Z, tests specific aspects of critical thinking: induction, deduction, observation, assumptions, and meaning. Induction is tested by items where the hypothesis is supported by its ability to explain facts and by its plausibility. Deduction is measured in items that require the individual to arrive at conclusions. Observational ability is tested by the ability to differentiate between an observational statement and an inferential statement. Assumptions and meaning are tested by the ability to fill the gap in reasoning and to weigh the evidence.

The Cornell Critical Thinking Test, Level Z, has been used since 1960 in many American studies. Internal consistency / reliability of the CCTT was estimated by both the "corrected split -haves" and "Kuder Richardson" 20/21 procedures. Split-halves estimates corrected by the Spearman Brown ranged between .55 and .76, and the Kuder Richardson estimates ranged between .50 and .77 (Ennis, Millman, Tomko 1985).

The items of the Cornell Critical Thinking Test have been discussed by members of the Illinois Critical Thinking Project and there is agreement that the designated items do test for the individual aspects of critical thinking ability indicated. This agreement is one " basis for the content validity claim." (Ennis, Millman, Tomko 1985, p. 15).

Another basis for the claim of content validity is that the answers to the questions can be defended.

According to Ennis, Millman, and Tomko, construct validity of a test depends on its accuracy to test a system of knowledge, and the extent to which the test contributes to that system of knowledge (1985, p.16). Correlation of the CCTT, Level Z, with other tests measuring critical thinking cluster around r= 0.50. Correlation of the CCTT with the Watson-Glaser Critical Thinking Appraisal is 0.79. Correlations between Scholastic Aptitude Test scores and CCTT scores range from 0.36 to 0 .71. As a predictor of graduate school success the CCTT, Level Z, did as well as the Graduate Record Exam. CCTT, Level Z, did not correlate highly with personal variables, dogmatism or neuroticism in undergraduate students. CCTT, level Z, did not correlate with personality variables, and no significant relationship was found between critical thinking and neuroticism.

Data Collection

All students completed the test items within the allotted 40 to 50 minutes. Students were able to follow the test directions without difficulty.

The data were collected in the spring semester 1996, from second year students in the business administration, music, and nursing diploma programs. The Cornell Critical Thinking Test, Level Z, was taken in a classroom setting with the investigator present to give instructions and to collect the consent forms, answer sheets, and booklets. The volunteer subjects also agreed in writing that their major course grade and their GPA score would be available to the investigator for the purposes of the study. Demographics

such as age, gender, and first language spoken were collected to determine whether these variables influenced the critical thinking scores.

The percentage numerical achievement scores and grade point averages were obtained from the registrars' office at the end of the semester for all of the business, music, and nursing students in the study.

Statistical Analysis

The critical thinking score for the CCTT, Level Z, is the number of questions answered correctly. The achievement score was the final grade in the second year of the major subject in business, music, or nursing. This was a numerical grade with a possible maximum score of 100 in all three groups. The grade point average was based on all the courses studied in the spring semester of the second year, including the major subject. ANOVA was used to test for differences among mean scores of the three groups of students. Alpha was chosen as 0.05. The t test for independent means was used to test for a difference between the means of the two gender groups and between the means of the two language groups (English or not English as the first language). The Pearson product moment coefficient of correlation using a two-tailed test at the .05 level was calculated to assess the relationships between critical thinking scores, achievement scores, GPA, and age.

Summary

The research design and methodology followed from the hypotheses. Students from three different programs at Humber College in Toronto were tested for their critical

thinking ability , using the Cornell Critical Thinking Test, Level Z. Statistical analyses were done to assess possible differences in scores of the three groups, and to assess possible correlations between scores of critical thinking ability, and academic achievement, GPA, and age. Gender of the students was also examined for a possible influence on with critical thinking ability, as was English as a first language.

The study investigated the relationship between critical thinking skills and academic achievement. Correlation does not connote causation. When two variables correlate highly, it cannot be concluded that one is necessarily influencing the other (they could both be under the influence of the same, third, factor), but if two values do not correlate in a study then it can be concluded that they are in fact exerting no measurable influence on each other in the context of the study.

CHAPTER FOUR

RESULTS: DESCRIPTION, ANALYSIS AND DISCUSSION

Introduction

A major objective of the study was to see whether there were any significant differences in critical thinking ability among second year business, music, and nursing students in a Canadian Community college. Another objective was to see if there was a significant relationship between critical thinking and (1) achievement and (2) GPA of these students. Table 1 shows the percentage of completed tests.

Table 1. Percentage of Students Completing the Cornell Critical Thinking Test

Program Year 2	# of Respondents	Total Number	% Responding
Business	56	189	29
Music	57	85	67
Nursing	68	223	31

About thirty per cent of the business and nursing students volunteered to complete the critical thinking test. Students decided not to participate for a variety of reasons such as being scheduled to work and having planned to leave class early, or having appointments or preferring to use the time for study.

The music students had the highest percentage of participants in the study (67%), possibly because their available times for the test were mid morning and they had fewer reasons for leaving during the testing period. The music students also displayed more curiosity about the test and asked many more questions about the purpose of the study than the other groups of students.

Overall, only 36.42 % of the total number of second year students in the three programs completed the critical thinking test. The sizes of the samples (56, 57, and 68) were not as large as the investigator had hoped but they were large enough to allow the planned statistical analyses. The fact that only 36% of eligible students volunteered means that the results must be interpreted with particular care. It might be that the results apply only to students who are unusually cooperative, or only to students who are unusually interested in research, or only to those who have a great deal of free time.

Educational Variables

Question # 1 asked, "Are the critical thinking scores significantly different in business, music, and nursing students in a Canadian Community College?" The mean score, the median, standard deviation and range for each of the three groups of students was calculated. The students in business had scores ranging from 4 to 37, music students scored from 7 to 34, and nursing students scored from 5 to 34. The maximum possible score is 52. The median score of the business students was 23, the median score of the music students was 22, and the median score of the nursing students was 22. The standard deviation was 5.81 for the business students, 5.06 for the music students and 6.11 for the nursing students. The mean score for business students was 22.10, for music students was 21.30, and for nursing students 22.30. The similarity of the scores indicate that there was little difference in the critical thinking scores of the business, music or nursing students. Table 2 report these findings.

Table 2.Mean, Median, Standard Deviation and Range of the Groups on the CCTT

Program Year 2	# of Subjects	Mean	Median	Standard Deviations	Range
Business	56	22.10	23	5.81	4-37
Music	57	21.20	22	5.06	7-34
Nursing	68	22.30	22	6.11	5-34

The mean, medium, and standard deviation of the three groups were similar. A possible explanation for the similarity of the critical thinking scores in the three groups of Humber College students is that almost all of the subjects in this study are graduates from Ontario High Schools and they might have developed their critical thinking skills during their high school education. Additionally, the standards for admission to the three courses are very similar, which might have drawn students with similar abilities.

Analysis of Variance (ANOVA) was used to determine if a significant difference existed in the critical thinking scores of the three groups of students. No statistically significant difference was observed among the critical thinking scores of the three groups $F(2,178) = .46$; $p=0.63$. Alpha was established at 0.05. Table 3 reports these results.

Hypothesis # 1 predicted no significant difference in the mean critical thinking scores of business, music, and nursing students. These results support the null hypothesis. The critical thinking scores tested by the Cornell Critical Thinking Test did not appear to be affected by the specific program that the student is enrolled.

Table 3. ANOVA Table: Summary Data of Three Groups on CCTT Scores

Source	d.f.	S.S	M.S.	F
Treatment (between col.)	2	33.02	16.51	.46
Residual (within col.)	178	6350	35.68	
Total	180	6383		

Question # 2 asked, "Is the relationship between critical thinking scores and achievement scores different among business, music and nursing students?" The Pearson-Product Moment Correlation was used to determine the relationship between the critical thinking scores and the achievement scores of the three groups. Table 4 is a summary of the achievement scores of the business, music, and nursing students.

Table 4. Summary of Achievement Scores

Program Year 2	Mean	Median	Standard Dev.	Range
Business	74.85	76.00	9.34	27 - 89
Music	79.29	79.00	10.19	60 - 98
Nursing	66.40	67.00	7.75	46 - 83

Table 5 reports the correlation coefficients and the p values. Little if any correlation between critical thinking scores and achievement scores of the three groups were noted (r= 0.18, 0.11, 0.21; p=0.23, 0.46, 0.09; n.s.).

Hypothesis # 2 stated there is no significant relationship between critical thinking scores and achievement scores in business, music, or nursing students. These results confirm the null hypothesis to be correct.

Table 5. Relationship between Critical Thinking and Achievement Scores

Program Year 2	Pearson r	p
Business	0.18	0.23
Music	0.11	0.46
Nursing	0.21	0.09

The p value is the chance of obtaining a correlation coefficient as far from zero as the one found if the two variables (critical thinking and achievement scores) are really not correlated at all in the overall population.

Question # 3. asked, "What is the relationship between critical thinking scores and GPA for business, music, and nursing students?" The Pearson-Product Moment Correlation was used to determine the relationship between critical thinking scores and GPA. Table 6 reports the GPA for the students in the study and Table 7 reports the correlation coefficients and the corresponding p values.

Table 6 Summary of GPA Scores

Program Year 2	Mean	Median	Standard Dev.	Range
Business	76.18	76.00	8.37	50-92.20
Music	80.07	80.50	4.26	71.90-88.70
Nursing	71.92	73.60	11.02	21-86.40

Table 7 Relationship between Critical Thinking Scores and GPA

Program 2nd Year	Pearson r	p
Business	0.13	0.39
Music	0.30	0.03
Nursing	-0.02	0.89

* Significant $p < 0.05$

The results of the business and nursing students showed little correlation between their critical thinking scores and their GPA scores. There was a small positive ($r=0.30$, $p=0.03$) correlation between critical thinking scores and GPA of the music students. Studies by Frederickson (1970), Gross, Takazawa, and Rose (1987) and Miller (1992) also found a small correlation between critical thinking scores and GPA. In his study Lehmann (1960) found that "better"critical thinkers had a higher first term GPA. Berger (1984) on the other hand did not find any significant correlation between critical thinking scores and GPA in her investigation.

The low positive correlation between GPA and critical thinking scores of the music students suggests that critical thinking may be marginally influencing the GPA, that the GPA may be influencing critical thinking (seems very unlikely), or another variable may be influencing both the critical thinking scores and the GPA.

Hypothesis # 3 states there is no significant relationship between critical thinking scores and GPA scores in business, music, or nursing students. This hypothesis is correct for business and nursing students, the music students' critical thinking scores had a small but significant correlation with their GPA scores.

Question # 4 asked "What are the relationships of age, gender, and English as the first language spoken to critical thinking scores of business, music, and nursing students?

Demographic Variables

An analysis of the demographic data found that age did not correlate significantly with critical thinking scores. Business, music, and nursing students' critical thinking scores and age showed little correlation. Table 8 reports the Pearson-Product Moment coefficient of correlation results of age and critical thinking.

Table 8 Relationship between Age and Critical Thinking Scores

Program Year 2	Pearson r	p
Business	0.24	0.09
Music	0.07	0.64
Nursing	-0.09	0.46

A two- tailed t test for independent means ($t = 1.41$, df. 172 $p > .05$) revealed no statistically significant difference in critical thinking between the scores of female and male subjects. Table 9 presents the results. Lehmann (1960) also found no significant differences in the scores of the female and male students on the Watson-Glaser Critical Thinking Abilities test.

Table 9 Relationship between Gender and Critical Thinking Scores

Gender	Mean CCTT Score	Median	Standard Dev.
Female (n = 107)	22.34	23	5.71
Male (n = 74)	21.07	22	5.94

The subjects who reported English as their second language had a mean critical thinking score of 20.2, and the subjects whose first language was English had a mean score of 22.4. A two-tailed "t" test showed no significant difference ($p< 0.05$).

Table 10 reports this finding. The small number of students reporting English as a second language precludes generalizing this result to other populations of students.

Table 10. Relationship between Language and Critical Thinking Scores

Primary Language	Mean	Median	Standard Dev.
English (n = 163)	22.40	23.00	5.92
Not English (n=17)	20.20	21	5.40

Hypotheses 4, 5, and 6 predicted no significant relationship between age, gender, and English as a first language and critical thinking scores. The results support these hypotheses.

Discussion

There was no significant difference noted in the critical thinking scores of the second year students in business, music, and nursing programs at Humber College. No significant correlation was found between critical thinking scores and achievement scores and similarly no significant correlation was found between critical thinking scores and GPA except for music students where there was a low but significant correlation (r=.30). It seems reasonable to think that if critical thinking skills were a major determinant of achievement scores, (i.e. if critical thinking ability exerted a major influence on achievement scores) then critical thinking scores and achievement scores would correlate more highly. No significant relationship was found between age, gender, or English as a

first language, and critical thinking scores.

CHAPTER FIVE

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The critical thinking scores of some Canadian college students were measured. The study investigated the relationship between critical thinking scores, achievement scores, and program GPA of students in business, music, and nursing in an Ontario Community College. Demographic information supplied by the students were also examined to determine if there was any relationship between critical thinking scores and age, gender, or language first spoken.

The Cornell Critical Thinking test was used to measure critical thinking. Achievement scores were the scores the student obtained in their major subject area and GPA was the average of all the scores the student obtained. Results were described, discussed, and tested. Both descriptive (r) and inferential (ANOVA) statistics were used to analyse the data.

Conclusions

Based on the resulting data the following conclusions can be drawn. First, there was no significant difference between critical thinking scores of the business, music, or nursing students. This was so despite the very different interests and curricula of the three groups. This finding suggests that none of the three curricula, (business, music or nursing) has any measurable advantage in developing students' critical thinking skills. This is consistent with the findings of Waite (1989) who found that the nursing curriculum model did not influence students' critical thinking scores.

A possible explanation for the similarity of the critical thinking scores in the three

groups is that almost all of the students are graduates from Ontario High Schools, and much of the critical thinking ability of students might have developed prior to their college education. The first year of college might have contributed only a small part of the ability. Additionally, the standards for admission to the three courses are very similar and these admission standards might select students with a certain level of critical thinking ability.

Secondly, there was no significant correlation between achievement scores and critical thinking scores in the business, music, or nursing students. This finding suggests that critical thinking does not have a strong influence on achievement scores; that is, high critical thinking scores do not assure high achievement scores and vice versa.

Thirdly, there was no significant correlation between GPA and critical thinking in the business or nursing students. A low but significant correlation ($r = 0.30$, $p<.05$) was found between critical thinking scores and GPA for the music students. One possible reason for this was mentioned previously; the music students wrote their critical thinking test in the morning and seemed unusually enthusiastic about completing the task. The music students might have had more interest in achieving high scores, both in the critical thinking test and in their program.

Other noteworthy findings of the study were that age did not correlate significantly with critical thinking scores, and there was no significant difference between the critical thinking scores of males and females. Also, seventeen students reported English as a second language but the critical thinking scores from this group did not differ from the other students' scores. There appears to be no measurable advantage or disadvantage in having a first language different from the language of the test for this

group of students.

Implications

The major aim of education in the Ontario community colleges is to provide students with skills which will assist them to function in the workplace. Another published objective is to develop responsible citizens with sound judgment and problem solving skills, and it is the achievement of this objective, perhaps, that would benefit from an improvement in the students' critical thinking skills. Critical thinking is needed to function fully in modern society.

Faculty in teaching adhere to their beliefs and values. If critical thinking is a value and if development of problem solving skills is an objective, it is important to determine how to develop critical thinking skills in the students. Resources would be required to carry out the research necessary to answer the question "how".

The findings of this study demonstrated no strong relationship between students' critical thinking skills and academic success in three specific disciplines but the overall objective of developing sound thinking skills in students should not be forgotten. In an age of rapid technological and other changes, critical thinking is presumably important to anticipating changes and deciding how to maintain employability. It might be that the major skill required for academic achievement is recall, whereas the major skill for long term employability is critical thinking. Perhaps the focus should be on rethinking classroom objectives, developing critical thinking strategies, and concentrating on the learner environment so that teaching would be more congruent with the learners' long term needs.

Recommendations

The literature review suggests that critical thinking is a necessary part of the education of citizens for the 21st century. The course outline of many college programs list improvement in critical thinking as an expected learning outcome, but it is not known whether the courses actually do improve the critical thinking of the students. Very little research has been done to investigate the question.

As a result of this study, recommendations for education, and research are suggested. From the data it seems that it is necessary to pursue additional research in critical thinking in order to acquire sufficient understanding to help students achieve long term success. If educators are convinced of the need to develop effective critical thinking abilities in students (in spite of the lack of support from the results of this study) the following recommendations are suggested:

1. If critical thinking skills can be taught, research is needed to determine methods of teaching that would effectively enhance the critical thinking of students.
2. Early in the community college experience, base line readings of the students' critical thinking should be established, and students should be retested at regular intervals to ensure that critical thinking skills are being developed.
3. Educators should consider how best to bring critical thinking concepts into their curricula along with the content they need to cover.
4. The use of critical thinking strategies in general teaching methods should be examined.
5. Research using multiple tools to test the critical thinking skills of students may determine more accurately how best to assist students acquire critical thinking ability.
6. Educators could evaluate their own critical thinking abilities and commitment to the

development of critical thinking in themselves and their students.

7. Follow up of the graduates of programs emphasizing critical thinking might reveal whether or not critical thinking skills are being used in the workplace, and if so, how.

8. This study should be replicated with larger number of subjects in order to allow generalizations to larger populations.

APPENDICES

APPENDIX A

INSTRUCTIONS FOR CORNELL CRITICAL THINKING TEST

* May I begin by thanking you for assisting me with this study of critical thinking.

* The purpose of this study is to examine the relationship between critical thinking scores and academic achievement scores obtained by the students. The results of this test will have no influence on your final grades in this course or any other course. The results will be used for research purposes only. Results from the study will be published only in a form that does not allow identification of the results of individual subjects. Data will be managed to ensure the maintenance of confidentiality.

* You will be given a consent form, an answer sheet and a booklet of the Cornell Critical Thinking test. These forms should be filled out and then you can commence the test.

* This test takes approximately 50 minutes to complete. You are allowed to go back and change answers if you desire. After 50 minutes the researcher will request that you hand in the forms and booklet.

*Do you have any questions?

*You can start writing.

* (After 50 minutes) Please place your answer sheet and consent sheet inside the booklet and return to me. Thank you.

APPENDIX B

CONSENT FORM FOR STUDY ON CRITICAL THINKING

The purpose of this study is to examine the relationship between critical thinking scores and scores obtained during the semester in the students' major area of study and the students' grade point average.

The test has a time limit of 50 minutes.

I agree to allow the researcher to have access to my grades only for the purpose of the research study.

The results will have no influence on your grades and the results of this test will be kept confidential.

I understand that I am free to refuse to participate and may withdraw my consent at any time.

_____

Signature

BACKGROUND INFORMATION

Date of Birth:_____

Gender_____

English is my first language Yes No

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