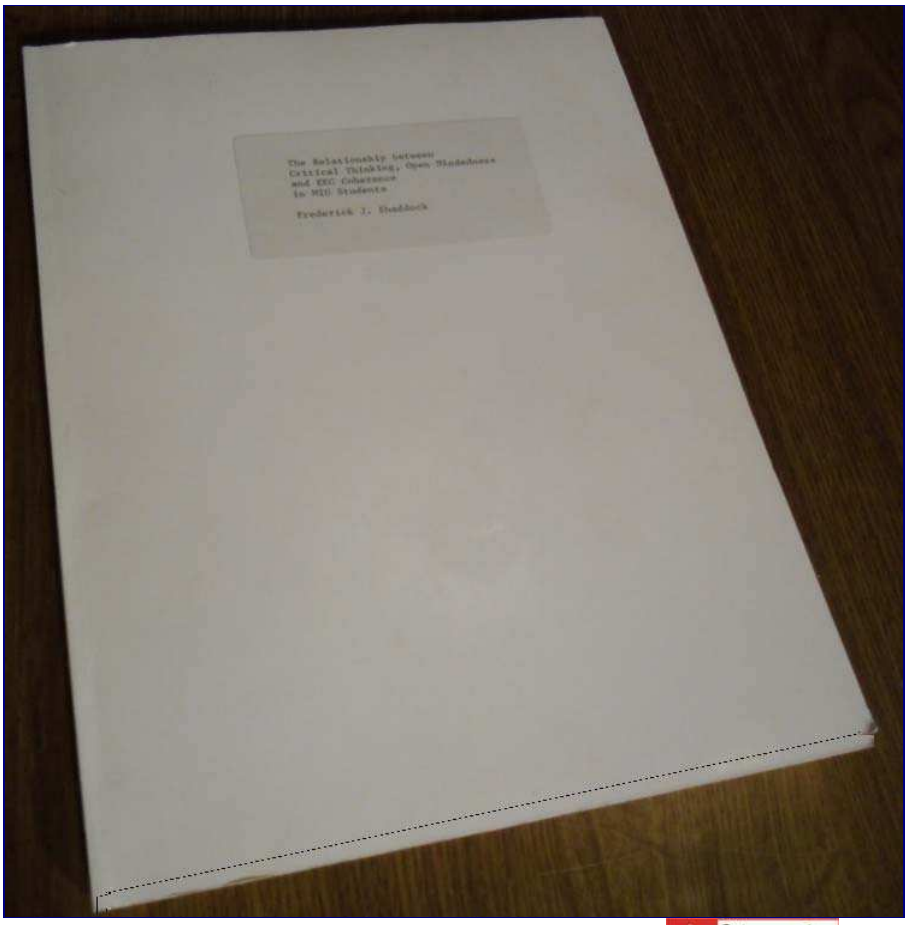
Critical Thinking, Open Mindedness and EEG Coherence

in Maharishi International University Students

Referenced in the Self Study for Accreditation



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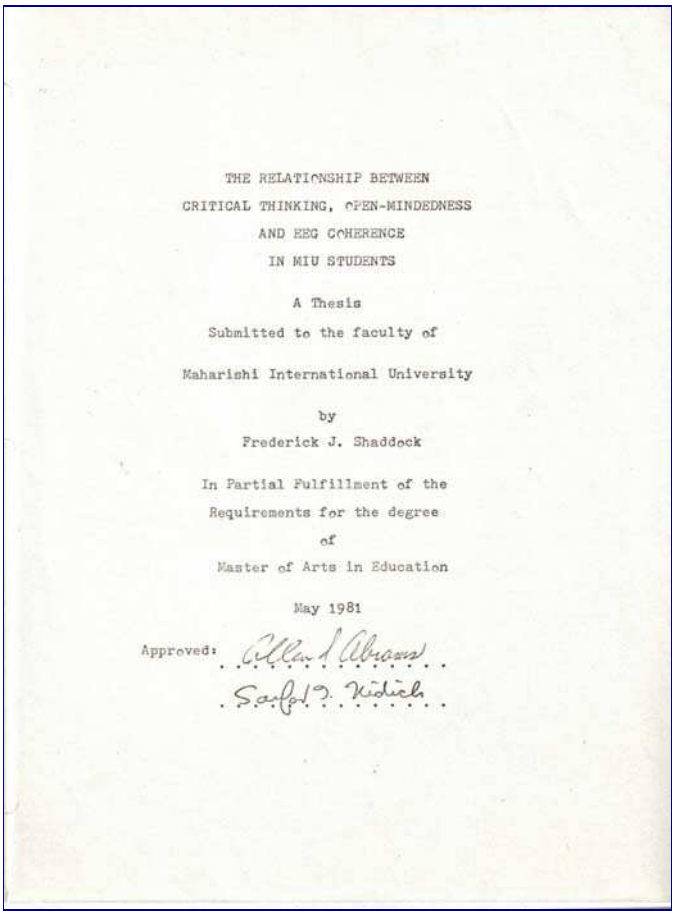

THE RELATIONSHIP BETWEEN
CRITICAL THINKING, OPEN-MINDEDNESS
AND EEG COHERENCE
IN MIU STUDENTS

A Thesis
Submitted to the faculty of
Maharishi International University

by
Frederick J. Shaddock

In Partial Fulfillment of the
Requirements for the degree
of
Master of Arts in Education

May 1981

Approved: Allan I. Abrams
Sanford I. Nidich

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ABSTRACT

Shaddock, Frederick J. M.A., Maharishi International University, May 1981. The relationship between critical thinking, open-mindedness, and EEG coherence in MIU students. Thesis advisors: Dr. Allan I. Abrams, and Sanford I. Nidich. Education Department: Dr. Susan L. Dillbeck.

Educators have long sought to develop critical thinking ability and open-mindedness in their students, as well as to measure this development. Physiological and psychological research studies on practitioners of the Transcendental Meditation (TM) program have showed EEG brain wave coherence to be a measure of the development of orderliness in thinking and expanded awareness.

It was hypothesized that EEG phase coherence would provide a neurophysiological correlate of critical thinking ability and open-mindedness. It was also hypothesized that the educational curriculum at Maharishi International University, which as the TM program as its basis, would show seniors to be more developed in critical thinking and open-mindedness than seniors at other universities. Other hypotheses were that critical thinking (as measured by the Watson-Glaser Critical Thinking Appraisal) would correlate positively with open-mindedness (measured using the Rokeach Adult Dogmatism Scale), class, and show no difference between the sexes in critical thinking and open-mindedness.

Results of the study showed that EEG phase coherence did not correlate significantly with critical thinking, open-mindedness, or with class rank (freshman, sophomore, junior, senior). Critical thinking, as predicted,

did correlate significantly with class. The MIU seniors scored significantly higher than established norms for college seniors in critical thinking ability, open-mindedness, and higher than MIU freshmen in critical thinking. The MIU freshmen were slightly lower than average in critical thinking according to norms for liberal arts college freshmen.

Open-mindedness scores did not correlate with critical thinking ability, except for the Watson-Glaser subtests in ability to recognize invalid assumptions, and ability to draw valid inferences. The 64 freshmen scored much higher in open-mindedness than predicted, about equal to the 40 seniors who took the Rokeach scale. The Watson-Glaser subtests did correlate highly with each other and the total test score.

Some EEG phase coherence variables correlated positively with each other, such as left and right alpha, and frontal alpha and frontal theta. Occipital alpha coherence correlated with frontal alpha and theta. As predicted, there was no difference between males and females in open-mindedness and EEG coherence, but males performed better than females in critical thinking.

A Kaiser varimax rotation was performed on a correlational matrix of 14 variables. A factor analysis identified four unique factors: 1) critical thinking and class, 2) frontal alpha and theta coherence, 3) left and right alpha, and 4) open-mindedness and ability to recognize invalid assumptions. Thus, critical thinking, bilateral EEG measures, homolateral EEG measures, and open-mindedness were independent of each other.

The satisfactory and superior performances of MIU students in critical thinking seem especially significant in light of results from a pilot study, using a Human Potential Questionnaire, which indicate that MIU students have an extraordinarily optimistic, perhaps even fanciful, view of man's full potential. Also, MIU students scored low in dogmatism despite their general concurrence with one basic world-view, the Science of Creative Intelligence.

Future research directions of both a theoretical and practical nature are discussed. The limitations of this study include its non-random sampling from a specialized population of students, plus the fact that the research was done by a graduate student at MIU which raises the question of experimenter bias. Future studies should be undertaken to overcome these drawbacks.

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I would like to express my thanks to my thesis advisors Dr. Allan I. Abrams and Dr. Sanford I. Nidich, as well as Dr. Susan Levin Dillbeck, for their enlightened guidance and steady support.

My thanks and love go to Dr. Warren and Gloris Shaddock for their trust and patience in my taking a promising but uncommon direction in my education.

I appreciate the objective feedback on my research from the professors of Colgate University and the University of Rochester, who sought to develop critical thinking ability
and open-mindedness in all their students.

Most of all, I am grateful to Maharishi Mahesh Yogi and the tradition of Vedic Masters who have brought back to mankind a technique which may make this development possible for all.

Chapter I: Introduction

Scientific, logical, and open-minded thinking has long been a major goal of the liberal arts educational tradition. Alfred North Whitehead wrote "the art of clear thinking, of criticism of premises, of speculative assumption, of deductive reasoning--this great art was discovered, at least in embryo, by the Greeks, and was inherited by Europe" (Whitehead, 1929).

Critical yet open-minded thinking among the masses is important in a modern democratic society. Professor John Dewey set forth very clearly the role of education in achieving this in Democracy and Education (1916).

> Some attitudes may be named which are central in effective intellectual ways of dealing with subject matter. Among the most important are directedness, open-mindedness, single-mindedness (or whole-heartedness) and responsibility... Openness of mind means accessibility of mind to any and every consideration that will throw light upon the situation that needs to be cleared up... The worst thing about stubbornness of mind, about prejudices, is that they arrest development; they shut the mind off from new stimuli. Open-mindedness means the retention of the childlike attitude; closed-mindedness means premature intellectual old age. (p.174)

Dewey further states in How We Think (1944):

> While it is not the business of education to prove every statement made, any more than to teach every possible item of information, it is its business to cultivate deep-seated and effective habits of discriminating tested beliefs from mere assertions, guesses and opinions; to develop a lively, sincere and open-minded preference for conclusions that are properly grounded, and to ingrain into the individual's working habits methods of inquiry and reasoning appropriate to the various problems that present themselves... The formation of these habits is Training of the Mind. (p.27)

Educators have recently called for a resurgence in the development of these abilities. A thirty-two member commission of scholars, including presents from Yale, Smith, Chicago, and Tulane, which was sponsored by the Rockefeller Foundation, emphasized that the liberal arts help people make critical judgments about ethical and social policies, and that this is "widely undervalued" in the U.S. They said "highest educational priority" must be given to improving these abilities, and that "critical thinking" should be viewed as a basic skill and be defined as such by the U.S. Department of Education (Time, October 1980, p.42).

Educators and authors have become increasingly concerned in recent years about the "sudden, drastic alteration of personality that has become an American phenomenon in the past decade thread is spreading fast...among religious-cult members, today's popular self-improvement mass therapies, and even within the vast Evangelical movement." They point out the "mind altering techniques employed by these groups tamper with the kind and quality of information fed to the brain..." which "seriously affect the brain's ability to process information and may result in impaired awareness, irrationality, disorientation, delusion, and even violently destructive acts" (Conway and Siegelman, 1979).

The current fiscal crisis in higher education also lends an urgency to the concern for developing the full mental potential of American students. "With declining enrolments, one obvious alternative for dealing with the financial problems of an institution is to improve the quality and thereby increase its attractiveness (Freedman, 1973: Group for Human Development in Higher Education, 1974; Leslie & Miller, 1974, Shulman, 1974).

Much research has been pursued along with this endeavor:

The development of the ability to think critically has long been accepted as a desirable educational objective and a major goal of instruction. Because of the rapid changes in America's society and the proliferation of new knowledge taking place today, individuals have a greater need for critical thinking ability than ever before in history. In America, people are asked to make decisions concerning difficult and complex social issues and the ability to think critically is often needed to provide the best basis for making such decisions. America's destiny may very well lie in the ability of our teachers and schools to develop students who are able to think critically. (S. Ballou Skinner and Paul B. Hounshell, 1972, p.555)

Perhaps Carlos de Zaftra best described the importance of critical thinking ability when he wrote in "Teaching for Critical Thinking":

> For the first time in his long history, mankind has in his power the ability to fill his cornucopia or to destroy himself. Because the rate of change has greatly accelerated and because the applications that are made of mankind's discoveries and inventions are more important than are the discoveries and inventions themselves, mankind now needs to do some critical thinking of an unprecedented quality. The future of the human race depends upon the quality of critical thinking that is done in the world today. (1966, p.14)

The Educational Policies Commission of the National Education Association devoted its 1961 publication, The Central Purpose of American Education to the goal of developing critical thinking abilities in students. The importance of the ability to think critically was recognized by the E.P.C. in its statement:

> The purpose which runs through and strengthens all other educational purpose--the common thread of education--is the ability to think...the development of every student's rational powers must be recognized as centrally important. (p.12)

The desirability of organizing the college general education science experiences to emphasize critical thinking ability was recognized as early as 1947 by the President's Commission on Higher Education. One of the objectives of science in education, according to this Commission's list of major goals is:

> To understand the common phenomena in one's physical environment, to apply habits of scientific thought to both personal and civic problems, and to appreciate the implication of scientific discoveries for human welfare. (p.52)

Support for the educational importance of critical thinking seems to be abundant. In his dissertation Critical Intelligence and its Development, Jon Nordby (1977) lays the philosophical groundwork for the next consideration--"How can critical intelligence or critical thinking be taught? A clear, detailed answer to this question is important to professional educators."

Nordby notes that philosophy professors have long had the major interest in developing critical thinking in their students.

> However, the educational importance of critical intelligence goes well beyond the critical evaluation of philosophical arguments. Educators in the social sciences, the natural sciences, the humanities, as well as in professional schools attempt to encourage the development of critical intelligence. For example, the students are asked critically to evaluate theories, to support certain conclusions with relevant evidence, and to organize and to write critical essays and term papers. Nor is developing critical intelligence simply confined to classroom activities. Educators often hope that their students will evaluate sales pitches, political arguments, and proposed explanations through critical deliberation, not simply in an arbitrary, emotional manner. (1977)

According to Nordby, educators have attempted to provide what they consider to be successful teaching methods and curricula to develop critical thinking ability, but have ignored "three obvious prior questions... The failure to address these prior questions is one reason why these attempted answers are neither sufficiently clear, nor sufficiently detailed. The original question, therefore is really the fourth of four questions:

1. What is critical intelligence or critical thinking?
2. What is teaching?
3. Can critical intelligence or critical thinking be taught?
4. How can critical intelligence or critical thinking be taught?" (1977).

Given the importance of critical, open-minded thinking, it seems logical that ways have been searched for to develop it by great men throughout educational history. Rene Descartes found a settled state of mind conducive to logical reasoning, and outlined four rules for establishing the validity of observations, such as dividing difficulties into many parts, and proceeding systematically from simple to complex.

The educational curriculum in Plato's Republic had the Dialectic as its 'coping-stone' -- "the method...which takes this course, doing away with assumptions and traveling up to the first principle of all" (Cornford, 1941, p.254). This teaching method was designed to train "philosopher-kings" by developing abstract reasoning ability, from knowledge of mere appearances to knowledge of reality. Similarities between the goals and procedure of the Dialectic and Transcendental Meditation techniques have been noted by Shear (1981).

Maharishi International University, a fully accredited liberal arts university in Fairfield, Iowa, seeks to develop the full potential of its students by including the Transcendental Meditation and TM-Sidhis program in its curriculum. "The TM technique is a simple, natural, effortless procedure for contacting the field of pure creative intelligence. It is practiced twice daily for about twenty minutes while sitting comfortably with closed eyes" (MIU Catalogue, 1981). Research studies at the International Center for Scientific Research (ICSR) on MIU students indicate that the state of "restful alertness" during TM corresponds to a high degree of orderliness of interhemispheric brain wave

activity, as measure by the electroencephalograph (EEG). Numerous research studies on practitioners of the TM program indicate that culturing "transcendental consciousness" progressively improves creativity, intelligence, personality qualities, health, and general awareness (Orme-Johnson & Farrow, 1977). EEG

coherence in MIU students was found to correlate positively with measures such as SAT scores, IQ, and Hoffman reflex recovery (MIU Catalogue, 1981).

The problem to be investigated in this study is to determine if a statistically significant correlation exists between orderliness of the electrical activity of the cerebral hemispheres, critical thinking ability, and open-mindedness in students practicing the TM program.

The orderliness of the electrical activity of the brain will be operationally defined as the measure of EEG alpha and theta brain wave phase coherence, frontal, left, right, and occipital. The instrument used will be the EEG unit a the International Center for Scientific Research at MIU.

Critical, or logical thinking ability will be defined as "thinking that proceeds on the basis of careful evaluation of premises and evidence, and comes to conclusions as objectively as possible through the consideration of all pertinent factors and the use of valid procedures from logic" (Dictionary of Education). Critical thinking will be quantitatively defined as the score on the Watson-Glaser Critical Thinking Appraisal, Form YM.

Open-mindedness shall be operationally defined as the opposite of closed or dogmatic thinking. Dogmatism will be defined as "1) positiveness in asserting an opinion, tenet, or belief as though it were established beyond question. 2) a philosophy or system of beliefs that assumes its fundamental postulates uncritica1ly" (Dictionary of Education). Open-mindedness will be quantitatively defined as low scores on the Rokeach Adult Dogmatism Scale, Form E.

The Transcendental Meditation and TM—Sidhis program may be defined in two parts. The basic TM technique is the simple, natural, effortless mental procedure designed to unfold the full potential of the mind, body, and behavior, brought to the west by Maharishi Mahesh Yogi in 1958.

> The technique of transcendental meditation is defined as a way of allowing the attention to go from the gross, surface level of ordinary thought to increasingly subtle levels, until finally the subtlest level is reached and then transcended. (Forem, p.27)

The TM-Sidhi program, brought out by Maharishi in 1976, is designed to accelerate the benefits of the TM technique, by culturing the mind to act from the subtlest, least excited state of consciousness.

The study of the TM—Sidhi program presents an apparent contradiction to logic. The TM-Sidhi program is a practical aspect of the Science of Creative Intelligence (SCI), the systematic study of the development of consciousness to its full potential. SCI is easily integrated with the study of logic, according to the MIU philosophy course "SCI and Logic -- Development of consciousness and correct employment of logical rules together foster the purest unfoldment of knowledge...Each step of deduction must be performed explicitly and without hidden assumptions, that is, fully consciously“ (MIU Catalogue, 1981). Yet the TM—Sidhi program also includes things which may strike most people as illogical--the development of extraordinary human abilities such as levitation. ”The TM-Sidhi technique of 'flying' is an extraordinary new technology for the generation of coherence" (MIU Catalogue, 1981).

A further consideration to be investigated is to assess the critical thinking ability with a view towards assessing the likelihood of gullible thinking patterns in MIU students.

This study should serve as a first step in isolating the effect of the TM program as a variable in developing critical thinking and open—mindedness. Inferences from the data would pertain only to the effect of the MIU curriculum and educational environment as a whole. Generalizations to other student populations would be limited because students who elect to attend MIU, a unique university. may have factors in common which might influence their measures in critical thinking. open—mindedness, and EEG coherence.

This research paper is organized in chapters. The next chapter reviews the related research on critical thinking ability, open-mindedness, and EEG coherence. This research will be evaluated in light of needed areas for research, and how the Science of Creative Intelligence may satisfy these areas. Then, the main hypotheses will be stated.

The third chapter will discuss methods used to test the hypotheses. Methods of obtaining test subjects will be discussed, as well as the limitations of these methods as sources of valid data. Each test instrument will be introduced with reasons why this instrument was chosen over the alternatives. The research design will be described, along with its limitations in accomplishing the purpose of the investigation.

The fourth chapter will address the statistical results for each research hypothesis. Each research question will receive an analysis of the data used to test the question, an interpretation of' the results, and conclusions regarding the hypothesis.

Chapter five will be a summary of those findings not anticipated at the time of forming the hypotheses. These will include related, interesting findings which should be kept separate from the consideration of each formal hypothesis. The results of a pilot study an estimation of man's potential are presented here.

Chapter six will contain general conclusions, restating what the research project was to accomplish, and how well it succeeded. It will suggest further research projects on the basis of questions which were formulated as a result of the research. It will also provide an indication of the usefulness of the research project, and its implications for the field of education.

Chapter II: Related Literature and Hypotheses

Research on Critical Thinking

The construct of critical thinking ability has many related terms, such as logical reasoning, empiricism, critical intelligence, ratiocination, and abstract reasoning. The research on critical thinking is also abundant. as are definitions for it. Yet basically, ”critical thinking is the process which brings about changes in habitual ways of thinking and acting in order to be more responsive to realities” (Organ, 1965, p.6).

Ways to improve critical thinking seem to be lacking.

> The literature reveals that effective participation in the world today requires the ability to think and read critically. There is evidence to support the view that his ability does not develop automatically; rather, it has to be nurtured. This fact has prompted many educators to point to the importance of providing instruction directed to improvement of critical thinking and reading. A perceptive search of current instructional practices, however, reveals serious shortcomings. (Alston. 1972)

In a survey to isolate the essential critical reading skills, Roch (1979) found that ability to draw conclusions, reasoning, ability to generalize, draw relationships, and make sound judgment: were considered the most essential of 400 qualities according to 50% of professional authors consulted.

People who are proficient in critical thinking seem to exhibit their potential more with higher quantities of praise, peer to peer interaction, and student participation in the classroom (Smith, 1977). Yet critical thinking ability seems to remain independent of emotional influences as found by Revlin, Leirer, Yopp, and Yopp (1980):

> When asked to reason about controversial, if not emotional, material, students do not suspend rational choice, but rather, their decisions are judicious ones, flowing logically, when errors do occur they result from an interruption of rational processes and reflect conflicts between competing goals rather than a switch to irrational decision processes.

Little (1972) found that students with high critical thinking ability were more imaginative, independent, stable emotionally, and trusting, but less conscientious than college students of low critical thinking ability (CT). Using a Personality Factor Questionnaire and the Watson-Glaser Critical Thinking Appraisal (WGCTA), Little found differences in personality characteristics between high CT and low CT males and females, but no difference between males and females on the WGCTA.

No sex differences in WGCTA scores were found by Hoogstraten and Christiaans (1975) and Gurfein (1977), but Simon and Ward (1974) did find that males outperformed females. Gurfein found that the WGCTA scores of 270 intact families, (comparing fathers to sons, mothers to daughters, fathers to daughters, and mothers to sons) correlated significantly, indicating that CT levels are similar by family.

O'Neill (1973) found that high school teachers were higher than their students in CT, and open-mindedness (OM) as measured by the Rokeach Adult Dogmatism Scale (RADS). Yet Alston (1972) found that in teachers, years of teaching experience was negatively correlated with CT. This indicates that greater chronological age does not necessarily mean greater CT and that younger teachers may be getting more training in CT.

Yoesting and Renner (1969) and George (1967) found that general physical science students increased their WGCTA scores over a semester significantly more than non-science students did. Simon and Ward (197U) however, found no difference between art and science students in CT.

Seymour (1973) and Brown (1967) found that chemistry students made greater improvements in CT than non-chemistry high school students. Brubaker (1972) found that students in similar majors had similar CT levels. CT was found to be the most significant common factor among those high school students who persisted in science studies (James, 1972).

Scores on the Test on Understanding Science (TFUS) correlated r=.48--.65 with the WGCTA among high school chemistry students (Troxel & Snider, 1970). As MIU considers itself a science oriented university, we may look for indications of high CT among the student body.

The effect of studying the Science of Creative Intelligence (SCI) on CT should be investigated because studies indicate that both creativity and intelligence are involved in CT. Moore (1973) and Brubaker (1972) found significant correlations between creativity and CT. Moore used four selected creativity tests to measure 'sensitivity to problems", "spontaneous flexibility', "semantic redefinition", and "originality." In the area of intelligence, George (1968) found that final grades in high school biology correlated with CT. George, and Lysaught (1964, 1970) found significant correlations between CT and Otis IQ scores.

Also in the area of ”general intelligence", significant correlations between the WGCTA and the Scholastic Aptitude Test (SAT) were found by James (1972) and Brubaker (1972). Grasz (1977) found significant correlations between the WGCTA, the Miller Analogy Test (MAT), and the Graduate Record Examination (GRE) verbal and quantitative sections.

Westbook and Sellers (1967) found correlations of .53 between the WGCTA and the Hennen-Nelson Tests of Mental Maturity, consistent with correlations of .55 between the WGCTA and the Miller Analogy Test (MAT).

Critical thinking ability seems to be very important to success in technology oriented occupations. Hunt (1973) found CT to be a good predictor of success in computational science. Hartman (1977) found that CT explained 43% of the variance in, and is a strong determinant of success in computer-assisted systems analysis. Hinojosa (1974) found that CT has no relationship to the type of leadership style adopted by administrative personnel.

There is reason to hypothesize that EEG coherence, higher stages of moral reasoning, and CT may correlate positively. Cruce-Mast (1975) found that CT correlated significantly with moral decision making as measured by the Defining Issues Test (DIT), the same test used to determine a correlation between EEG coherence and moral reasoning (MIU Catalogue, 1981). EEG coherence and moral reasoning were also cited to correlate with subjective experiences of transcendental consciousness (TC) through TM.

A positive relationship between the development of Maharishi‘s seven states of consciousness, and Piaget's major stages of cognitive development has been investigated theoretically by Shear (1979). Carlson (1975) found a significant correlation between Piagetian level of thought and scores on the WGCTA. The "formal operation" subjects outperformed the "concrete operation" subjects significantly on the Piagetian Task Instrument (PTI), WGCTA, and the Test on Understanding Science (TFUS).

CT ability seems to vary with type of schooling. In a study comparing high school seniors in different parochial schools, Quinn (1963) found that Protestants, Jews, and Catholics were highest, middle, and lowest, respectively on scores on the WGCTA, and open-mindedness using the RADS. The differences were apparently not due to religious heritage or parents' educational background; the explanatory factor seemed to

be rigidity of the educational atmosphere. Geckler (1965) also found differences in CT and OM between protestant students at different parochial schools.

According to Hinojosa (1974), "a definite relationship between dogmatism and critical thinking ability exists. Dogmatic individuals, this investigation concluded, tend to score lower on critical thinking ability measures." This finding is supported by other studies using the WGCTA and the RADS Form E: Quinn (1963), Geckler (1965), Marrs (1971), O'Neill (1973), Seymour (1973). Moore (1977), and Wilkins (1979). This study will determine if this is also true for MIU students, and if the TM program might lead to improvements.

Many other methods to improve critical thinking ability have been tried and tested. Values Clarification exercises were found to improve CT significantly in high school math students (Moore, 1977). Teacher question-asking behavior seems to have an influence on improving student CT. George (1968) found that teachers with high levels of CT achieved the greatest improvements in their students' CT levels, Inquiry-oriented, examinatory modes of instruction were found to improve students' CT more than a passive, teacher-oriented approach (Garris, 1974; Vance, 1972: Story, 197M; and Pisano. 1980).

Class materials also have had an effect on improving student CT. Yager (1968) found that students using more than one textbook for an 8th grade science course improved their CT ability significantly more than a control group of students using just one textbook. Their Test on Understanding Science scores were higher also.

Cercone (1977) found that 10th grade English students improved their CT ability more than a control group by engaging in one dramatic activity related to their class work per week for twelve weeks. Bailey (l9?9) found that an instructional model of how to learn and process information, the Problem Information Processing Paradigm (PIPP), improved the CT ability of high school students more than a control group's. Greenblatt (1979) found that the use of political cartoons stimulated greater critical reading skills in 11th graders in a social studies class.

Matthews (1980) found that students in classes emphasizing a student centered, versus teacher dominant, learning situation exhibited higher levels of ability to solve problems and think critically.

McCloudy (1974) investigated the effect of kinds of sounds and levels of intensity of noises on critical thinking ability. He found that increased levels of intensity of normal classroom noise, abnormal classroom noise, mood music, rock music, machinery sounds, and traffic noises decreased the ability of students to think critically. It seems that lower levels of sound intensity and excitation are most conducive to critical thinking. This is another reason the "state of least excitation' cultured ; through the TM program should be investigated with respect to critical thinking ability.

MIU seeks to provide a holistic view of knowledge through its core course curriculum consisting of one or two week blocks in the various academic disciplines. Indications
that this type of education may develop CT are found in a study by Schafer (1972) showing that liberal arts graduates more - consistently higher in CT than state college graduates
specializing in one specific area of knowledge.

CT has been studied with respect to personality characteristics to a limited extent. Simon and Ward (197U) found that scores on the WGCTA were independent of scores of extroversion versus introversion on Eysenck's Personality Inventory (EPI). Goble and Hounshell (1972) found CT as measured by the WGCTA to be independent of self-actualization as measured by Shostrom's Personality Orientation Inventory (PPI).

Research on Open-Mindedness

Open-mindedness is usually dealt with in the research as the opposite of dogmatic, or closed-minded thinking. Most of the research in this area has been done by Milton Rokeach, a professor of psychology at the University of Michigan. Rokeach, in his book The Open and Closed Mind (1960) defines a dogmatic individual as one holding ”a relatively closed cognitive organization of beliefs and disbeliefs about reality and dogmatism as ”a cognitive defense network against anxiety.”

The term dogmatism is associated in the research with the terms authoritarianism. cognitive rigidity, bias. prejudice, and the opposite of fair-mindedness (Watson. 1925). The Dictionary of Educating presents a comprehensive definition of what dogmatic means:

1) of a person given to highly authoritative pronouncements.
2) of statements without critical scrutiny and challenge as to grounds and evidence.
3) of systems based on assumptions that cannot be scrutinized.
4) of teachings characterized by authoritative statements on the part of the teacher intended for acceptance by the pupils without question: to be contrasted with teaching that guides pupils in thinking their own way through problems.

The effects of dogmatic instruction on pupils has been referred to by Soderbergh (1964) as "a condition fatal both to the afflicted teacher and the exposed pupil.” Vacchiano, Strauss, and Schiffman (1968) found that the dogmatic person is characterized as frustrated by changeable conditions, submissive and conforming, ultra-conservative, and respecting without question established ideas.

Gordon (no date) has studied authoritarianism and dogmatism with respect to type of work environment preferred, and found that dogmatic individuals tend to be ”accepting of and acquiescent to authority, who prefer to have specific rules and guidelines to follow, who prefer impersonalized work relationships, and who seek the security of organization and in-group identification.”

Rokeach describes differences in levels of open-mindedness as ”personality differences in receptivity to new information" (1968, p.144). Receptivity to new information is crucial to the progress of scientific knowledge. From the time of the ancient Greeks, Socrates "the bugbear of Athena" urged his fellow men to attack their assumptions and use their own faculties to seek the "Good'—-the highest truth.

Desiderius Erasmus “the Voltaire of the 16th century”, though ordained a priest, disdained the dogma and fanaticism present in the Catholic faith at his time. He wrote '...the whole world has firmly set its heart against using its God-given brain" (1511). His satires on the superstitions presenting the church of Rome led in part to

the German Reformation, carried on by Martin Luther who further challenged the infallibility of the pope.

Michel de Montaigne‘s philosophical approach was expressed in his famous Essays by his questioning ”what do I really know?" He balanced contradictory views believing that all ideas contain elements of truth, and that all knowledge is relative. He was an antidogmatist, and firm believer in the spirit of free inquiry.

The qualities of open-mindedness are fundamental to the expansion of consciousness necessary for both scientific and philosophical thought. Immanuel Kant wrote that he was aroused from “dogmatic slumber“ upon reading the works of David Hume, a staunch skeptic and empiricist philosopher.

One of the greatest scientists of our times, Albert Einstein admonished his students to “...take the business of science progress into your own hands; insist on thinking Your own thoughts even if contrary to the crowd. Challenge the presumed orthodoxy of ideas? (Holton, p.163).

Gordon Allport, in The Nature of Prejudice (1959, p.8) states that "On the average, church-goers and professedly religious people have considerably more prejudice than do non-church goers and non-believers towards racial, ethnic, and other religious groups. Allport refers to this tendency as a "central disposition" in his study of individual personality.

Quinn (1963) found differences in open—mindedness between students at different religious high schools, Catholics being higher in dogmatism than Jews and Protestants. Geckler (1965) found that in 10th grade students, Baptists, and members of the Church of God were higher in dogmatism than Episcopalians, for instance. Level of dogmatism seems to vary with denomination.

From time to time newspaper and magazine articles have accused practitioners of the Transcendental Meditation program to be involved in a ”religious cult.' Proponents of the TM program retort that TM is not a religion. Campbell(1974) writes "Transcendental meditation, though taught individually, does not depend on devotion to a master any more than on assent dogma", and that followers of any religion may practice the TM program without compromising their faith. A consideration of this paper will be to determine if students practicing the TM program at MIU tend to be dogmatic or not. This paper, of course will not deal with-the issue of whether or not the TM program is a religion. But even if it is, perhaps this study will help determine if practitioners of the TM program are blind followers or, as the Vedic literature puts it, “discerning worshippers.”

Rokeach's work has focused on the relationship between what we know, and how we know it--how we acquire that knowledge. He has analyzed different belief systems among a wide variety of political and religious groups. Blankenship (1968) has studied the relationship between open and closed—mindedness, and capacity for independent thought and action: "

> The more closed--minded an individual, the more difficult it should be to distinguish between information received about the world, and information received about the source (of the information). Conversely, the more open-minded an individual, the better should be the ability to receive and analyze information objectively and act upon the information independently, and on its own merits.

This summarizes many of the research findings of Rokeach. In constructing the Rokeach Adult Dogmatism Scale, Rokeach and his research assistants "scrutinized the various defining characteristics of open and closed systems. We then tried to construct statements designed to tap these characteristics" (1960, p.72). A copy of the RADS Form E is found in the Appendix of this paper.

Rokeach performed a study with Mezel (1966) which found that congruity of beliefs is a greater unifier among people than other factors, such as racial, or cultural similarity. This study showed that whites preferred to be with black people of similar beliefs, than with whites of dissimilar beliefs. Jamias and Troldahl (1965) studied the innovativeness of high and low open-minded groups, and found that the more open—minded groups, regardless of race and culture, had a high adoption rate of new ideas, while high dogmatic behavior was manifested by compliance or identification with social norms.

Dogmatism has been found to correlate with neurotic anxiety by Hanson and Clune (1973). and Cohen and Harris (1972). In a study of 86 primary school children, Cohen and Harris found a correlation of $r=.52$ $p<.001$) between neurotic anxiety and dogmatism. Here again the level of dogmatism in TM practitioners should prove interesting as they tend to be lower than norms in anxiety and neuroticism.

Regular practice of the Transcendental Meditation program has been found to reduce anxiety (Nidich et al., 1972: Hjelle, 1974; Penner et al., 1974; Davies, 1974; Shapiro, 1974; Stern, 1974; Ferguson and Gowan, 1976; and others). Ross (1972), Ferguson and Cowan, and Shapiro found reduced neuroticism in individuals practicing the TM technique.

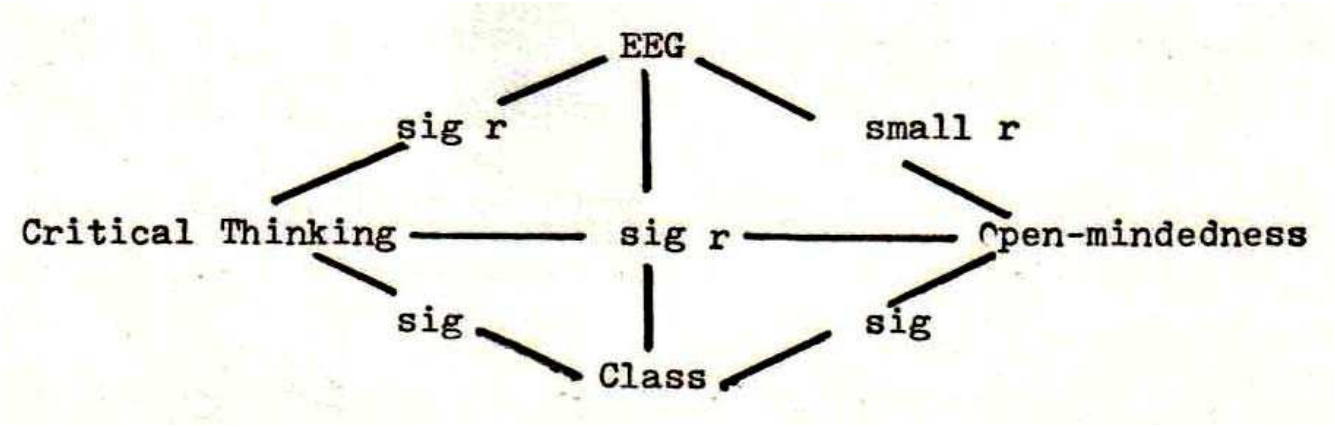
Level of anxiety with respect to classroom performance has been studied to a great extent. Williams (1971) found significant improvement in tolerance for ambiguity (as measured by Budner's Intolerance for Ambiguity Scale) and open-mindedness (using the RADS) in an experimental group of undergraduate educational psychology students engaging in a cross-cultural simulation game. These activities seem to be those which emphasize an expansion of awareness
to see other viewpoints.

Expansion of consciousness and improved ability to see others' viewpoints are predicted effects of regular practice of the TM program, as the nervous system is relieved of the effects of stress. Along with this flexibility of awareness seems to come improved stability and tolerance towards the constantly changing situations one encounters. So it will be interesting to note whether improvements in open-mindedness (using the RADS) are found in MIU students.

Statement of hypotheses

1. Seniors will significantly outperform freshmen in critical thinking.
2. There will be no significant difference between MIU freshmen and freshmen norms in critical thinking ability.
3. MIU seniors will outperform senior norms in critical thinking.

4. Subtests of the Watson-Glaser Critical Thinking Appraisal will significantly correlate with the total score.
5. Seniors will outperform freshmen in open-mindedness.
6. There will be no significant difference between MIU freshmen and freshmen norms in open—mindedness.
7. MIU seniors will outperform senior norms in open-mindedness.
8. There will be a significant positive correlation between critical thinking ability and open-mindedness.
9. Seniors will outperform freshmen in EEG coherence.
10. There will be a significant correlation between EEG coherence and critical thinking ability.
11. There will be a slight correlation between EEG coherence and open-mindedness.
12. There will be a positive correlation between most EEG coherence measures.
13. There will be no difference between males and females in critical thinking ability.
1U. There will be no difference between males and females in open-mindedness.
15. There will be no difference between males and females on the EEG coherence measures.



Chapter III: Methodology

Subjects

77 freshmen, 3 sophomores, 12 juniors, and 46 seniors from Maharishi International University took part in this study. Subjects were volunteers from a variety of classes. Freshmen were all in their first year core course curriculum, and upperclassmen were recruited from a variety of art and science classes. 23 of the seniors were randomly selected
(using a random number table and class list) to take the Rokeach Adult Dogmatism Scale to determine if there was a significant difference in open-mindedness between those who volunteered and those who were randomly selected (no difference).

At MIU there are 175 freshmen and 199 seniors, so this sample was representative of 44% of the freshmen, and 23% of the seniors. 64 of the freshmen took the Watson-Glaser Critical Thinking Appraisal, 53 took both the WGCTA and the RADS, and 64 took the RADS. MIU regularly tests the MIU student body in EEG coherence at the laboratory at ICSR, So EEG scores were available already. 23 seniors took the WGCTA, (23 took both the WGCTA and the RADS). and 23 seniors took only the RADS.

Instruments: Watson-Glaser Critical Thinking Appraisal

The Watson-G1aser Critical Thinking Appraisal was designed by Goodwin Watson, and his research assistant Edward M. Glaser in 1941 at Columbia University & Teachers College. According to Smith (1977) this test is based on Dressel and Mayhew's (1954) definition of critical thinking, and research in this area:

> The essence of the democratic creed is that each person possesses potentialities for discovering his own problems, and for developing personally satisfactory and socially acceptable solutions to them, so that he has no need to defer completely to the will of an authority although he is perfectly willing to make use of expert opinion when relevant. (Dressel and Mayhew, 1954).

With this in mind, "the exercises include problems, statements, arguments, and interpretations of data similar to those which a citizen in a democracy might encounter in his daily life" (Watson and Glaser, 1964). The test has had four editions, Form Am, Form Bm, Form Ym, and Form Zm.

The test includes five subtests designed to measure different, though interdependent, aspects of critical thinking. Each form contains 100 items, and the test can be completed in about 50 minutes. The WGCTA is a test of critical thinking power rather than speed, so there is no rigid time limit. The five subtests are described as follows:

> 1. Inference. (Twenty items.) Samples ability to discriminate among degrees of truth and falsity of inferences drawn from given data.
>
> 2. Recognition of Assumptions. (Sixteen items.) Samples ability to recognize unstated assumptions or pre-suppositions which are taken for granted in given statements or assertions.
>
> 3. Deduction. (Twenty-five items.) Samples ability to reason deductively from given statements or premises: to recognize the relation of implication between propositions: to determine whether what may seem to be an implication or a necessary inference from given premises is indeed such.
>
> 4. Interpretation (Twenty-four items.) Samples ability to weigh evidence and to distinguish between (a) generalizations from given data that are not warranted beyond a reasonable doubt, and (b) generalizations which, although not absolutely certain or necessary do seem to be warranted beyond a reasonable doubt.
>
> 5. Evaluation of Arguments. (Fifteen items.) Samples ability to distinguish between arguments which are strong and relevant and those which are weak or irrelevant to a particular question at issue (Watson and Glaser, 1964).

The subtests of the Watson-Glaser Critical Thinking Appraisal were selected from the best of a larger number of subtests included in earlier editions. The WGCTA, according to the list of references in Euros' Mental Measurements Yearbooks had been used in many more research studies, and had undergone more revision and improvement than the alternatives. The alternatives considered, for the reader's information, were:

> The Cornell Critical Thinking Test (Ennis & Millman, 1978)
> Maw Critical Thinking meet (new, 1959)
> Logical Reasoning Test (Burney)
> Test of Critical Thinking in the Social Studies (Wrightstons.1939)

Chickering Critical Thinking Behaviors (McDowell & Chickering,1967
The Critical Consciousness Inventory {Smith-Alschuler, 1976)
McDermott Inventory of Critical Thinking Attributes
Curry Test of Critical Thinking
Wisconsin Tests of Testimony and Reasoning, Test R-1
Literal Comprehension and Critical Reading Test (Greenblatt)
The Critical Listening Test (Richards)
A Test of Critical Thinking, Form G (American Council on Educ.)
A Test on Principles of Critical Thinking, Form F15 (Rust)

Figural reasoning tests, those which involve reasoning through symbols and diagrams (non—verbal) are considered by many psychometricians to be the purest measure of critical thinking ability (Whimbey, 1976). This study, however, was concerned with critical thinking with relation to complex, and verbal reasoning.

The Cornell Critical Thinking Test (CCTT) was seriously considered for use in this study, but the theoretical problems used to test critical thinking were felt to be needlessly negative (eg. whether or not certain strains of ducks should be killed). Spearman—Brown correlations were low with respect to the WGCTA in a study by Follman (1969). The WGCTA was one of four unique factors in a study by Landis (1976) while the CCTT was not. In a factor analytical study of critical thinking tests, the WGCTA accounted for a larger percentage of the total variance in a Kaiser varimax rotation of a correlational matrix of 22 subtests of scholastic achievement tests than the CCTT.

Michael, Devaney, and Michael (1980) concluded that "the CCTT measure may be substantially lacking in factoral validity, as the psychological nature of its constructs could not be readily identified."

The selection of the proper test instrument for this study was important. Ross (1975) found in a study of 8 inductive tests and 3 deductive tests, including the WGCTA, research in inductive reasoning is instrument dependent--not all instruments test reasoning ability in the same way. Rust (1959) found that in a study of several CT tests including WGCTA, ”only in rare instances was the a priori reasoning of the test makers regarding the grouping of items confirmed. All items within a subtest do not measure the same abilities and therefore do not measure what they are intended to."

Frank S. Freeman (1950) wrote that in tests of CT “individual critical thinking is reduced often to a minimum". He felt that at best, they test ability to discriminate arguments and recognize assumptions, and that limitations of the tests must be recognized. In an item analysis of the WGCTA on 200 high school students in South Australia, Broadhurst (1970) concluded that the WGCTA is ”not as valid a measure of critical thinking as one may desire.”

Robert Ennis, the creator of the CCTT, in an analysis of the WGCTA concluded that the WGCTA gives too high a score to the "chronic pathological doubter" (1958). He mentioned the “common knowledge" criterion in the WGCTA as not satisfactory and that the fifth subtest is structured so that a person answers depending on his value system, not CT. Yet, history, validity, and reliability seemed to favor the WGCTA.

Split-half reliability coefficients for the WGCTA Form YM were .85 for 5297 liberal arts freshmen, and .85

for 200 college senior women from ten liberal arts colleges. These were odd-even split-half reliability coefficients corrected by the Spearman-Brown prophesy formula. Corrected split-half and KR-20 total test reliability estimates for the WGCTA Form Zm were lower, .655 and .667 respectively (Follman and Miller,1971).

Content validity of the WGCTA is discussed in the Manual for Forms YM and ZM (Watson & Glaser, 196M):

> Content validity is usually established by showing that the items in the test call for responses that represent a ba1ance and adequate sampling of some clearly defined universe of knowledge, attitudes, or skill. In the area of critical thinking there is no general agreement on the definable limits of the subject-matter per se, nor is it possible to conceive of a clearly defined universe into which all aspects of critical thinking could be classified.

With respect to construct validity, the way in which the parts of a test relate to each other and to the whole, "the moderately low subtest intercorrelation coefficients, ranging from .21 to .50 support the contention that relatively distinctive abilities are being measured with sufficient overlap to warrant their inclusion in one total score" (Watson and Glaser, 1964. p.14).

The predictive validity of the WGCTA, how well it predicts future performance in some relevant area, "as of any other test or selective device, tends to be unique and must be established empirically in each situation where the test is to be used" (Watson and Glaser, 1964, p.15). For example, George (1968) found WGCTA scores to be a valid predictor of final grades in biology and Lysaught (1964) found them to predict success in computer programming. Lysaught and Pierleoni (1970) determined that the most powerful criteria for educational institutions seemed to be combined WGCTA and Otis IQ scores.

One consideration should be kept in mind concerning follow-up studies using the WGCTA. Welch and Walberg (1970) found no evidence for inflated posttest scores caused by the experience of a pretest and conclude that:

> ..it might be speculated that pretest and sensitization effects are not serious problems when the treatment occurs in a normal classroom situation over the academic year and when test taking is part of the normal routine. (p.613)

Contrary to this assumption of Welch and Walberg, Lucus (1972) did find a pretest effect with the WGCTA in an experiment with South Australian high school biology students.

The authors of the WGCTA tried to insure unquestionably right answers as the standard for the scoring key. To this end they submitted all the items to a jury of 15 persons trained in logic and the scientific method who apparently showed perfect agreement as to the correct responses.

The WGCTA received good 'reviews" in Burns' Mental Measurements Yearbooks. Robert H. Thouless of Cambridge University (Buros, 19 . p.§) wrote "No one who has tried to construct a test of this type will underestimate its difficulties. The authors have succeeded in making a test which should prove useful for measurement and diagnosis and ...there are ingenious methods of assessing qualities of opinions and...the

ability to think critically on particular problems."

Harold Fawcett (1945,p. 139) cited the WGCTA as “a helpful and effective means of measuring abilities which are today so essential to competent citizenship" but "probably best suited for students on the senior-high school level."

Walker H. Hill of Michigan State University (Buros, 19 , p.796) wrote that ”If, as this reviewer believes, critical thinking is a central goal of education, serious efforts to understand it and appraise it must be encouraged...and the Watson-Glaser Critical Thinking Appraisal is one of the useful instruments for this purpose.” But he urged caution in the use of subtest scores. He cited as a "loophole" in the inference subtest the required use of ”certain commonly accepted knowledge or information which practically every person knows" as stated in the WGCTA Manual. Hill also found the norms to be based on a ”regrettably limited college population. "

Carl I. Hovland of Yale University (Buros, 19 , p.797) wrote “The Watson-Glaser test is a conscientious, imaginative effort to provide appraisal in a most difficult area--that of 'critical thinking'." Hovland also found the norms in the manual ”quite sketchy". He mentioned that it is critical to take into account which form of the WGCTA one uses in a study because of differences ranging up to six points. Hovland also said that since the theoretical relationship between critical thinking I and other measures of intelligence is not established, it is difficult to asses whether the correlation of .70 reported between this test and the Terman-McNemar Test of Mental Ability means that the Watson-Glaser test is measuring a single major aspect of intelligence or is just another form of intelligence test."

John P. Crites (1965, p.328) found the WGCTA to be a "novel" and "laudable approach" but urged caution in using the subtest scores and suggested using only the total score until more research is done on the WGCTA. Crites also wrote that "caution should be exercised in using the combined grades percentiles" which this study will do. He said ”the two new forms of the Watson-Glaser, YM and ZM, are supposedly equivalent, but they differ as much as six raw score points at the same percentile, particularly in the middle of the distribution.” Because "there appears to be insufficient range on the test...for college students, particularly those in their last year" the “data raise a question about whether the Watson-Glaser is appropriate for use at the higher educational levels, as the Manual implies." Crites concludes that "little is known about its stability over time and its usefulness in prediction, but its internal consistency is high and its concurrent validity is acceptable" and suggests "a more difficult form could be devised for the selection of graduate students."

G.C. Helmstadter (1965, p.254) however, found that "in general, the test seems to be an excellent one..." and wrote "this instrument could provide an excellent criterion measure for those who claim their instruction results in the 'abi1ity to think' rather than simply the acquisition of subject matter." This seems to be what MIU seeks to achieve in its students.

Helmstadter agreed with other reviewers that ”some users might welcome a wider variety of normative groups". In comparing the two WGCTA forms “it does seem strange that when two forms of a test are available. and an equivalent raw score table is presented, no correlation between the two form is given... an

examination of both the median item discrimination indexes and the reliabilities for the various subtests suggests that form YM is likely to be slightly superior to form ZM."

This study will use form YM. Helmstadter concludes ”while there may be some flaws in the test, it is doubtful whether a significantly better measure will be found until there is a major breakthrough either in test technology or in our understanding of the 'thinking' process."

Instruments: The Rokeach Adult Dogmatism Scale, Form E

The Rokeach Adult Dogmatism Scale was used to measure open-mindedness. "The primary purpose of this scale is to measure openness or closedness of belief systems” (Rokeach. 1966, p.71). There have been five editions of the Rokeach Scale, Forms A through E, each building upon the previous one. Form E consists of no statements which Rokeach and his researchers felt to be typical of dogmatic beliefs, and takes about 12 minutes.

Subjects indicate disagreement or agreement with each item on a scale ranging from -3 (strongly disagree) to +3 (strongly agree), with the 0 point excluded in order to force responses toward disagreement or agreement. For scoring purposes, a constant of 4 is added to each item score to give a 1 to 7 point scale. The total score is the sum of
scores obtained on each of the no items on the test.

"By virtue of the way open and closed are defined, this scale also purports to measure general authoritarianism and intolerance" (Rokeach, 1960, p.96). with such a wide variety of possible belief systems, constructing a short scale with construct and content validity was a
challenge. Rokeach constructed the scale by interviewing a wide variety of people "we intuitively thought to be closed-minded. Above all, each statement in the scale had to be designed to transcend specific ideological positions in order to penetrate to the formal and structural characteristics of all positions” (p.72).

The last revision of the Rokeach Scale, the 40-item Form E, was found to have a corrected reliability of .81 for students in English colleges, and .78 for English workers in an automobile factory (Vauxhall Motors) in 1959 (Rokeach, 1960, p.89).` Form E was found to have reliabilities (odd-even) ranging from .68 to .85 in students at Ohio State University
and Michigan State University. "These reliabilities are considered to be quite satisfactory, especially when we remember that the Dogmatism Scale contains quite a strange collection of items that cover a lot of territory and appear on the surface to be unrelated to each other" (Rokeach, 1960, p.90).

Other open-mindedness/dogmatism scales considered were:

Dommert's adaptation of the Rokeach Scale (1967)

Figart's version of the Dogmatism Scale (1965)

A Short-form Dogmatism Scale for Use in Field Studies (Troldahl and Powell (1965)

A Shortened Version of the Rokeach Dogmatism Scale (Schulze, 1962)

A balanced "positive statement" and "negative statement" dogmatism scale developed by Ray (1970)

Ray's scale was seriously considered because it was felt desirable to make the test instrument being given to the MIU students sampled as positive and uplifting as possible. Yet little research and comparative statistics are currently available for Ray's scale, designed in Australia.

A sample of the Rokeach Adult Dogmatism Scale} Form E, may be found in the Appendix of this paper.

The first four statements of the Rokeach Adult Dogmatism i Scale are items involving the belief-disbelief dimension. This section measures the degree of isolation within and between belief and disbelief systems. "isolation refers to the degree of segregation or lack of intercommunication between neighboring regions or subregions. It is assumed that the more closed the system, the greater the isolation between and within the belief and disbelief systems" (1960, p. 73). "Disbelief systems' refers to opposing viewpoints and schools of thought. Items in this section measure the accentuation of differences between the belief and disbelief systems, and the coexistence of contradictions within the belief system of a presumably dogmatic person.

The next thirteen statements on this no statement form seek to measure unverbalized, primitive beliefs. These are beliefs concerned with whether the world we live in is friendly or hostile, beliefs regarding the uncertainty of the future, self-inadequacy, moral self-righteousness, and paranoia. Rokeach determined that dogmatic individuals tend to feel more insecurity, and helplessness, which results in their needing to overcome such feelings by self-aggrandizing, and self-righteous identification with a cause, power, and status.

The next nineteen statements seek to measure authoritarianism, and belief in the absolute truth of a cause with intolerance towards alternative views. Dogmatic individuals,
according to Rokeach would tend to be more hostile towards disbelievers and would seek to isolate themselves from them.

The last four statements are items involving the time-perspective dimension. Rokeach assumes that the more closed the belief-disbelief system, the more its organization is future- or past-oriented, that is, the more the present will be rejected as important in its own right.

Instruments: EEG brain wave phase coherence

To determine if physiological parameters exist for critical thinking ability and open-mindedness, EEG phase coherence measurements from four areas of the scalp were taken. The five EEG measurements were:

· Frontal Bilateral alpha coherence (FQFQ a)
· Frontal Bilateral theta wave coherence (F3F4 Ø)
· Homolateral Left alpha coherence (F3C3 a)

· Homolateral Right alpha coherence (F4C4 a)
· Occipital Bilateral alpha coherence (O1O2 a)

These five channels were measured using a Grass Model 78D electroencephalograph and Polygraph Data Recording System. All students measured had their EEG taken while meditating in a sound-resistant room at the EEG lab at the International Center for Scientific Research at MIU. The measures of EEG coherence were the mean coherence measures between pairs of leads for ten .53 minute periods, during which the students practiced the TM program.

Limitations

This study contains methodological drawbacks which severely limit valid generalizations to other student populations, and conclusions about the long-term effects of the Transcendental Meditation program or the MIU curriculum. The main limitations were those concerning research design, selection of subjects, and the possibility of experimenter bias.

The research design is essentially no more than a one-shot case study, with no pretest before entering the MIU curriculum. History could then be a factor. Perhaps certain students took a critical thinking course just prior to taking the Watson-Glaser Critical Thinking Appraisal. Differences in critical thinking ability and open-mindedness could also
be due to normal maturation from freshman to senior year.

The subjects chosen for this study were not randomly selected, which limits generalizability of the results to the entire MIU population. Although the seniors who took the RADS were checked against a randomly selected group of seniors, this was not done for the freshmen who took the RADS, or for any students who took the WGCTA.

The norms for the WGCTA listed in the manual are not overly abundant and were compiled in 1964. There is the possibility that the average student naturally has higher or lower critical thinking ability in 1981. Perhaps the students used in the norms were actually below average in CT or OM to begin with. This would make the MIU student population
appear better in CT and open-mindedness than it actually should.

The uniqueness of the MIU student population must be considered when making generalizations to students across the country. MIU is unique in that it attracts students who are inclined to practice the Transcendental Meditation technique, and who may be dissatisfied with more 'conventional' educational institutions. Previously, a student would have to already be more open-minded towards new methodologies to consider going to MIU. By being critical of the success of conventional universities, a student choosing MIU may also already be more independent, and critical in his thinking.

An obvious limitation of this study is the fact that the research was done by a graduate student at MIU (self) who is himself a practitioner of the TM program. This suggests that he is a devotee of Maharishi, and raises

the question of experimenter bias. It is possible that he may have been attempting, either consciously or unconsciously, to make his university and the TM program ”look good".

There is also the chance of contamination, when the researcher's familiarity with the test subjects effects the outcome of the study. Although the MIU graduate students share many of the campus facilities and activities with the undergraduates tested, contamination is less likely when using standardized paper and pencil tests.

Future follow-up studies should be undertaken to overcome these drawbacks in design and procedure, and to determine the long-term effects of the MIU curriculum and the TM program.

Chapter IV: Results

The first hypothesis predicts that MIU seniors will significantly outperform freshmen in critical thinking ability. This hypothesis was tested by comparing the mean scores on the Watson-Glaser Critical Thinking Appraisal using a t-test for independent groups, and by computing a correlation coefficient between class at MIU and WGCTA scores.

The Watson-Glaser scores were significantly correlated with class (1=freshmen, 2=sophomores, 3=juniors, 4=seniors) with a coefficient of r= .41 using the no students who took all the tests, and .37 using those students who at least took the Watson-Glaser Critical Thinking Appraisal. Using the group of no who took all the tests (the WGCTA, Rokeach Adult Dogmatism Scale, and the EEG phase coherence measurements), the correlations were significant between class and scores on the WGCTA subtests. The correlation between the Deduction subtest and class was .40, and between Evaluation of Arguments and class was .37.

The difference in mean scores between the freshmen and seniors at MIU was significant (t=4.95, df=85) as shown on Table 1. Thus the first hypothesis that MIU seniors would outperform MIU freshmen was accepted.

The second hypothesis was that MIU freshmen would not perform significantly different from established norms for other liberal arts freshmen. This hypothesis was tested using the table of norms (Table 1c) in the Watson-Glaser Critical Thinking Appraisal Manual. The percentile ranks in this table were based on results from 5,297 freshmen at 15 liberal arts colleges in 13 states. According to this table, the mean score on the WGCTA of 70.53 would place the average MIU freshman score in the 45th percentile, slightly below average.

The freshmen WGCTA was also tested against the mean score for South Australian high school seniors (Lucas, 1972) by a t-test and no significant difference was found. These two methods of comparison led to the confirmation of the second hypothesis.

The third hypothesis was that MIU seniors would outperform established norms for liberal arts college seniors. This hypothesis was tested using the Table 1d in the WGCTA Manual. The percentile ranks for this table were obtained in a study with 554 first-semester senior women at ten liberal arts colleges for women in seven states

(Haas, 1963). According to this table, the seniors' mean score of 83.17 would place the average MIU senior in the 83rd percentile. Seniors at MIU were thus higher in CT with respect to their peers, than MIU freshmen were.

Table 3

Correlations between the subtests of the Watson-Glaser Critical Thinking Appraisal and Total score

	Inference	Assumption	Deduction	Interpret	Evaluation
Inference	1.000				
Assumption	.443	1.000			
Deduction	.457	.173	1.000		
Interpretation	.262	.413	.615	1.000	
Evaluation	.177	.329	.515	.700	1.000
Total WGCTA	.625	.594	.784	.852	.763

Table 3a

Comparison of Subtest Intercorrelations and Subtest-Total Correlations for the Watson-Glaser Critical Thinking Appraisal cited In Various Research Studies

	Key	Inference	Assumption	Deduction	Interpret.	Evaluation
Assumption	1	.32	1.00			
	2	.23	1.00			
	3	.24	1.00			
	4	.27	1.00			
	5	.18	1.00			
	6	.443				
Deduction	1	.42	.30	1.00		
	2	.44	.40	1.00		
	3	.31	.30	1.00		
	4	.34	.34	1.00		
	5	.25	.19	1.00		
	6	.457	.173	1.00		
Interpretation	1	.50	.35	.48	1.00	
	2	.33	.45	.58	1.00	
	3	.21	.20	.58	1.00	
	4	.35	.27	.52	1.00	
	5	.18	.18	.49	1.00	
	6	262	.413	.615	1.00	
Evaluation	1	.39	.23	.35	.42	1.00

	2	.31	.30	.48	.50	1.00
	3	.33	.10	.37	.35	1.00
	4	.26	.12	.29	.30	1.00
	5	.16	.10	.32	.43	1.00
	6	.177	.329	.515	.700	1.00
Total WGCTA	1	.75	.64	.73	.79	.62
	2	na	na	na	na	na
	3	.66	.47	.77	.62	.66
	4	.65	.64	.77	.73	.52
	5	.52	.53	.74	.76	.59
	6	.625	.594	.784	.852	.763

Key

1. Manual for WGCTA (1964)	Tenth grade normative samples (N=2947)
2. Hunt and Randhawa (1973)	119 computer science university students
3. Hoogstraten and Christiaans ('75)	97 Dutch university psychology students
4. Westbrook and Sellers (1967)	411 public high school seniors
5. Troxel (1970)	444 public high school seniors
6. Shaddock (1981)	40 MIU university students

The mean WGCTA scores for seniors were also compared with mean scores provided in Table 2 in the WGCTA Manual. This table showed scores from job applicants at a manufacturing company, and from employees who were college graduates. The MIU seniors significantly outperformed the job applicants ($t=3.31$, $df=60$), and outperformed the college graduates, although not significantly ($t=1.6$, $df=63$). Due to the high percentile ranking according to table 1d, 33 percentile points above average, the third hypothesis was accepted, but further norms for comparison should be sought.

The fourth hypothesis stated that the subtests of the Watson-Glaser Critical Thinking Appraisal would correlate significantly with the total score as shown by Table 3, all subtests correlated positively with the total score, and with each other. Thirteen out of the fifteen possible combinations were statistically significant positive correlations. The correlations between Evaluation of Arguments and Inference, and between Deduction and Recognition of invalid Assumptions were not significant.

The correlation between the total WGCTA score and Interpretation of arguments was the highest value ($r=.85$) which was also the highest correlation in the correlational matrix for norms provided in the WGCTA Manual (Watson-Glaser, 1964, p.15). Thus the fourth hypothesis was not completely accepted, due to the positive, but not significant values.

Table 1

Watson-Glaser Critical Thinking

Appraisal means and standard deviations of different groups

	N=	Mean	std. dev.	S.E.M.
MIU Freshmen	64	70.53	11.07	1.38
MIU Seniors	23	83.17	8.71	1.82
All MIU students	101	74.96	11.99	1.19
South Australian High Sc. Seniors	57	63.29	11.35	----
Manufacturing Co. Job applicants	39	74.40	10.8	----
Manufacturing Co. College grads.	42	79.9	7.4	---

Table 2

Rokeach Adult Dogmatism Scale means and standard deviations of different groups

	N=	Mean	std. dev.	S.E.M.
MIU Freshmen	64	128.72	25.41	3.17
MIU Seniors	40	128.28	20.59	3.26
All MIU students	117	128.73	23.28	2.15
English Colleges	80	152.8	26.2	----
English Workers	60	175.8	26.0	----
Ohio State Univ.	58	141.3	28.2	----
VA Domicary	80	183.2	26.6	----

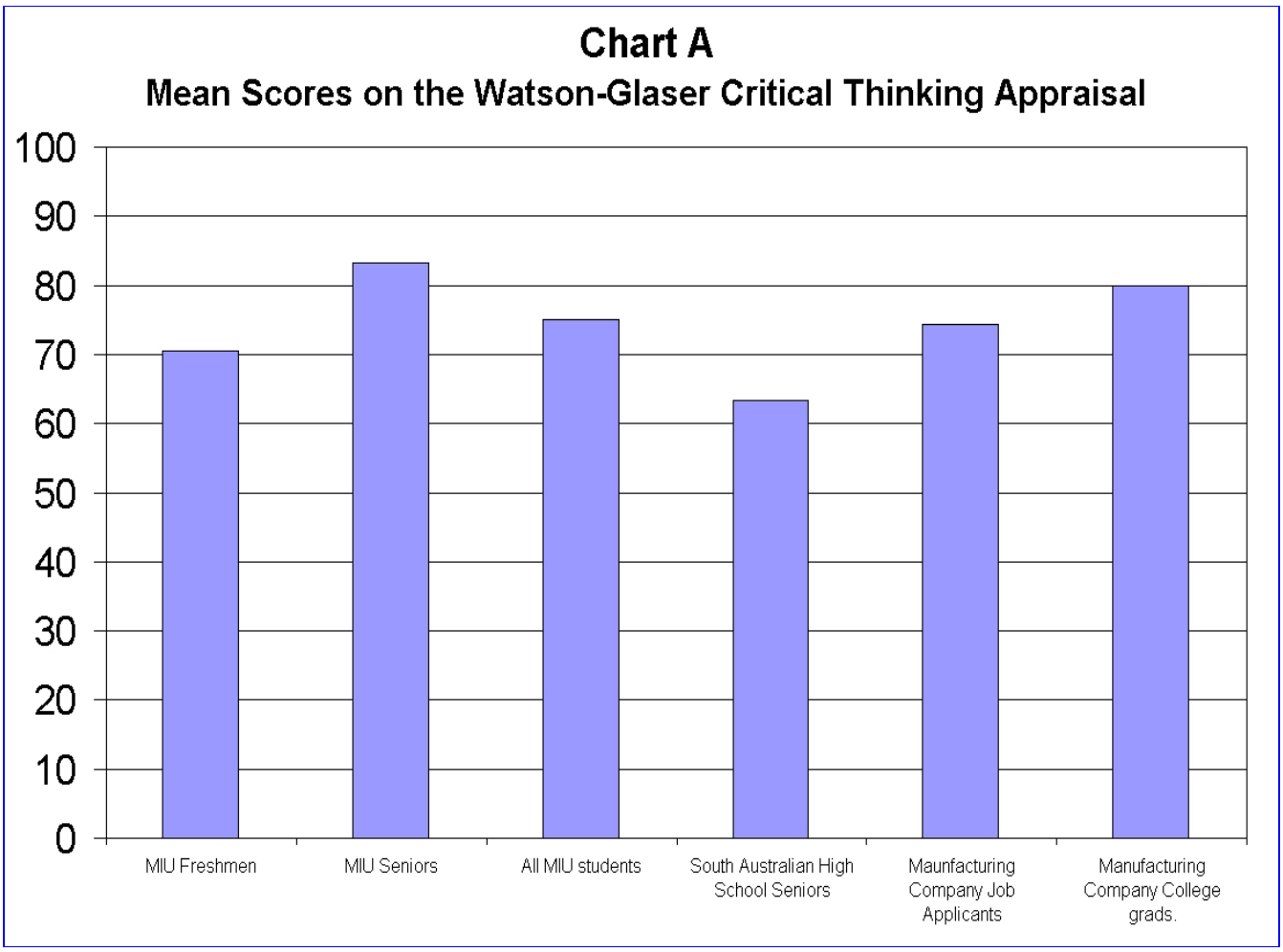
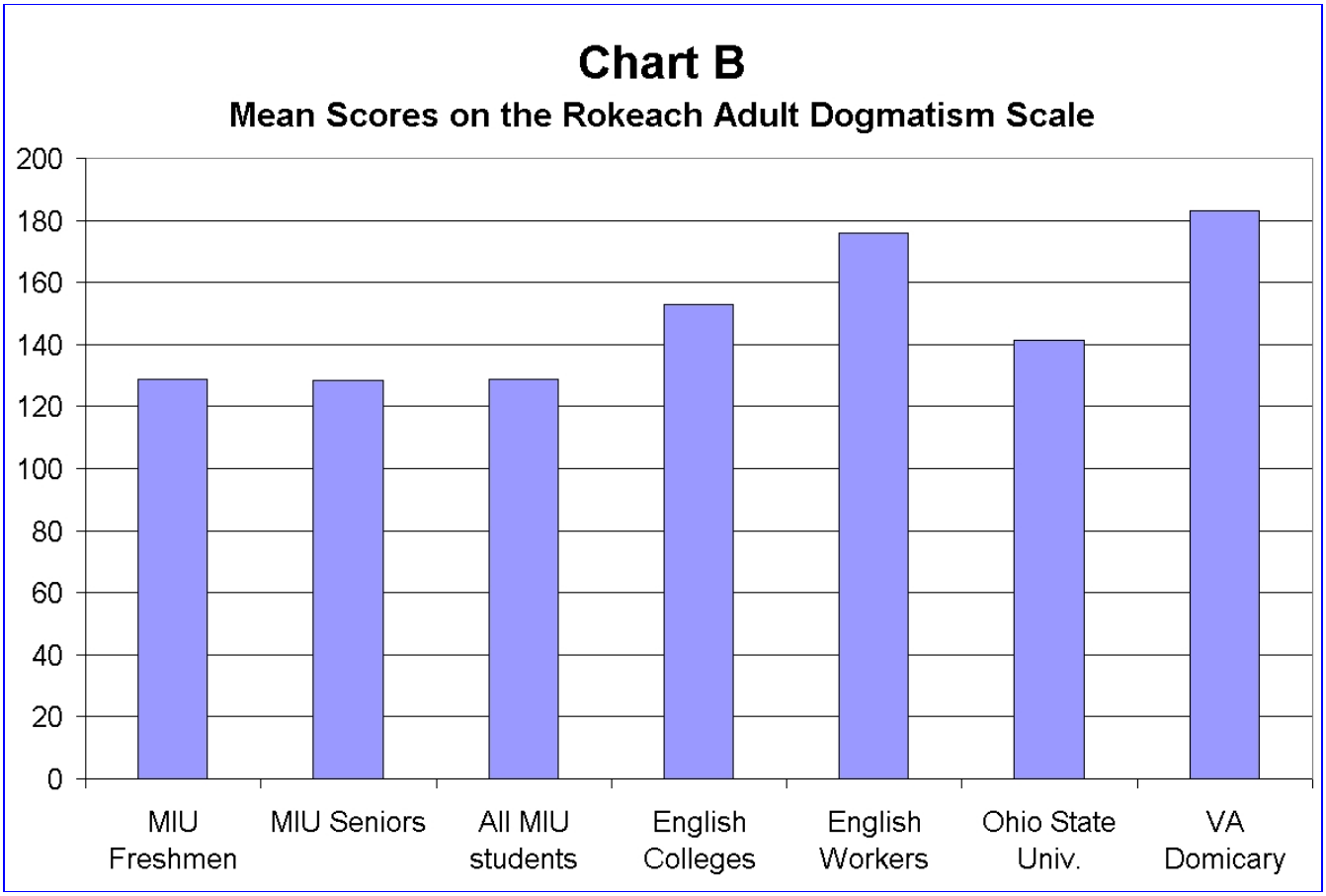


Chart A
Mean Scores on the Watson-Glaser Critical Thinking Appraisal
100
90
80
70
60
50
40
30
20
10
0
MIU Freshmen
MIU Seniors
All MIU students
South Australian High School Seniors
Maunfacturing Company Job Applicants
Manufacturing Company College grads.



The fifth hypothesis was that class would correlate positively with open-mindedness as indicated by low Scores on the Rokeach Adult Dogmatism Scale, Form E. This hypothesis was tested by computing the correlation between class and scores on the RADS, and by a comparison between the freshmen and seniors using a t-test.

The correlation between class and RADS scores was near zero. As shown by table 2, the seniors and the freshmen RADS scores were about equal. Thus the seniors were no more open-minded than the freshmen, so the fifth hypothesis was rejected. However, both the MIU freshmen and seniors scored more open-minded than norms established through students at Ohio State University, and colleges in England. The mean score for all MIU students was significantly more open-minded (t=3.75, df=173} than the Ohio State University group.

The sixth hypothesis was that MIU freshmen would be no more open-minded than freshmen norms. The MIU freshmen scored much lower in dogmatism than expected with a mean score of 128.72 (see table 2). They outperformed all the norms listed in Table 4.3 of Rokeach's book The Open and Closed Mind (1960, p.90). Because of this, the sixth hypothesis was not confirmed. This result is an indication that students who elect to attend MIU are already very open-minded.

The seventh hypothesis was that MIU seniors would out-perform established norms for college seniors in open-mindedness. The seniors were slightly higher in OM, but not significantly, than the freshmen, but were much higher than the norms Rokeach determined (1960, p.90). The t values for significance ranged from 2.50 to 11.45 for mean differences of 13.0 points with Ohio State University, and 54.9 with a New York

Veterans Administration domiciliary, respectively. Thus the seventh hypothesis was firmly supported.

The eighth hypothesis was that there would be-a significant correlation between critical thinking ability and open-mindedness as found in the research. This hypothesis was rejected. WGCTA scores for all MIU students correlated only .17 with open-mindedness as measured using the RADS. The freshmen WGCTA scores correlated more strongly (.24) with OM but still not significantly.

However, the subtest of ability to recognize assumptions of the WGCTA did correlate positively (.53) with OM, that is it correlated negatively (-.53) with dogmatism as measured on the Rokeach Adult Dogmatism Scale. Nevertheless, the lack of consistency between the CT-OM correlations in this study and those stronger correlations found in the literature review, suggest either a lack in the research methodology of this study, or a fundamental difference between the student populations sampled.

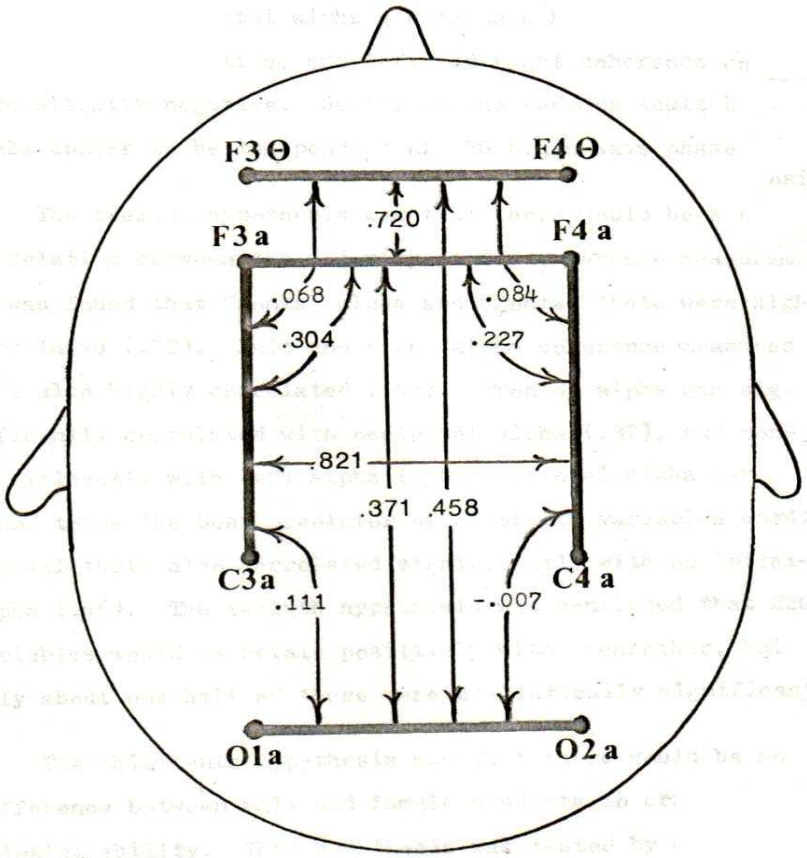
The ninth hypothesis was that seniors would outperform MIU freshmen in EEG brain wave phase coherence. It was found that frontal bilateral alph1(F3F4 a) and frontal bilateral theta (F3F4 Ø) did correlate positively with class, but not significantly so. Occipital alpha showed a near zero correlation, and left and right alpha coherence measures showed a negative, non-significant correlation.

In light of these inconclusive findings, the ninth hypothesis was rejected. It should be pointed out that, with reference to hypotheses that length of time attending MIU, freshmen could have been practicing the TM program for a greater number of years than seniors who learned the technique later in life. The ninth hypothesis was also tested by comparing the means of five EEG measurements of freshmen and seniors through a t-test, finding no significant differences between classes.

The tenth hypothesis was that critical thinking ability would correlate positively with EEG measurements. There were no significant correlations between WGCTA scores and EEG scores, in fact the correlations between WGCTA and frontal alpha and theta measurements were negative (-.23 and -.22, respectively). EEG measurements turned out to be a worse predictor of CT in seniors than in freshmen, according to the correlation coefficients.

CHART C:

EEG Phase Coherence Correlations
For Hypothesis 12



The eleventh hypothesis was that there would be a positive, but not necessarily significant, correlation between EEG coherence and open-mindedness. Here again, there were no significant correlations. Frontal alpha and theta coherence correlations were slightly positive, and left and right coherence correlations were slightly negative. Scores on the Rokeach Adult Dogmatism Scale appear to be independent of EEG brain wave phase coherence.

The twelfth hypothesis was that there would be a positive correlation between the majority of EEG coherence measurements. It was found that frontal alpha and frontal theta were highly correlated (.72). Left and right alpha coherence measures were also highly correlated (.82). Frontal alpha was significantly correlated with occipital alpha (.37). and non-significantly with left alpha (.30). Frontal alpha was found to be the best predictor of other EEG variables used. Frontal theta also correlated significantly with occipital alpha (.46). The twelfth hypothesis was confirmed that EEG variables would correlate positively with each other, but only about one-half of these were statistically significant.

The thirteenth hypothesis was that there would be no difference between male and female students in critical. thinking ability. This hypothesis was tested by computing the correlation between sex and WGCTA scores

(1=male, 2=female) and by comparing the means of the two groups through a t-test.

The correlation between WGCTA scores and sex in all MIU students was -.26; men performed better. The correlation between WGCTA scores and sex varied with class. While the correlation was -.29 among MIU freshmen the correlation was exactly zero in seniors. Senior men and women were virtually equal in CT while freshmen men were significantly higher than the freshmen women in CT. The mean scores of all MIU men were significantly higher than the mean scores for MIU women (t=3.15, df=99) supporting Simon and Ward's (1974) finding.
Thus the thirteenth hypothesis was rejected.

The fourteenth hypothesis was that there would be no significant difference between males and females in open-mindedness. This hypothesis was tested through a correlation between sex and RADS scores, and a comparison of male and female mean scores using a t-test. This hypothesis was confirmed as no differences between the sexes in open-mindedness were found through either method.

The fifteenth hypothesis was that there would be no difference between males and females in EEG phase coherence. This hypothesis was tested in the same manner as the fourteenth. Computing a correlation coefficient between sex and five EEG coherence measures showed the females to be slightly higher than males on all EEG measures. A comparison of male and female means in frontal alpha, frontal theta, left alpha, right alpha, and occipital alpha showed these differences to
be non-significant.
The final step in the analysis of data was to determine the unique factors which accounted for the major portions of the variance in the correlation matrix of fourteen variables. This was accomplished using the BIOMED statistical package of programs on MIU's PDP-11 computer.

Eigenvalues. or uniqueness coefficients on an unrotated factor loading pattern revealed four principal components. The unrotated factors responsible for major portions of the variance in the matrix were determined to be:

1) a critical thinking factor combined with lack of EEG frontal alpha and theta coherence,

2) an EEG phase coherence factor combining all measures, frontal, lateral, and occipital,

3) a Dogmatism, class, frontal theta. and lack of left and right alpha coherence factor,

4) a Dogmatism, frontal alpha, lack of occipital alpha, lack of inference ability, and lack of ability to recognize assumptions factor.

The factor loadings pattern was then rotated to maximize the main factors and minimize those factors which had eigenvalues close to zero. Kaiser's rule was used--if a factor has an eigenvalue of less than one, it will be generally uninterpretable and should be rejected prior to rotation. The varimax rotation of the correlational matrix yielded four
more refined factors (See Table 4):

1) a critical thinking ability and class factor,

2) a frontal alpha, frontal theta, and occipital alpha factor,

3) a left and right alpha factor, and

4) an ability to recognize unstated assumptions, Inference, and open-mindedness factor.

From this factor analysis, it was found that critical thinking and class act as a single factor, which agrees with the finding that CT and class were positively correlated (r=.41). This indicates that older, more educated students have greater critical thinking abilities, and suggests a progressive influence of MIU's curriculum. It is interesting to note that CT and class are independent from any of the EEG measurements, and from open-mindedness.

It appears that the three bilateral EEG measurements act as one factor, while the two homolateral EEG measurements act as another factor. This agrees with the finding that these were two groups of highly correlated variables, and suggests the existence of two fundamental and directionally perpendicular coherence factors.

It appears from the finding that ability to recognize unwarranted assumptions, and open-mindedness comprise one factor, that they may be tapping similar mental pathways. This also indicates that a major aspect of dogmatic or closed-minded thinking is the tendency to allow assumptions to pass without notice and challenge.

Table 4

Varimax Rotation .
Factor Loadings Pattern

Variables	Factor 1: Watson (CT)	Factor 2: Frontal	Factor 3: Lateral EEG	Factor 4: Recognition of Assumptions, Inference & Open-Mindedness
Class	.623	.401	-.223	-.064
Sex	-.139	.289	.096	.012
Inference	.452	.088	-.182	.598
Recognition of Assumptions	.345	.002	.101	.812
Deduction	.778	-.210	-.149	.092
Interpretation	.846	-.182	.160	.059
Evaluation	.819	-.234	.073	-.066
Watson (CT)	.915	-.158	.003	.351
Rokeach (OM)	.257	.142	-.166	-.783

Frontal alpha	-.063	.808	.266	-.156
Frontal theta	-.031	.879	.015	-.169
Left alpha	.012	.152	.919	.140
Right alpha	-.020	.082	.919	-.010
Occipital alpha	-.197	.699	-.112	.306
Uniqueness coefficients				
Eigenvalues	3.669	2.373	1.955	1.941

Factor loading values greater than .500 are underlined for clarity Chapter 5: Other findings

An item analysis of the Rokeach Adult Dogmatism Scale revealed some inconsistencies, and possible shortcomings of the RADS. Both students high in open-mindedness, and low in open-mindedness tended to agree with items #15 and #17 of the RADS:

> 15) While I don't like to admit this even to myself, my secret ambition is to become a great man, like Einstein, or Beethoven, or Shakespeare.
>
> 17) If given the chance I would do something of great benefit to the world.

According to Rokeach, agreement with these statements would be an indication of dogmatism. However, their predictive validity of the total RADS score was very low. These statements may not necessarily be dogmatic statements.

The students had many comments about the RADS which they included on their answer sheets. Some responses were:

> "Who wrote these questions?"
> "Who made this test? Not you I hope."
> "Is this a test for insecurity?'
> "I feel sorry for people who'd feel like that."

The RADS evoked laughter from two seniors who found the statements "ridiculous'. One girl found the RADS "too negative" to complete.

An analysis of the WGCTA found that MIU seniors and freshmen did best on the subtest of ability to recognize unstated assumptions.

As the MIU students performed close to, or better, than average in critical thinking ability, another pilot study in belief systems was performed. The WGCTA is an indicator of how logically a person arrives at what he believes, and the RADS is an indicator of how tolerant a person is of other beliefs. A questionnaire was designed by the experimenter to determine what type of things, specifically, the MIU students believe in.

The test was called the Human Potential Questionnaire (HPQ), which consists of 13 potential human abilities. The subjects are asked to state true or false whether they believe these abilities are 1) possible 2)their personal experience, and 3) important abilities to achieve. A sample HPQ is found in the Appendix of this paper.

The HPQ was administered to 14 MIU freshmen and 14 MIU upperclassmen (sophomores, juniors, and seniors). The subjects were chosen after classes among volunteers, attempting to sample as close to randomly as possible. The test was short enough that all students who were asked to fill it out did so willingly.

The results of the questionnaire indicate that MIU freshmen and seniors have a very optimistic view of man's full potential. Among the abilities they believed were possible for man to achieve were: levitation by mere intention, ability to know the future, become immortal, and see objects hidden from view.

Most of the freshmen and a great number of MIU seniors answered that they have personally experienced these unusual abilities in their own lives. Both freshmen and seniors felt that the development of these "supernormal" abilities was very important.

These results present an interesting paradox. in light of the high scores in critical thinking ability and open-mindedness. Although seniors tended to perform very well in the ability to think logically, the seniors taking the HPQ tended to believe in, and claim they experience things which to the majority of the human population may seem quite illogical.

The results of the HPQ certainly warrant further revision of the questionnaire, a research study correlating answers on the HPQ with CT and OM, and a comparison study of MIU students with another university.

Chapter 6: General conclusion

The purpose of this study was to determine if a significant correlation exists between EEG phase coherence, critical thinking ability, and open-mindedness. This study also investigated how these variables vary with class and sex of students at MIU.

Seven out of fifteen hypotheses were confirmed. The study did investigate all hypotheses, and stated objectives, and led to new ideas for further research. This study did find that freshmen at MIU were more open-minded than expected, but did not find a correlation between critical thinking ability, open-mindedness, or EEG coherence, as expected. Other possible neurophysiological correlates of critical thinking ability, and open-mindedness need to be sought, perhaps H-reflex.

A follow up study on the 64 freshmen taking the WGCTA should be undertaken. It may be desirable to see if the second semester freshmen are any different from the first semester freshmen in any of the variables before grouping them together.

There may be a "floor effect" on a longitudinal RADS study involving the MIU freshmen, as their scores were already very low, in dogmatism. Perhaps a new dogmatism/open-mindedness scale could be developed to be more discriminating among very open-minded people.

An Item analysis of the Watson-Glaser Critical Thinking Appraisal would be useful, to see if MIU students

found the same items most difficult that Broadhurst (1970) did in his study of South Australian college students.

It would be interesting to see if the WGCTA scores correlate with SAT scores in MIU students. Scores in mathematics, and logic-oriented classes would be illuminating. Differences in critical thinking ability and open-mindedness between art and science majors could also be investigated. Perhaps most of all a truly experimental study, comparing peope's CT and OM before and after learning the TM program would be useful to help isolate the effect of developing "higher states of consciousness" on these variables.

As ability to perform deductions did correlate .40 with class, it appears that MIU upperclassmen are proficient at applying general rules to specific situations. Practitioners of the TM program report experiences of abstract levels of the thinking process, which become integrated with every-day concrete levels of thought. The existence of experienceable abstract ideas, or innate universals would run counter to David Hume's that deduction would not involve experience of abstract levels of thought. Thus it would be especially interesting to see whether MIU freshmen improve in deductive abilities.

Immanuel Kant asserted that experience of transcendental ideas was possible, which formed the basis of his Transcendental Logic. Domash (1977} describes the experience of transcendental consciousness during the TM program as contacting a field of pure orderliness, or zero entropy. The TM program apparently makes use of the Third Law of Thermodynamics in bringing the activity of the mind to a more settled, and orderly state. This most orderly state of the mind seems to be an experience of contacting a transcendental field of pure logic.

The Science of Creative Intelligence (SCI) describes this state as a field of pure knowledge, the eternal Veda. Vedic Science is the science of the Veda, and is the fulfillment of SCI. It is predicted that through the practice of the experiential aspect of Vedic Science, the TM program, knowledge of the entire field of knowledge, Veda, grows in one‘s awareness.

Vedic Science outlines the general structure of knowledge itself. One branch of the Veda, one of the "Upangas“, is Nyaya. Nyaya is "the science of reasoning“ which "presents sixteen points by which to test the procedure of gaining knowledge" (Maharishi, 1967, p.4?3). Apparently, the MIU seniors especially have the Nyaya aspect of the Veda well structured in their awareness.

The results of this research paper on open-mindedness provide empirical insight into the nature and meaning of dogmatism. Cornman and Lehrer write (1972) that "If religious revelation was the dogmatism of the past, scientific empiricism is the dogma of today" and that "the plain man, we have suggested, is a dogmatist. He dogmatically assumes his perceptual beliefs, many of them, at any rate, constitute knowledge" (p.61).

It is interesting to note that the motto of MIU is that "Knowledge is structured in consciousness“, and that MIU's curriculum adds to objective, perceptual knowledge, the value of subjective, intuitive knowledge. The MIU students would, through the development of their intuitive faculties which the TM program presumable cultures, be able to integrate the subjective and objective means to gain knowledge. This ability to see

knowledge from both subjective and objective perspectives may be an explanatory factor in their low scores in dogmatism, and high scores for open-mindedness..

The research results in this paper are not opposed to the possibility that the Science of Creative Intelligence, and its practical aspect, the Transcendental Meditation and TM-Sidhi program, develop critical thinking ability and open-mindedness. This may be better determined through a longitudinal study on students practicing the TM program.

The theoretical foundation of SCI concerning the development of discriminating intellect and expanded awareness, indicates that the TM program has the potential to develop critical consciousness, and open-awareness. If this proves possible, and if the practice of the TM program becomes implemented in more educational curricula, we may be able to look forward to students who are greater purifiers of knowledge, through critical thinking, and pioneers in exploring new possibilities in knowledge and cultural harmony, through increased open-mindedness
to other views.

R A D S Form E

Name _____ Date __/__/__
School _____ Sex M F Class ____ Status _____
Date of Birth __/__ /__ Major _____
Other: _____

(This information is for research statistical comparison purposes only. Your information and scores will be kept confidential.}

The following is a study of what the general public thinks and feels about a number of important social and personal questions. The best answer to each statement below is your personal opinion. we have tried to cover many-different and opposing points of view; you may find your-self agreeing strongly with some of the statements, disagreeing just as strongly with others, and perhaps uncertain about others; whether you agree or disagree with any statement, you can be sure that many people feel the same as you do.

Mark each statement in the left margin according to how much you agree or disagree with it. Please mark every one. Write +1, +2, +3, or -1, -2, -3, depending on how you feel in each case.

+1: I AGREE A LITTLE -1: I DISAGREE A LITTLE
+2: I AGREE OH THE WHOLE -2: I DISAGREE ON THE

+3: I AGREE VERY MUCH	WHOLE -3: I DISAGREE VERY MUCH

RADS Form E

The test questions on the Rokeach Adult Dogmatism Scale
are password protected, to prevent them from becoming too widely known
and diluting the value of the scale as a test instrument.

Please contact Rick@CICorp.com if you would like a copy of the questions.

l. The United States and Russia have just about nothing in common.

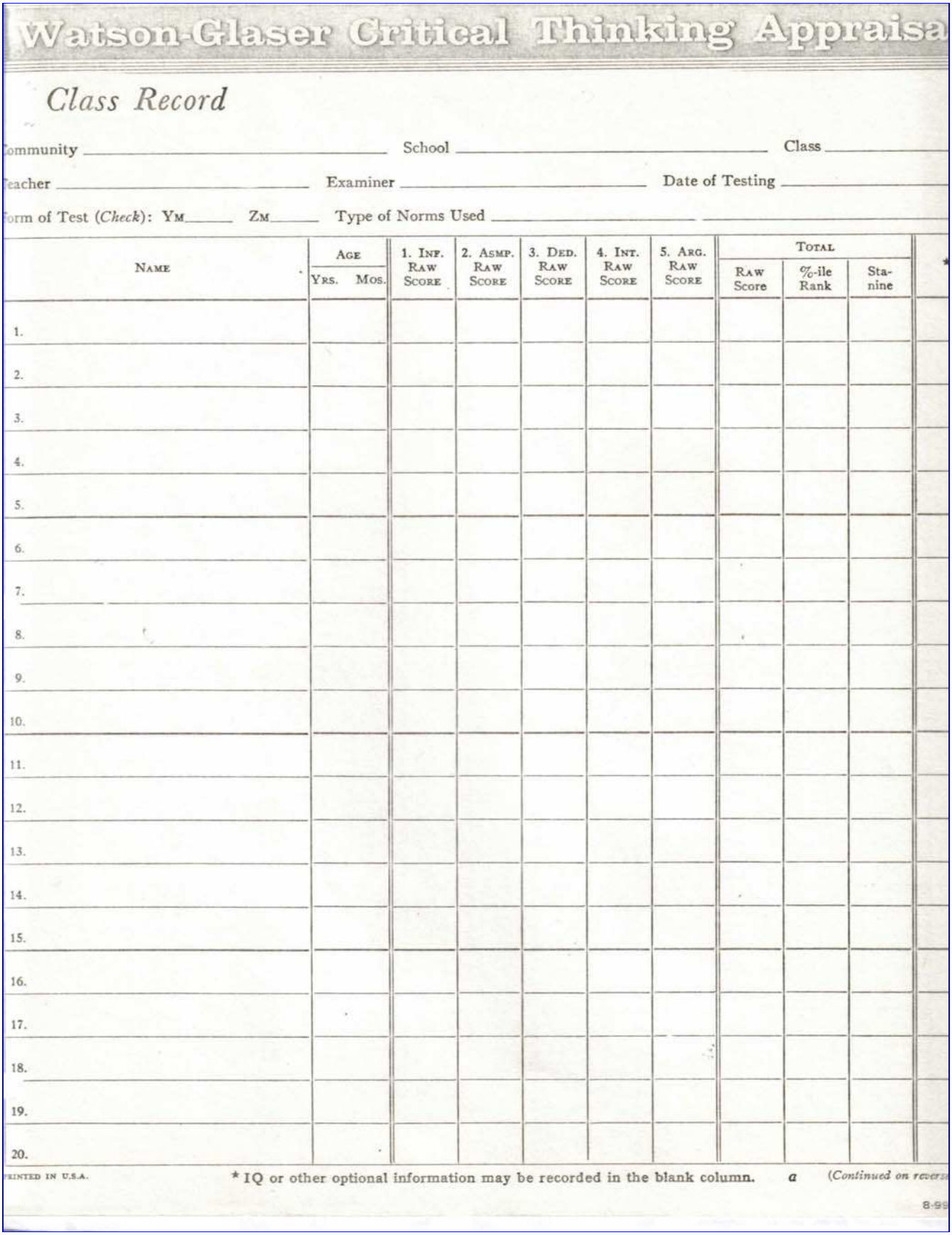
2. The highest form of government is a democracy and the highest form of democracy is a government run by those who are most intelligent.

3. Even though freedom of speech for all groups is a worthwhile goal, it is unfortunately necessary to restrict the freedom of certain political groups.

4. through 40

Answer Sheet

1. _____	21. _____
2. _____	22. _____
3. _____	23. _____
4. _____	24. _____
5. _____	25. _____
6. _____	26. _____
7. _____	27. _____
8. _____	28. _____
9. _____	29. _____
10. _____	30. _____
11. _____	31. _____
12. _____	32. _____
13. _____	33. _____
14. _____	34. _____
15. _____	35. _____
16. _____	36. _____
17. _____	37. _____
18. _____	38. _____
19. _____	39. _____
20. _____	40. _____



Watson-Glaser Critical Thinking Appraisa

Class Record

Community _____ School _____ Class _____

Teacher _____ Examiner _____ Date of Testing _____

Form of Test (*Check*): Ym_____ Zm_____ Type of Norms Used _____

Name	Age Yrs.	Age Mos.	1. Inf. Raw Score	2. Asmp. Raw Score	3. Ded. Raw Score	4. Int. Raw Score	5. Arg. Raw Score	Total Raw Score	Total %-ile Rank	Total Sta-nine	*
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											
13.											
14.											
15.											
16.											
17.											
18.											
19.											
20.											

PRINTED IN U.S.A. * IQ or other optional information may be recorded in the blank column. *a* (*Continued on reverse*)

8-9

ctomeegmiu78.jpg

Human Potential Questionnaire

Instructions: For the following statements circle T if the statement is true or mostly true, circle F if the statement is false or mostly false.

In my opinion man has the potential to:

1. levitate by mere intention	T F
2. know the future intuitively	T F
3. increase his intelligence	T F
4. improve his creativity	T F
5. become more friendly	T F
6. see objects hidden from view	T F
7. understand the communication of animals	T F
8. know God	T F
9. enjoy life fully in happiness	T F
10. become immortal	T F
11. achieve perfect health	T F
12. perceive objects in terms of the Self	T F
13. maintain unbounded awareness at all times	T F

Human Potential Questionnaire - part 2

Instructions: For the following statements circle T if the statement is true or mostly true, circle F if the statement is false or mostly false.

I have personally experienced the ability to:

1. levitate by mere intention
2. know the future intuitively
3. increase my intelligence
4. improve my creativity
5. become more friendly
6. see objects hidden from view
7. understand the communication of animals
8. know God
9. enjoy life fully in happiness
10. become immortal
11. attain perfect health
12. perceive objects in terms of the Self
13. maintain unbounded awareness at all times

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Human Potential Questionnaire - part 3

Instructions: Please rate the following statements according to their importance to you. They may be important now or merely as a future desire or hope.

I feel that it is important to be able to:	Not important		Somewhat important		Very important	
1. levitate by mere intention	1 2 3 4 5	6 7 8			9 10	6
2. know the future intuitively	1 2 3 4 5	6 7 8			9 10	5
3. increase one's intelligence	1 2 3 4 5	6 7 8			9 10	12
4. improve one's creativity	1 2 3 4 5	6 7 8			9 10	12
5. become more friendly	1 2 3 4 5	6 7 8			9 10	12
6. see objects hidden from view	1 2 3 4 5	6 7 8			9 10	5
7. understand the communication of animals	1 2 3 4 5	6 7 8			9 10	7
8. know God	1 2 3 4 5	6 7 8			9 10	13
9. enjoy life fully in happiness	1 2 3 4 5	6 7 8			9 10	12
10. become immortal	1 2 3 4 5	6 7 8			9 10	9
11. attain perfect health	1 2 3 4 5	6 7 8			9 10	11
12. perceive objects in terms of the Self	1 2 3 4 5	6 7 8			9 10	9
13. maintain unbounded awareness at all times	1 2 3 4 5	6 7 8			9 10	1

ctomeegmiu73.jpg

DATA SHEET # Upper Division

Human Potential Questionnaire

Instructions: For the following statements circle T if the statement is true or mostly true, circle F if the statement is false or mostly false.

In my opinion man has the potential to:

1. levitate by mere intention
2. know the future intuitively
3. increase his intelligence
4. improve his creativity
5. become more friendly
6. see objects hidden from view
7. understand the communication of animals
8. know God
9. enjoy life fully in happiness
10. become immortal
11. achieve perfect health
12. perceive objects in terms of the Self
13. maintain unbounded awareness at all times

ctomeegmiu74.jpg

Human Potential Questionnaire - part 2

Instructions: For the following statements circle T if the statement is true or mostly true, circle F if the statement is false or mostly false.

I have personally experienced the ability to:

1. levitate by mere intention
2. know the future intuitively
3. increase my intelligence
4. improve my creativity
5. become more friendly
6. see objects hidden from view
7. understand the communication of animals
8. know God
9. enjoy life fully in happiness
10. become immortal
11. attain perfect health
12. perceive objects in terms of the Self
13. maintain unbounded awareness at all times

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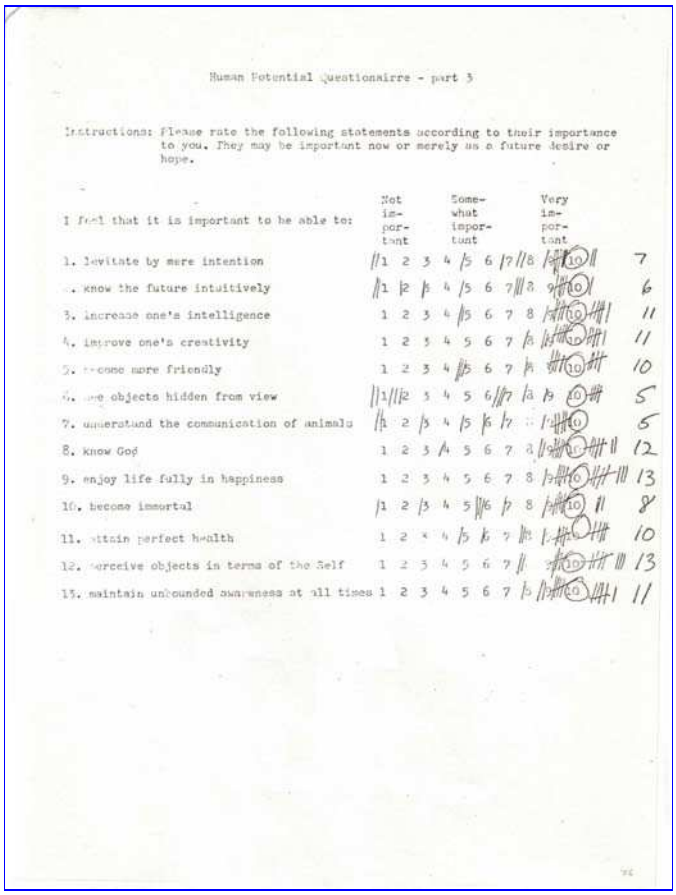

Human Potential Questionnaire - part 3

Instructions: Please rate the following statements according to their importance to you. They may be important now or merely as a future desire or hope.

I feel that it is important to be able to:	Not im-por-tant			Some-what impor-tant			Very im-por-tant			
1. levitate by mere intention	1	2	3	4	5	6	7	8	9	7
2. know the future intuitively	1	2	3	4	5	6	7	8	9	6
3. increase one's intelligence	1	2	3	4	5	6	7	8	9	11
4. improve one's creativity	1	2	3	4	5	6	7	8	9	11
5. become more friendly	1	2	3	4	5	6	7	8	9	10
6. see objects hidden from view	1	2	3	4	5	6	7	8	9	5
7. understand the communication of animals	1	2	3	4	5	6	7	8	9	5
8. know God	1	2	3	4	5	6	7	8	9	12
9. enjoy life fully in happiness	1	2	3	4	5	6	7	8	9	13
10. become immortal	1	2	3	4	5	6	7	8	9	8
11. attain perfect health	1	2	3	4	5	6	7	8	9	10
12. perceive objects in terms of the Self	1	2	3	4	5	6	7	8	9	13
13. maintain unbounded awareness at all times	1	2	3	4	5	6	7	8	9	11

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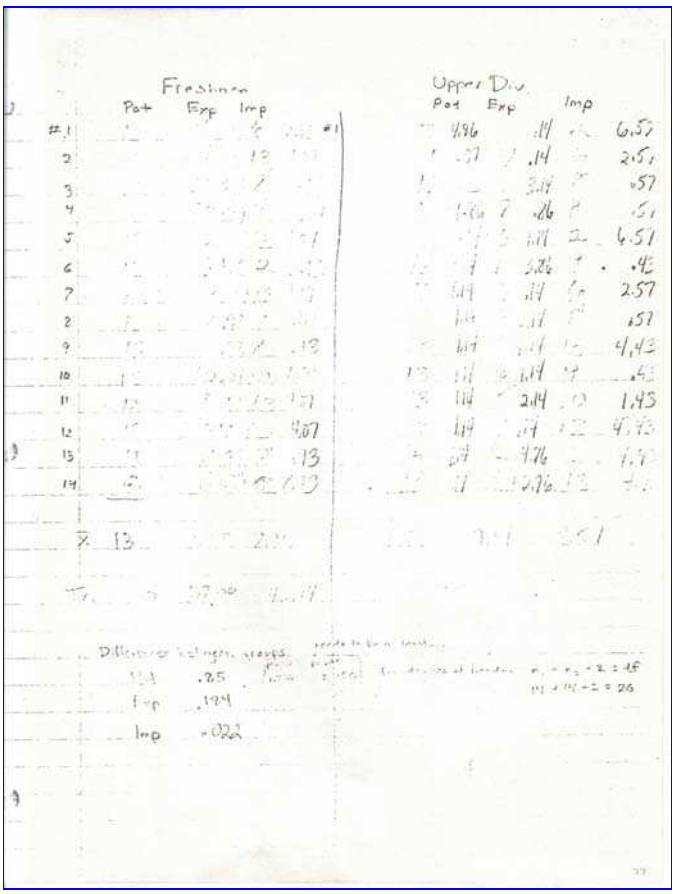

Freshmen Pat Exp Imp

Upper Div Pat Exp Imp

ctomeegmiu77.jpg

References

(under construction - being typed from notes)

Alfred North Whitehead (Whitehead, 1929)

John Dewey, Democracy and Education (1916).
Some attitudes may be named which are central in effective intellectual ways of dealing with subject matter. Among the most important are directedness, open-mindedness, single-mindedness (or whole-heartedness) and responsibility... Openness of mind means accessibility of mind to any and every consideration that will throw light upon the situation that needs to be cleared up... The worst thing about stubbornness of mind, about prejudices, is that they arrest development; they shut the mind off from new stimuli. Open-mindedness means the retention of the childlike attitude; closed-mindedness means premature intellectual old age. (p.174)

Dewey further states in How We Think (1944):
While it is not the business of education to prove every statement made, any more than to teach every possible item of information, it is its business to cultivate deep-seated and effective habits of discriminating tested beliefs from mere assertions, guesses and opinions; to develop a lively, sincere and open-minded preference for conclusions that are properly grounded, and to ingrain into the individual's working habits methods of inquiry and reasoning appropriate to the various problems that present themselves... The formation of these habits is Training of the Mind. (p.27)

hey said "highest educational priority" must be given to improving these abilities, and that "critical thinking" should be viewed as a basic skill and be defined as such by the U.S. Department of Education (Time, October 1980, p.42).

hey point out the "mind altering techniques employed by these groups tamper with the kind and quality of information fed to the brain..." which "seriously affect the brain's ability to process information and may result in impaired awareness, irrationality, disorientation, delusion, and even violently destructive acts" (Conway and Siegelman, 1979).

"With declining enrolments, one obvious alternative for dealing with the financial problems of an institution is to improve the quality and thereby increase its attractiveness (Freedman, 1973: Group for Human Development in Higher Education, 1974; Leslie & Miller, 1974, Shulman, 1974).

Skinner, S. B. and Hounshell, P. B. (1972), The Effect of the St. Andrews College Natural Science Course upon Critical Thinking Ability. School Science and Mathematics, 72: 555–562. doi: 10.1111/j.1949-8594.1972.tb13798.x

Perhaps Carlos de Zaftra best described the importance of critical thinking ability when he wrote in "Teaching for Critical Thinking":
For the first time in his long history, mankind has in his power the ability to fill his cornucopia or to destroy himself. Because the rate of change has greatly accelerated and because the applications that are made of mankind's discoveries and inventions are more important than are the discoveries and inventions themselves, mankind now needs to do some critical thinking of an unprecedented quality. The future of the human race depends upon the quality of critical thinking that is done in the world today. (1966, p.14)

The Educational Policies Commission of the National Education Association devoted its 1961 publication, The Central Purpose of American Education to the goal of developing critical thinking abilities in students. The importance of the ability to think critically was recognized by the E.P.C. in its statement:
The purpose which runs through and strengthens all other educational purpose--the common thread of education--is the ability to think...the development of every student's rational powers must be recognized as centrally important. (p.12)

The desirability of organizing the college general education science experiences to emphasize critical thinking ability was recognized as early as 1947 by the President's Commission on Higher Education. One of the objectives of science in education, according to this Commission's list of major goals is:
To understand the common phenomena in one's physical environment, to apply habits of scientific thought to both personal and civic problems, and to appreciate the implication of scientific discoveries for human welfare. (p.52)

In his dissertation Critical Intelligence and its Development, Jon Nordby (1977) lays the philosophical groundwork for the next consideration--"How can critical intelligence or critical thinking be taught? A clear, detailed answer to this question is important to professional educators."
Nordby notes that philosophy professors have long had the major interest in developing critical thinking in their students. However, the educational importance of critical intelligence goes well beyond the critical evaluation of philosophical arguments. Educators in the social sciences, the natural sciences, the humanities, as well as in professional schools attempt to encourage the development of critical intelligence. For example, the students are asked critically to evaluate theories, to support certain conclusions with relevant evidence, and to organize and to write critical essays and term papers. Nor is developing critical intelligence simply confined to classroom activities. Educators often hope that their students will evaluate sales pitches, political arguments, and proposed explanations through critical deliberation, not simply in an arbitrary, emotional manner. (1977)

The educational curriculum in Plato's Republic had the Dialectic as its 'coping-stone' -- "the method...which takes this course, doing away with assumptions and traveling up to the first principle of all" (Cornford, 1941, p.254).

y. Similarities between the goals and procedure of the Dialectic and Transcendental Meditation techniques have been noted by Shear (1981).

The TM technique is a simple, natural, effortless procedure for contacting the field of pure creative intelligence. It is practiced twice daily for about twenty minutes while sitting comfortably with closed eyes" (MIU Catalogue, 1981).

Numerous research studies on practitioners of the TM program indicate that culturing "transcendental consciousness" progressively improves creativity, intelligence, personality qualities, health, and general awareness (Orme-Johnson & Farrow, 1977).

EEG coherence in MIU students was found to correlate positively with measures such as SAT scores, IQ, and Hoffman reflex recovery (MIU Catalogue, 1981).

Critical, or logical thinking ability will be defined as "thinking that proceeds on the basis of careful evaluation of premises and evidence, and comes to conclusions as objectively as possible through the consideration of all pertinent factors and the use of valid procedures from logic" (Dictionary of Education).

The technique of transcendental meditation is defined as a way of allowing the attention to go from the gross, surface level of ordinary thought to increasingly subtle levels, until finally the subtlest level is reached and then transcended. (Forem, p.27)
https://www.facebook.com/jack.forem/info?ref=ts

n. ”The TM-Sidhi technique of 'flying' is an extraordinary new technology for the generation of coherence" (MIU Catalogue, 1981).

et basically, ”critical thinking is the process which brings about changes in habitual ways of thinking and acting in order to be more responsive to realities” (Organ, 1965, p.6).

The literature reveals that effective participation in the world today requires the ability to think and read critically. There is evidence to support the view that his ability does not develop automatically; rather, it has to be nurtured. This fact has prompted many educators to point to the importance of providing instruction directed to improvement of critical thinking and reading. A perceptive search of current instructional practices, however, reveals serious shortcomings. (Alston. 1972)

In a survey to isolate the essential critical reading skills, Roch (1979) found that ability to draw conclusions, reasoning, ability to generalize, draw relationships, and make sound judgment: were considered the most essential of 400 qualities according to 50% of professional authors consulted.

People who are proficient in critical thinking seem to exhibit their potential more with higher quantities of praise, peer to peer interaction, and student participation in the classroom (Smith, 1977).

Yet critical thinking ability seems to remain independent of emotional influences as found by Revlin, Leirer, Yopp, and Yopp (1980):
When asked to reason about controversial, if not emotional, material, students do not suspend rational choice, but rather, their decisions are judicious ones, flowing logically, when errors do occur they result from an interruption of rational processes and reflect conflicts between competing goals rather than a switch to irrational decision processes.

Little (1972) found that students with high critical thinking ability were more imaginative, independent, stable emotionally, and trusting, but less conscientious than college students of low critical thinking ability (CT). Using a Personality Factor Questionnaire and the Watson-Glaser Critical Thinking Appraisal (WGCTA), Little found differences in personality characteristics between high CT and low CT males and females, but no difference between males and females on the WGCTA.

No sex differences in WGCTA scores were found by Hoogstraten and Christiaans (1975) and Gurfein (1977), but Simon and Ward (1974) did find that males outperformed females. Gurfein found that the WGCTA scores of 270 intact families, (comparing fathers to sons, mothers to daughters, fathers to daughters, and mothers to sons) correlated significantly, indicating that CT levels are similar by family.

O'Neill (1973) found that high school teachers were higher than their students in CT, and open-mindedness (OM) as measured by the Rokeach Adult Dogmatism Scale (RADS). Yet Alston (1972) found that in teachers, years of teaching experience was negatively correlated with CT. This indicates that greater chronological age does not necessarily mean greater CT and that younger teachers may be getting more training in CT.
Yoesting and Renner (1969) and George (1967) found that general physical science students increased their WGCTA scores over a semester significantly more than non-science students did. Simon and Ward (197U) however, found no difference between art and science students in CT.
Seymour (1973) and Brown (1967) found that chemistry students made greater improvements in CT than non-chemistry high school students. Brubaker (1972) found that students in similar majors had similar CT levels. CT was found to be the most significant common factor among those high school students who persisted in science studies (James, 1972).
Scores on the Test on Understanding Science (TFUS) correlated r=.48--.65 with the WGCTA among high school chemistry students (Troxel & Snider, 1970). As MIU considers itself a science oriented university, we may look for indications of high CT among the

student body.
The effect of studying the Science of Creative Intelligence (SCI) on CT should be investigated because studies indicate that both creativity and intelligence are involved in CT. Moore (1973) and Brubaker (1972) found significant correlations between creativity and CT. Moore used four selected creativity tests to measure 'sensitivity to problems", "spontaneous flexibility', "semantic redefinition", and "originality." In the area of intelligence, George (1968) found that final grades in high school biology correlated with CT. George, and Lysaught (1964, 1970) found significant correlations between CT and Otis IQ scores.
Also in the area of ”general intelligence", significant correlations between the WGCTA and the Scholastic Aptitude Test (SAT) were found by James (1972) and Brubaker (1972). Grasz (1977) found significant correlations between the WGCTA, the Miller Analogy Test (MAT), and the Graduate Record Examination (GRE) verbal and quantitative sections.
Westbook and Sellers (1967) found correlations of .53 between the WGCTA and the Hennen-Nelson Tests of Mental Maturity, consistent with correlations of .55 between the WGCTA and the Miller Analogy Test (MAT).
Critical thinking ability seems to be very important to success in technology oriented occupations. Hunt (1973) found CT to be a good predictor of success in computational science. Hartman (1977) found that CT explained 43% of the variance in, and is a strong determinant of success in computer-assisted systems analysis. Hinojosa (1974) found that CT has no relationship to the type of leadership style adopted by administrative personnel.
There is reason to hypothesize that EEG coherence, higher stages of moral reasoning, and CT may correlate positively. Cruce-Mast (1975) found that CT correlated significantly with moral decision making as measured by the Defining Issues Test (DIT), the same test used to determine a correlation between EEG coherence and moral reasoning (MIU Catalogue, 1981). EEG coherence and moral reasoning were also cited to correlate with subjective experiences of transcendental consciousness (TC) through TM.
A positive relationship between the development of Maharishi‘s seven states of consciousness, and Piaget's major stages of cognitive development has been investigated theoretically by Shear (1979). Carlson (1975) found a significant correlation between Piagetian level of thought and scores on the WGCTA. The "formal operation" subjects outperformed the "concrete operation" subjects significantly on the Piagetian Task Instrument (PTI), WGCTA, and the Test on Understanding Science (TFUS).
CT ability seems to vary with type of schooling. In a study comparing high school seniors in different parochial schools, Quinn (1963) found that Protestants, Jews, and Catholics were highest, middle, and lowest, respectively on scores on the WGCTA, and open-mindedness using the RADS. The differences were apparently not due to religious heritage or parents' educational background; the explanatory factor seemed to be rigidity of the educational atmosphere. Geckler (1965) also found differences in CT and OM between protestant students at different parochial schools.
According to Hinojosa (1974), "a definite relationship between dogmatism and critical thinking ability exists. Dogmatic individuals, this investigation concluded, tend to score lower on critical thinking ability measures." This finding is supported by other studies using the WGCTA and the RADS Form E: Quinn (1963), Geckler (1965), Marrs (1971), O'Neill (1973), Seymour (1973). Moore (1977), and Wilkins (1979). This study will determine if this is also true for MIU students, and if the TM program might lead to improvements.
Many other methods to improve critical thinking ability have been tried and tested. Values Clarification exercises were found to improve CT significantly in high school math students (Moore, 1977). Teacher question-asking behavior seems to have an influence on improving student CT. George (1968) found that teachers with high levels of CT achieved the greatest improvements in their students’ CT levels, Inquiry-oriented, examinatory modes of instruction were found to improve students' CT more than a passive, teacher-oriented approach (Garris, 1974; Vance, 1972: Story, 197M; and Pisano. 1980).
Class materials also have had an effect on improving student CT. Yager (1968) found that students using more than one textbook for an 8th grade science course improved their CT ability significantly more than a control group of students using just one textbook. Their Test on Understanding Science scores were higher also.
Cercone (1977) found that 10th grade English students improved their CT ability more than a control group by engaging in one dramatic activity related to their class work per week for twelve weeks. Bailey (l9?9) found that an instructional model of how to learn and process information, the Problem Information Processing Paradigm (PIPP), improved the CT ability of high school students more than a control group's. Greenblatt (1979) found that the use of political cartoons stimulated greater critical reading skills in 11th graders in a social studies class.
Matthews (1980) found that students in classes emphasizing a student centered, versus teacher dominant, learning situation exhibited higher levels of ability to solve problems and think critically.
McCloudy (1974) investigated the effect of kinds of sounds and levels of intensity of noises on critical thinking ability. He found that increased levels of intensity of normal classroom noise, abnormal classroom noise, mood music, rock music, machinery sounds, and traffic noises decreased the ability of students to think critically. It seems that lower levels of sound intensity and excitation are most conducive to critical thinking. This is another reason the ”state of least excitation' cultured ; through the TM program should be investigated with respect to critical thinking ability.
MIU seeks to provide a holistic view of knowledge through its core course curriculum consisting of one or two week blocks in the various academic disciplines. Indications
that this type of education may develop CT are found in a study by Schafer (1972) showing that liberal arts graduates more - consistently higher in CT than state college graduates
specializing in one specific area of knowledge.
CT has been studied with respect to personality characteristics to a limited extent. Simon and Ward (197U) found that scores on the WGCTA were independent of scores of extroversion versus introversion on Eysenck's Personality Inventory (EPI). Goble and Hounshell (1972) found CT as measured by the WGCTA to be independent of self-actualization as measured by Shostrom's

Personality Orientation Inventory (PPI).

Rokeach, in his book The Open and Closed Mind (1960) d

0pen-mindedness is usually dealt with in the research as the opposite of dogmatic, or closed-minded thinking. Most of the research in this area has been done by Milton Rokeach, a professor of psychology at the University of Michigan. Rokeach, in his book The Open and Closed Mind (1960) defines a dogmatic individual as one holding ”a relatively closed cognitive organization of beliefs and disbeliefs about reality and dogmatism as ”a cognitive defense network against anxiety.”
The term dogmatism is associated in the research with the terms authoritarianism. cognitive rigidity, bias. prejudice, and the opposite of fair-mindedness (Watson. 1925). The Dictionary of Educating presents a comprehensive definition of what dogmatic means:
1) of a person given to highly authoritative pronouncements.
2) of statements without critical scrutiny and challenge as to grounds and evidence.
3) of systems based on assumptions that cannot be scrutinized.
4) of teachings characterized by authoritative statements on the part of the teacher intended for acceptance by the pupils without question: to be contrasted with teaching that guides pupils in thinking their own way through problems.
The effects of dogmatic instruction on pupils has been referred to by Soderbergh (1964) as "a condition fatal both to the afflicted teacher and the exposed pupil.” Vacchiano, Strauss, and Schiffman (1968) found that the dogmatic person is characterized as frustrated by changeable conditions, submissive and conforming, ultra-conservative, and respecting without question established ideas.
Gordon (no date) has studied authoritarianism and dogmatism with respect to type of work environment preferred, and found that dogmatic individuals tend to be ”accepting of and acquiescent to authority, who prefer to have specific rules and guidelines to follow, who prefer impersonalized work relationships, and who seek the security of organization and in-group identification.”
Rokeach describes differences in levels of open-mindedness as ”personality differences in receptivity to new information" (1968, p.144). Receptivity to new information is crucial to the progress of scientific knowledge. From the time of the ancient Greeks, Socrates "the bugbear of Athena" urged his fellow men to attack their assumptions and use their own faculties to seek the "Good'—-the highest truth.
Desiderius Erasmus “the Voltaire of the 16th century”, though ordained a priest, disdained the dogma and fanaticism present in the Catholic faith at his time. He wrote '...the whole world has firmly set its heart against using its God-given brain" (1511). His satires on the superstitions presenting the church of Rome led in part to the German Reformation, carried on by Martin Luther who further challenged the infallibility of the pope.
Michel de Montaigne‘s philosophical approach was expressed in his famous Essays by his questioning ”what do I really know?" He balanced contradictory views believing that all ideas contain elements of truth, and that all knowledge is relative. He was an antidogmatist, and firm believer in the spirit of free inquiry.
The qualities of open-mindedness are fundamental to the expansion of consciousness necessary for both scientific and philosophical thought. Immanuel Kant wrote that he was aroused from “dogmatic slumber“ upon reading the works of David Hume, a staunch skeptic and empiricist philosopher.
One of the greatest scientists of our times, Albert Einstein admonished his students to “...take the business of science progress into your own hands; insist on thinking Your own thoughts even if contrary to the crowd. Challenge the presumed orthodoxy of ideas? (Holton, p.163).
Gordon Allport, in The Nature of Prejudice (1959, p.8) states that "On the average, church-goers and professedly religious people have considerably more prejudice than do non-church goers and non-believers towards racial, ethnic, and other religious groups. Allport refers to this tendency as a "central disposition" in his study of individual personality.
Quinn (1963) found differences in open—mindedness between students at different religious high schools, Catholics being higher in dogmatism than Jews and Protestants. Geckler (1965) found that in 10th grade students, Baptists, and members of the Church of God were higher in dogmatism than Episcopalians, for instance. Level of dogmatism seems to vary with denomination.
From time to time newspaper and magazine articles have accused practitioners of the Transcendental Meditation program to be involved in a ”religious cult.' Proponents of the TM program retort that TM is not a religion. Campbell(1974) writes "Transcendental meditation, though taught individually, does not depend on devotion to a master any more than on assent dogma", and that followers of any religion may practice the TM program without compromising their faith. A consideration of this paper will be to determine if students practicing the TM program at MIU tend to be dogmatic or not. This paper, of course will not deal with-the issue of whether or not the TM program is a religion. But even if it is, perhaps this study will help determine if practitioners of the TM program are blind followers or, as the Vedic literature puts it, “discerning worshippers.”
Rokeach's work has focused on the relationship between what we know, and how we know it--how we acquire that knowledge. He has analyzed different belief systems among a wide variety of political and religious groups. Blankenship (1968) has studied the relationship between open and closed—mindedness, and capacity for independent thought and action: "
The more closed--minded an individual, the more difficult it should be to distinguish between information received about the world, and information received about the source (of the information). Conversely, the more open-minded an individual, the better

should be the ability to receive and analyze information objectively and act upon the information independently, and on its own merits.
This summarizes many of the research findings of Rokeach. In constructing the Rokeach Adult Dogmatism Scale, Rokeach and his research assistants "scrutinized the various defining characteristics of open and closed systems. We then tried to construct statements designed to tap these characteristics" (1960, p.72). A copy of the RADS Form E is found in the Appendix of this paper.
Rokeach performed a study with Mezel (1966) which found that congruity of beliefs is a greater unifier among people than other factors, such as racial, or cultural similarity. This study showed that whites preferred to be with black people of similar beliefs, than with whites of dissimilar beliefs. Jamias and Troldahl (1965) studied the innovativeness of high and low open-minded groups, and found that the more open—minded groups, regardless of race and culture, had a high adoption rate of new ideas, while high dogmatic behavior was manifested by compliance or identification with social norms.
Dogmatism has been found to correlate with neurotic anxiety by Hanson and Clune (1973). and Cohen and Harris (1972). In a study of 86 primary school children, Cohen and Harris found a correlation of r=.52 p<.001) between neurotic anxiety and dogmatism. Here again the level of dogmatism in TM practitioners should prove interesting as they tend to be lower than norms in anxiety and neuroticism.
Regular practice of the Transcendental Meditation program has been found to reduce anxiety (Nidich et al., 1972: Hjelle, 1974; Penner et al., 1974; Davies, 1974; Shapiro, 1974; Stern, 1974; Ferguson and Gowan, 1976; and others). Ross (1972), Ferguson and Cowan, and Shapiro found reduced neuroticism in individuals practicing the TM technique.
Level of anxiety with respect to classroom performance has been studied to a great extent. Williams (1971) found significant improvement in tolerance for ambiguity (as measured by Budner's Intolerance for Ambiguity Scale) and open-mindedness (using the RADS) in an experimental group of undergraduate educational psychology students engaging in a cross-cultural simulation game. These activities seem to be those which emphasize an expansion of awareness
to see other viewpoints.

Original Individual Page format: 1 2 3 4 5 6 7 8 9 10 11 12 13 14

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