The Implementation of Multiple Intelligences in the Classroom to Enhance Student Learning

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ABSTRACT

The purpose of this study was to investigate and document the effectiveness of Howard Gardner's Multiple Intelligences (M.I.) Theory in a pre-college math course. Gardner's M. I. inventory was used to measure the differences in two groups of participants. Two groups are studied: one group who has not been made aware of their intelligence versus, a second group of students whose intelligences have been identified. Differentiations in post-test scores using the Standardized-Test of Adult Basic Education TABE and a t-test assuming unequal variances were compared for each group of participants.

Group A and Group B were motivated by the opportunity to return to college. However, each group was composed of fifteen students. In addition, Group B enjoyed the feeling of self-worth and respect from knowing their unique intelligence. The M.I. Inventory

was given to Group B and not Group A. Post-test scores were analyzed and compared between the two subject groups.

Results from the statistical findings of Howard Gardner's M. I. Inventory showed no significant differences in Group A and Group B post-test score; perhaps factors other than M.I. may have been responsible for the similarity in post-test scores. The thought of returning to college, after being suspended may be significant to learning using Gardner's M.I. Inventory. Nevertheless, M. I. results and findings will be shared with the community.

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Chapter 1: Introduction

Not acquiring math skills using intelligences is a growing problem in the United States. *Webster's II: New World Dictionary* (1995) defines math and intelligence as the following: mathematics is critical thinking using numbers and operations/relations; and intelligence is the ability to gain knowledge. In talking about intelligence it is almost inconceivable not to discuss learning styles, because they go together like fingers on a hand (Jensen, 1998). Since ability to learn and understand math is very important, information about relevant student intelligence in math has always been integral to educational research. According to Gardner, professor of cognition and education, mathematical intelligence is the ability to reason (1983).

Gardner's work has shown that people with deficiencies in learning math can benefit from knowing their intelligences. Lazear purported several ways of understanding and teaching using intelligences (1991). Explanations of intelligences can provide key information for success in almost any field, especially math (maximization of potentials). Sprenger (1999) also stated that being aware of statistical characteristics of one's innate ability helps to facilitate learning and improve strengths.

Learning is life-long (Maehl, 2000) and the demonstration of intelligences comes from the need to succeed. People are born learners, using the intelligent design of the brain (Smilkstein, 2003). Students, who are filled with the desire to learn, are focused on knowledge, skill, and cognitive abilities.

Yet, individuals resist learning (especially math) for all kinds of reasons. One of the main reasons for mathematical difficulties is fear of the unknown, which affects a person's

capacity to learn new and difficult information. However, using innate abilities helps to alleviate consequences such as math anxiety.

Again, Gardner's *Theory of Multiple Iintelligences* (1983) is concerned with the state of the mind; developed by studying what people actually do in life (Miele, 2002). Gardner believed we can learn what to do in certain situations by watching and learning from successful individuals in that field of study. Consequently, some learning resistance results from the inability to use one's intelligence wisely.

Eric Jensen (1995) suggested interactive methods such as exercising the mind and body, making up questions, moving around, increasing feedback, eating brain food, mind mapping, and using material taught in some new way may all facilitate learning and understanding. Furthermore, to avoid math anxiety, such activities as above can also be employed.

Mathematics is a language. The learning tenets employed may involve words and symbols. A way to learn this language is through mathematical intelligences which could include: time management, academic support centers, supplementary work, homework assignments, and mentors. Other skills needed to help overcome math anxiety are critical thinking and problem solving. Success in mathematics requires a strong foundation (dominant intelligences).

Background to the Problem

Mathematical intelligence as a concept owes much to India. Our present number system can be traced back to the third century B.C. According to Lawrence W. Swiencik's (1993) educational poster, one of the earliest written records called the Shabakah-method of multiplication occurred in Hindu works around the twelfth century. The lattice multiplication

table used then is similar to the one used today. It is believed that this was an attempt to make some sense out of the world. Subsequent work in math resulted in conjectures theories.

Arthur R. Jensen (1998), a renowned psychologist from Berkeley California and one of the most controversial figures in intelligences theory, viewed multiple intelligences used in math as biological. His hypothesis was derived from intelligences and racial differences. Jensen and his mentor Hans J. Eysenck (1979) viewed intelligences as a g factor (general mental ability). Eysenck and Jensen's views of intelligences were produced while studying at the London School of Psychology established by Sir Francis Galton and Charles Spearman (Miele, 2002). Jensen's definition of intelligence was limited to objectionable behavior differences between species. The intelligences he used included: sensory sensitivity, perception, discrimination, and stimulus generalization, various types of conditioning and learning, habit reversal, learning set formation, concept formation, reasoning, and problem solving. Concerns regarding math intelligence and related concepts are said to be broad and most experts in psychology have not agreed on a definition for mathematical intelligence. However, Jensen does not see Howard Gardner's multiple intelligences as a science (Miele, 2002).

Learning theorists like David Kolb, Irwin Rubin, and James McIntyre used different methods to explain the concept of mathematical intelligences. Kolb, Rubin, and McIntyre's (1984) intelligence/learning cycle included four degrees: concrete experience, reflective observation, abstract conceptualization, and active experimentation. A person's score on their learning style inventory test puts the learner into one of the categories above. Preference chosen on that test explains how one learns. Their assumption was that individuals are more receptive to information delivered in a method matching their personal preferences

(intelligences). Although knowing how one learns can reduce frustration, empower, and motivate learners, it does not work for all learners.

Kolb, Rubin, and McIntyre (1984) generated a learning style inventory (LSI) to measure cognitive abilities, but the instrument proved only to be an indicator of the way one learns. Their next inventory was called the Adaptive Learning Style Inventory (ALSI) which encompassed the learners' individuality. Even though the ALSI improved the theory, it was silenced by what critics call three barriers to learning:

- Traditional values regarding classroom lectures,
- Learner's inability to understand the learning process and take responsibility for their ability and
- Teachers not having the flexibility to understand individuality in learning

In spite of their research, the effectiveness of the inventory focused on how one learns (Jensen, 1998).

Maximizing Intelligence by David J. Armor (2003) suggested how mathematical intelligence and other intelligences may be enhanced. A professor of public policy in the School of Public Policy at George Mason University, Armor (2003) believed genetics and the environment played a role in intelligences. He presented four propositions for intelligences. They included the following: 1) intelligence in math and any other field is influenced by education and occupational success, 2) changes can be made to intelligence within limits, 3) risk factors influence intelligence such as: parent's intelligences and education, size of family and structure, family income, nutrition, and parent's behavior, and 4) the cumulative result of numbers two and three – parent involvement. Although Armor (2003) agreed with the existence of multiple intelligences, he did not believe Intelligent Quotient (I.Q.) should be

removed completely. For example, some Black and Hispanic students from 1970 to 1990 increased their intelligences level because of government programs aimed at enhancing those skills (Armor, 2003).

Some students can avoid certain errors while increasing intelligence in math and other areas by appealing to their strengths and selecting opportunities that are suitable to their intelligences. The preference-strength is constant, but the behavior may not be. Teaching to one's style/intelligence (ability) is comfortable, but lacks effective learning-knowledge gained from failure. Nevertheless, Armor (2003) saw learning/intelligence as one piece of the puzzle.

Intelligence/learning is a compilation of different individual's opinions/beliefs. Adequate assessment tools to measure the cognitive ability or intelligence are in dispute. Mathematical intelligence and all others must be comprehended before they can be assessed (Francois, 1995). Throughout the years intelligence testing has taken many directions.

Theories about intelligence date back to the inception of psychology (Anastasi & Urbina, 1997). The measurement of physical and mental characteristics can be traced back to the third century B.C. in India. In the 1800s, testing was used to categorize mental illness (Anastasi & Urbina, 1997). Since that time, theories of intelligences have developed into a science (Drummond, 1996). While the understanding of what intelligence is has grown, so has instrument validity (Naglieri, 1999).

Finally the experts in intelligence have concluded that no theory explains all facets of intelligence. Some specific areas of intelligences have been established such as Howard Gardner's *Theory of Multiple Intelligences* (1983), but in order for the debate over intelligences to be resolved, new research may be needed to reach a conclusion.

Statement of the Problem

Most students see intelligence in mathematical education as employment, employability, and learning that lasts (Mentkowski et al., 2000). Pre-College math courses should focus on students' individual abilities to reason in solving problems. Individual plans should be designed using each student's intelligence to accomplish goals in the pre-college math courses. If the performance of students in the class is poor, innate abilities (intelligences) need to be included to insure a higher success rate. This study will investigate the null hypothesis, which says M.I. enhances learning. The comparison of two groups (independent/dependent) will be used to test the null hypothesis.

Purpose of the Study

The purpose of this study is to investigate and document achievement of adults in a pre-college math course using Howard Gardner's Multiple Intelligences (M.I.) to enhance learning. The effectiveness of Gardner's M.I. to enhance learning will be measured in a mathematics course at a Midwest college for one semester. The research will document and differentiate the ability of adult students to succeed. Two groups will be compared and studied: one who has not been made aware of their intelligence versus, a second group of students whose intelligences have been identified. Pre-test and Post-test (Standardized-Test of Adult Basic Education, TABE) scores will be compared for each group of participants.

Research Questions

This research will focus on (null hypothesis-M.I. enhancement of learning) the following:

1. Can the dominant intelligence be used to enhance mathematical reasoning?

2. Should criteria be set for channeling intelligences, if so, which criteria?
3. Can the dominant intelligence be raised to help others, if so, how far?
4. Are there any alternatives in place for individuals who cannot channel intelligence to mathematical reasoning?

Importance of the Study

This study will explore the following characteristics of M.I.:

1) The effect of Gardner's Multiple Intelligences (M.I.) theory on student success. Gardner's M.I. theory allows learners to become balanced individuals. Harmony gained through M.I. enhances an individual's capacity to function in his/her environment. This understanding of oneself also leads to greater social and psychological processing in his/her community.

2) How M.I. has advanced.

Having existed for over twenty years (Gardner, 1983) M.I. has had a great effect on student's mental abilities. Hence, most of its proponents have been in education.

3) This research will emphasize the advantages of M.I..

Learners are given an opportunity to use their own unique abilities, which reinforce skills, knowledge, and capabilities. For example, learners are excited to learn about a tool (intelligences) they possess which can be channeled into learning math. The empowerment achieved from an inborn ability leads to self-assurance.

4) Contents covered in M.I. theory will help increase learning potential.

The theory of M.I. includes explanations, explorations, demonstrations, and implementation. The explanation provides information starting with the theoretical definition

of M.I. or its application. Exploration probes M.I. regarding school, parents, and the community. Demonstration shows examples of M.I. such as lesson plans. Some of the implementation exercises include learning centers, simulations, and presentations.

The idea of using intelligences to establish learning was seen as an important role for individuals to enhance his/her ability (Sprenger, 2003).

Multiple intelligences affect a person's ability to concentrate, practice, internalize, and retain new and difficult information (Gardner, 1983). An inconsistency in learning and teachers styles creates a mismatch and impairs learning (McEwan, 2003). Instructors aware of intelligence for math should modify their teaching style to accommodate learners (Brookfield, 1990).

Limitations of the Study

This study is restricted to the following limitations:

1. The population will include adult male and female students enrolled in a basic mathB3 course at a Midwest college in 2007. The college is committed to delivering high-quality instructions and programs for adult learners.

2. Students may have felt rushed through the pre-test because of the accelerated format of the MathB3 course, the duration is six to eight weeks. Accommodations are made for individuals with special needs such as special test-taking procedures. This study is intended to support individuals' intelligences. Certain situations and/or circumstances may be effected due to physical or mental abilities.

3. This study will be restricted to Howard Gardner's exploration and explanation of multiple intelligences implementation.

4. Howard Gardner's work in M.I. will be used to report the implementation of multiple intelligences in the classroom to enhance student learning. This research/study was prepared by Charles Jefferson and is not intended to make inroads on property, territory, and/or others rights.

Definitions

For clarification of meaning, the following terms are defined.

- Conjecture: Theorizing, predicting, and speculating (*Webster's II: New World Dictionary*, 1995).
- Learning: Knowledge gained through exposure (*Webster's II: New World Dictionary*, 1995).

Summary

Educators need to formulate a personal education plan for each student if they want to help students acquire math skills using their personal intelligence. Even though such an initiative could prove quite expensive; proof of the effectiveness shown in such an undertaking must be readily perceived to improved math scores throughout the United States. Howard Gardner's *Theory of Multiple Intelligence* has shown tremendous achievements in this area of learning. The following chapters will include a review of literature, methodology, results and discussion, summary, conclusion and recommendations.

Chapter II: Review of Literature

This chapter will include three learning styles, eight multiple intelligences as well as goals and characteristics of adult learners. In the past, most behaviorists believed that intelligence belonged to individuals inherently. They thought human beings could learn anything if it was presented appropriately; researchers today, though, believe the opposite. Now there is a belief that people have multiple intelligences, which are thought to be unique to each individual. Inborn intelligences have its own strengths and restrictions from birth, and challenges to these innate abilities are therefore difficult.

One of the researchers leading the theory of intelligences is Howard Earl Gardner (1983). He disagreed with the cognitive developmental stages of work by Jean Piaget. Gardner's work has weakened Piaget's work by proving that a child can be at various stages of learning at different times.

Everyone possesses a unique intelligence. It allows them to accomplish certain tasks easily (Gardner, 1983). Our present educational system has placed too much emphasis on traditional learning, without paying attention to individual's unique intelligences. Learners have been forced and/or encouraged to use memory techniques. This type of learning promotes poor learners. Emphasis should be placed on understanding (intelligence) and remembering the concept, rather than rote memory. Multiple intelligences/learning is geared toward each student's learning and understanding in his/her own unique ability. Learners become motivated and empowered through their uniqueness with multiple intelligences.

Learning/intelligence in math is a challenge in America. One contributing factor may be the diversity in our population (Jensen, 1998). People with special needs benefits from knowing his or her learning style/intelligence.

Styles used to establish learning/intelligences play an important role in an individual's approach to discovering his/her ability regarding mathematics. Howard Gardner (1983) believes that these approaches affect a person's capacity to fixate, incorporate, and exercise new and difficult information. Gardner's research has shown that multiple intelligences are just different ways to learn using innate intelligences. Gardner (1983) defined intelligence as problem solving. Along with learning styles, multiple intelligences plays an important role in learning. There is a relationship between styles used to learn and multiple intelligences (Gardner, 1983).

The three most common types of learning styles are auditory, visual, and tactile/kinesthetic. The eight intelligences defined by Gardner are visiual/spatial, verbl/linguistic, logical/mathematical, bodily/kinesthetic, musical/rhythmic, interpersonal, intrapersonal, and naturalist. Finally, a review of the three learning styles, eight multiple intelligences, goals, attributes of adult learners using intelligences in mathematics, mental attributes, physical attributes, social attributes, and factors of adults as learners using intelligences are the following:

Auditory Learners –Learning through listening

Auditory learners learn best through verbal lectures, discussions, talking things through, and listening to what others have to say. Auditory learners interpret the underlying meaning of speech through listening to tone of voice, pitch, speed, and other nuances. Written information may have little meaning until it is heard. The auditory learners often benefit from reading text aloud and using a tape recorder (Gardner, 1983). They remember people's name, lyrics to songs, and commercials.

Some of the things that work for these learners are:

1. Active Listening -- note taking-- verbal summary of lectures
2. Reading aloud
3. Editing and revising papers, and discussing assignments with others

Another approach that works well for auditory learners is prompting -- giving verbal clues to recall information -- verbalizing steps in math before solving, using word association to recall definitions, making up personal tests for quizzing self, and using order and structure for everything. Some of the famous auditory learners include Ludwig Van Beethoven, Madonna, Louis Armstrong, and Wolfgang Amadeus Mozart.

Visual learners - Learning through seeing

These learners need to see the teacher's body language and facial expressions for understanding. Body language and facial expressions give clues to information that needs to be noted. Most visual learners usually sit in the front of a mathematics classroom to avoid obstructions (Gardner, 1983).

They usually see with the mind's eye: diagrams, illustrated textbooks, overheads transparencies, videos, flipcharts, and handouts. For example, during a lecture, visual learners prefer to take detailed notes because these notes help them absorb information. Other traits include the love of color accessories, such as folders and pencils. They are also the first to notice changes in scenery. Some of the methods that work well for visual learners are described below:

1. Visual clues that are linked with verbal context
2. Picture cues that remind them of word definitions
3. Chronologically rerunning movies in their minds
4. Recalling reading material if read silently

Learners benefit from focusing attention through the use of color. They use highlighters to identify main ideas, and other important information. Some of the famous visual learners include famous folks like Georgia O'Keefe, Pablo Picasso, Claude Monet, and M.C. Escher.

Tactile/Kinesthetic learners - Learning through movement and touch

These learners learn best through a hands-on approach, actively exploring the physical world around them. Tactile/Kinesthetic people find it hard to sit still for long periods of time. They prefer interactive activity and exploration (Gardner, 1983). For example, they jump for joy when happy, stamp their feet when angry, and are always ready to try new things. Some of the things that work for tactile/kinesthetic learners are described below:

1. Direct involvement (learn by doing)
2. Performing interactive activities associated with concepts
3. Acting out reading
4. Researching
5. Writing on boards

Another appeal for tactile/kinesthetic learners is rhythmic patterns. They create songs or chants to remember such things as math rules (Lazear, 1991). Some of the famous tactile/kinesthetic learners include famous folks like Mary Lou Retton, Michael Jordan, Babe Ruth, and Monica Seles.

Visual/Spatial Intelligence

People using this intelligence are art/space smart. They possess artistic capabilities, have an eye for detail and color, spatial awareness, and enjoy painting and sculpting.

Individuals with this intelligence think in pictures (mental images) to solve mathematical problems (Lazear, 1991). Students are visual/spatial - art/space smart when they:

1 Think in pictures and images

2 Are good with spatial relations

3 Have a good eye for detail and color

4 See solutions to problems

5 Learn through visuals

6 Like to draw and create

Their possible careers include artist, navigator, decorator, architect, and engineer. Some of the famous people with this intelligence include people such as Georgia O'Keefe, Pablo Picasso, Claude Monet, and M.C. Escher.

Verbal/linguistic Intelligence

People using this intelligence are word smart. They are good at reading, writing, speaking, read frequently, have a good vocabulary, tell stories, and play with words. Individuals with this intelligence learn best through verbal representation (Lazear, 1991). Students are word smart when they:

1 Manipulate language through reading, writing, and discussing

2 Communicate effectively and use auditory skills

3 Have a good vocabulary, write clearly, spell easily, and think in words.

Their possible career interests include authors, poets, journalists, writers, public speakers, politicians, salespeople, and translators. Some of the famous people with this intelligence include William Shakespeare, John Steinbeck, Jane Austin, and Emily Dickinson.

Logical/ Mathematical Intelligence

Learners who are generally active when presented with a problem are logical and mathematical learners. The brain acts like a computer when trying to work out problems. They have the ability to understand numerical relationships and patterns. This intelligence may be the entrance to the super highway of learning.

Howard Gardner (1983) discovered much of what we know about mathematical intelligence. Logical/mathematical intelligence traditionally was viewed throughout Western Europe as the most valued intelligence and first.

1. Learners of the most valued intelligence ask a lot of questions
2. Learners having this kind of intelligence have the ability to reason using critical thinking and problem solving skills
3. The skills used in Logical/Mathematical Intelligence include problem solving and reasoning. This intelligence is viewed as "raw intelligence," and is usually found on multiple choice standardized tests; it was previously regarded as the most important intelligence until 1983 when Gardner established the concept of multiple intelligences.

However, success in mathematics has been compared to the success in chess. Both fields of endeavor require high levels of logical/mathematical intelligence. Gardner (1983) indicates that the well-known, well-tested formula of hard work, and love for one's art are the prime determining factors of success when all other things are constant.

Logical/mathematical intelligence consists of the ability to detect patterns, reason deductively, and think logically. This intelligence is most often associated with scientific and mathematical thinking (Lazear, 1991). Students are logic/math smart when they:

1. Think in numbers, patterns and algorithms
2. Think clearly and analytically
3. Learn by appeal to logic
4. Use abstract symbols
5. Solve logic problems easily
6. Are good in math

Their possible careers include scientists, computer programmers, researchers, accountants, mathematicians and detectives. Some of the famous people with this intelligence include Albert Einstein, Bertrand Russel, Marie Curie, and Issac Newton.

Bodily/Kinesthetic intelligence

People using this intelligence are body smart. They are good at dancing, athletics, acting, and use their bodies in skilled ways. Individuals with this intelligence learn best when there is movement or hands-on form (Lazear, 1991). Students are Body Smart when they:

1. Are highly coordinated
2. Use gesture and body language
3. Take things apart and fix them
4. Learn through hands on activities
5. Enjoy acting and role playing
6. Enjoy dancing and athletics

Their possible careers include athletics, physical education teachers, surgeons, gymnasts, actors, and firefighters. Some of the famous people with this intelligence include Mary Lou Retton, Dewayne Wade, Babe Ruth, and Monica Seles.

Musical/Rhythmic Intelligence

People using this intelligence are music smart. They are good at gaining meaning from music, playing an instrument, and singing. Individuals with this intelligence are sensitive to sound (Lazear, 1991).

Students are music smart when they:

1. Have a good sense of rhythm and melody
2. Like to sing , hum, chant, and rap
3. Enjoy listening to music
4. Read and write music
5. Learn through music and lyrics
6. Enjoy creating music

Their possible careers include musicians, composers, singers, and conductors. Some of the famous people with this intelligence include Ludwig Van Beethoven, Madonna, Louis Armstrong, and Wolfgang Amadeus Mozart.

Interpersonal Intelligence

People using this intelligence are people smart. They are good at making friends. Individuals with this intelligence learn best from interacting with others (Lazear, 1991).

Students are people smart when they:

1. Make and maintain friends easily
2. Understand and respect others
3. Lead and organize others
4. Resolve conflict
5. Learn by interacting with others

6. Like to work and be with others

Their possible careers are sociologists, researchers, actors, and teachers. Some of the famous people with this intelligence include Mother Teresa, Winston Churchill, Martin Luther King Jr., and John F. Kennedy.

Intrapersonal Intelligence

People using this intelligence are self-smart. They are good at self-reflecting. Individuals with this intelligence learn best when they are given time to process information and reflect on their learning (Lazear, 1991). Students are self-smart when they are:

1. Introspective
2. Aware of their own feelings, strengths, ideas, values and beliefs, set and meet goals, and enjoy private time to think and reflect

Their possible career paths are theologians, researchers, and philosophers. Some of the famous people with this intelligence include St. Thomas Aquinas, Sigmund Freud, Confucius, and Mohandas Gandhi.

Naturalist Intelligence

People using this intelligence are nature smart. They have an awareness of the natural world phenomena, discriminate natural items like animals, insects, birds, fish, rocks, minerals plants, or non-natural items like cars. Individuals with this intelligence learn best when the content is related to the natural world (Lazear, 1991). Students are Nature Smart when they:

1. Are aware of their natural surroundings
2. Discriminate different flora and fauna
3. Are good at sorting and classifying

4. Have keen observational skills
5. Understand natural phenomena
6. Garden or care for pets or animals

Their possible careers include ecologists, oceanographers, and zoologists. Some of the famous people with this intelligence include Charles Darwin, Carl Sagan, Jane Goodall, Jacques Cousteau, and Henry David Thoreau.

Learning mathematics includes all of the intelligences above to various degrees; each student is given an equal opportunity to learn using their dominant intelligence. Styles used to learn multiple intelligences help students' self-confidence and motivate them to be the best they can be, as shown from Gardner's analysis above. Learners using M.I. enjoy the feeling of self-worth and respect the diverse intelligence and uniqueness of others.

Gardner's *Theory of Multiple Intelligences* (1983) enhances learner's styles and intelligences. Again, the most efficient technique used to encourage a student to learn is the one that works for that individual's unique intelligence. The intelligences above, along with patience, compassion, open-mindedness, and firmness affect a person's overall mathematical comprehension. All people share one or more of these traits in varying degrees.

All types of intelligence may overlap like a super-highway; learning depends on the person's inborn ability (intelligence).Verbal/linguistic intelligence depends on the person's reading, writing, and speaking, while logical/mathematical intelligence would depend on the person's graphic organization, forcing of relationship, and pattern discernment or wit. Such could be observed in a person's ability to think critically, make decisions, and solve problems. Visual/spatial intelligence depends on the person's active imagination, guided imagery, and drawing. These strategies can be seen in one's ability to communicate with

others as through teacher/student relationships. However, an example of these traits, may vary depending on the teacher's own personal traits.

An effective instructor varies the appeals in a lesson to reach multiple intelligences. For example, an instructor could use Verbal/linguistic intelligence with students by varying vocal intonation, using procedural approaches, talking students through issues, and communicating with parents. Logical/mathematical intelligence is employed as the instructor challenges students by setting high standards, encouraging students to think independently, and using symbols in place of words.

Since learning styles/multiple intelligences used in channeling mathematics are unique to an individual, strategies supporting intelligence in math will include goal setting. When learners find themselves with an audience not compatible with their goals, changes are made using their intellect, leadership for learning, creativity, and flexibility (Glickman, 2002). Changes in tasks come about when perceived expectations are not met and procedures are not adequately analyzed. The procedures are restructured and organized for individual intelligence in learning. Adult learners want help with things outside of their innate ability, such as math, and ways to increase intrinsic motivation (Raffini, 1996). Most adults are goal oriented and want a skillful teacher (Brookfield, 1990). The process of teaching and learning/intelligence must relate to the goal.

Goals

The function of goals may depend on the circumstance or situation (Jonassen, 1989). The objective for teaching and learning (intelligences) depends on the subject and audience. An instructor's flexibility may enhance students' goals. Other factors may include focusing of other characteristics such as creative teaching methods in mathematical courses using cooperative learning, effective homework, and successful lesson planning (Caffarella, 2002).

This research examines goal-setting, by looking at measures influencing and supporting adult intelligences used in mathematics.

Attributes of Adult Learners using Intelligences in Mathematics

Adult learners are focused on education and are resources for themselves and others. Abilities used to handle situations come from passed experiences, ideas, and judgments. The demonstration of their motivation to learn comes from the need to succeed. Intelligences used in innate abilities are for acquiring needs and wants. Most adults are slower than younger learners in adapting to unfamiliar situations, but ability to complete assignments is not impaired. They draw on life experiences when doing certain assignments, especially mathematics (Draves, 1984). Adult intelligence is enhanced by familiar experiences in life such as paying bills. Many of the needs experienced by adults are familiar to other age groups.

Some purport that adults have special needs, which may be considered a different learning style. Because the adult population is large and shares a lot of responsibilities for others, it requires special attention. Adults have pride. They also have awareness of their culture and desire sensitivity and respect. The adult learners want to help themselves. An example of this type of learning might be -Tell and/or show me how you got the answer - help me help myself. They understand the need to know how; especially, when they are responsible for the results (test). Characteristics of the adult learner require creative teaching strategies (Caffarella, 2002).

So, what are some other characteristics of adult learners using intelligence in America? Some people say life-long experience, street knowledge, and survival instincts. Understanding mental attributes and intelligences of adult learners makes teaching math less problematic. Awareness of physical attributes, social attributes and other factors affect a person's attitude

toward learning: their ability to learn, understand, and use new material, ultimately leading to their success as a student. Let's view some of the learning attributes and factors:

Mental Attributes

Mentally the position of adults as learners can be justified by their readiness to learn math. The majority of adults are eager to learn. Their ability to learn is motivated by such factors as life experience, goal orientation, self-esteem, and money. They know what it is like to work hard and not solve a problem. Learning (life) is viewed as problem solving. Most adults don't want their experience to be a repeat of past schooling because time and money are precious. Adults take advantage of another chance to be successful in education with new material; they are ready to succeed and feel a need to succeed in learning.

Physical Attributes

Adult learners' physical characteristics change with age. Their ability to withstand things like cold and other discomforts may not be what it once was. It must be understood that some physical characteristics decline with age. The ability for adults to learn new material can be accomplished using various Intelligences and accommodation. Successes for adults as learners are enhanced when creative techniques and accommodations (special needs) are employed.

Social Attributes

Social characteristics of adults as learners can include: not knowing what to expect, cultural sensitivity, and other preconceived ideas. Ability to learn could be hampered because of past school experiences. Understand that being back in school could set off old responses or reactions to similar situations revisited (Caffarella, 2002). M.I. helps with learning new material and empowers students. Adults' success as learners depends on the

instructor not inappropriately exposing inabilities regarding intelligences, amongst others.

Factors of Adults as Learners using Intelligences

Adults bring other factors to learning such as a foundation of life experience and respect. Experiences adults bring to the class come from a variety of situations such as working, responsibilities, being active/contributing members in a community and sometimes being parents (Brookfield, 1990). Adults are autonomous and need a reason for learning certain material and its use regarding practical situations. They are goal and relevancy oriented because of values placed on time and money. This is practical for adult learners because their focus is attaining their goal as soon as possible. Adult learners want to accomplish their goals and needs in a friendly, caring, and supportive environment. They want to be treated as adults, use their past experience and intelligences to learn, and use methods that are respectful and stimulating. They also appreciate new teaching methods aimed at helping them learn such things as math (Brookfield, 1990). Their expectations are based on time, money, application, and respect.

Characteristics of adult learners should be enhanced by designing instructions around their strengths (intelligences). Their strengths are comprised of the following:

- Relating new material to what has been experienced
- Receiving positive feedback
- Using presentation methods that reach visual, auditory, tactile/kinesthetic and multiple intelligences
- Empowering learners by providing an application for the instructions
- Helping them to help themselves regarding keys to educational success; note

taking, study strategies, memory tips, goal setting, critical thinking skills, and do's and don'ts

- Being flexible; starting with simple steps and progressing to more complex ones
- Setting realistic goals with specific strategies for accomplishing each goal

Characteristic attributes, and factors of adult learners using intelligence above were described by (Brookfield, 1990).

Incorporation of such teaching/learning strategies will increase success rates. Some of the creative teaching methods employing varieties of strategies include integrating computers into the curriculum, employing interactive lesson plans, assigning effective homework, and engaging in cooperative education. Specific teaching methods depend on the learners physical and mental, abilities. Successful instructors understand how adults learn using their innate intelligences.

Summary

After reviewing the literature on M.I., it is clear that educators in the United States are waging war against people not acquiring mathematical skills. Gardner's theory of learning styles and multiple intelligences provides a foundation for learning improvement in the US across cultures. This is one of the theories acknowledging the fact that the US is diverse and that people learn in different ways; teaching must therefore be adapted to meet individual needs.

Chapter III: Methodology

The purpose of this study is to investigate and document the effectiveness of Howard Gardner's Multiple Intelligences (M.I.) to enhance learning (null hypothesis). This study will use his M.I. Theory to compare (comparison/quasi experiment) two groups of-independent/dependent- adult students' success in a mathematic course (MathB3) at a Midwest college for one semester in 2007. In chapter 1 expert's finally agreed on a hypothesis calling for new research, in order for the debate over intelligence to be resolved. Howard Gardener in chapter two acknowledged the fact that the US is diverse and that people learn in different ways; teaching mathematics must therefore be adapted to meet individual needs. Here, the methods used to investigate M.I. effectiveness in mathematics are viewed and studied below.

This chapter will include a depiction of the research methods/details, pilot study selection criteria, and the instrument used to collect information. Finally, it will be followed by data collection, data analysis, limitations, and a summary.

Research Methods/Details

Early in the review of literature, I discussed a unique intelligence possessed by everyone. It allows him/her to accomplish certain tasks easily (Gardner, 1983). We also learned Gardner's disagreement with the cognitive developmental stages of learning, work done by Jean Piaget. Gardner's work has weakened Jean Piaget's work by proving that a person can be at various stages of learning at different times.

Two groups were selected to be studied: one group of independent students (independent variable) whose intelligences had not been identified, and were not subjected to the M.I. Inventory, versus a second group (controlled/experimental) of dependent students

(dependent variable) who had been made aware of their intelligence, (this is to say, outcome of math post-test scores may depended on their response to the M.I. Inventory). Each group reviewed concepts of problem solving with science applications and quizzes. However, the control group reviewed the above math and were made aware of their (M.I.) via an M.I. Inventory and the instructor. The number of participants in each group was fifteen.

In the controlled group, a twenty minute lecture was conducted to emphasize benefits of M.I., such as less time and effort expended using logic. After the last lecture, a twenty minute inventory was administered to the control group. Post-test (Standardized-Test of Adult Basic Education, TABE) scores were used to compare each group of participants, M.I. influences, and grade reporting (pass or fail). Significance of the M.I. was measured using statistics and indicated by an increase/decrease in grade level.

Pilot Study

Before giving the M.I. to the control group, it was given to four MathB3 students not included in Group A or Group B. The pilot study was given to measure time and see if any complications would hinder the study. The study continued, because the M.I. Inventory was written on a seventh grade level and no problems occurred in the pilot study that would impede the quality of the study.

Subject Selection and Description

The participants' for this study were 30 suspended adult students, randomly selected, male and female, given an opportunity to re-enter the college. The reason for this selection was because of their motivation to re-enter college and they signed up for the course. Criteria for subject selection included informed consent and completion of the (Standardized-Test of Adult Basic Education, TABE) Pre-test, see Appendix A.

Instrumentation

The pre-test and post-test (Standardized-Test of Adult Basic Education, TABE) were used to assess students' achievement regarding similarities and differences using the implementation of M.I.. Each group of participants' results can be shown before and after intervention. Validity and reliability of the TABE has been accepted throughout the State of Wisconsin in the United States.

It is composed of Mathematics Computation and applied mathematics. One part of the TABE - mathematics computation has fifteen items on it, designed to measure core computational skills, and a time of nine minutes is suggested. Another part of the TABE, Applied Mathematics has twenty-five items on it, designed to evaluate mathematical literacy, and it suggested a time of twenty-five minutes duration. Scantron machine and scantron answer sheets were used to score the tests. The TABE test is not the only instrument used in the intervention of the control group.

However, the M.I. Inventory was given between the pre-test and post-test. M.I. is used in schools throughout the country. Validity and reliability have been predicated and embraced by schools throughout the Wisconsin. Now, let's describe elements of the M.I..

It is an online inventory based on Howard Gardner's work. The inventory lists eight M.I. categories, such as Logical/ Mathematical Intelligence, Musical/Rhythmic Intelligence, and asks approximately ten questions for each. Participants are asked to enter an x next to expressions that pertain to that participant and are true. The scores (x) are tallied and entered at the bottom of each category. The category or categories with the highest score (x) are the dominant intelligence. Finally, participants taking the M.I. Inventory (controlled group)

were given information before the test regarding what represented their intelligences, possible careers, and some of the famous people with their intelligences, see Appendix B.

Data collection-Indication

Again, the purpose of this study was to investigate and document achievement of adults in a pre-college math course using Howard Gardner's Multiple Intelligences; therefore, I find it necessary to describe how the data used in this study was composed. Data was collected for the pre-test, M.I. inventory, and post-test.

The registration process for all students taking the MathB3 course included a pre-test (Standardized-Test of Adult Basic Education, TABE). Test scores were recorded and entered into a computer. They were then stored for later usage in the MathB3 course, see Table 3 below.

In addition the pre-test - entrance test, concepts of problem solving with science applications, and quizzes were collected and analyzed. They were recorded and entered into a computer. The M.I. Inventory data was stored for later usage to compare its cause and effect.

Finally, a post-test, TABE was given by the instructor and collected, serving as an exit test. Test scores were recorded and entered into a computer (Appendix C and D). They were stored for grade reporting (pass or fail).

Data Analysis and Methodological Assumptions

Resolutions and conclusions regarding Howard Gardner's M.I. effectiveness in the classroom can be found in chapter IV and chapter V. This study investigative procedure was used to differentiate the ability of adult students to succeed. Again, a pre-test/post-test (Standardized-Test of Adult Basic Education, TABE) and concepts of problem solving with

science applications quizzes were given to each group of participants.

Analysis of the pre-test/post-test using statistical analysis (measures of central tendency and a two sample t-test assuming unequal variances) were essentially used to determine cause and effect of the M.I. Inventory. The statistics used to show behavior due to operant conditioning between the two groups in this comparative/quasi experiment study can be seen in Tables 3 and Table 4.

Limitations

The MathB3 participation was involuntary and the TABE was part of the class, class time was limited. This class was given in an accelerated format of six weeks instead of sixteen; class sessions are one day a week for two and a half hours. The duration was compensated by using an individual education plan for each student to enhance the implementation of M.I. in the classroom. This study is intended to support individual intelligences.

Summary

Cause and effect of the M.I. inventory will be discussed in the following chapter. The study reviewed research methods/details, pilot study, Subject Selection and Description, the instrument used to collect information, data collection, and data analysis. Procedures above were used to evaluate differences in the groups.

Chapter IV: Results and Discussion

The assumption predicted that the implementation of M.I. can be used to enhance intelligences thereby, promoting success. The null hypothesis said M.I. enhances learning. The participants for this study are thirty suspended adult students male and female of who were given an opportunity to re-enter the college. It includes various races, such as Hispanics, Afro-Americans, and Caucasians. The reason for this selection is because of their motivation to return to college even though the class is in an accelerated format. The thirty suspended adult students in the study completed the pre-test (Standardized-Test of Adult Basic Education, TABE). The population is normally or approximately normally distributed.

This chapter will include results/demographic information. In addition, it will be followed by a discussion of the research questions and a summary. Let's review the results and the discussion.

Results/Demographic Information

Two groups were selected to be studied using an inferential statistical test of significance: one group (Group A- fifteen students) whose dominant intelligences have not been identified, and are not subjected to the M.I. Inventory, according to Gardner's *Theory of Multiple Intelligences* (1983). There was a second group (Group B-fifteen students) of dependent students who have been made aware of their intelligences; outcome of scores may depend on their being aware of their dominant intelligence. The control group (Group B) reviews concepts of problem solving with science applications and quizzes and are made aware of their (M.I.) via an M.I. Inventory and the instructor, see Appendix B.

Subjects in the independent group (Group A), reviewed concepts of problem solving with science applications and quizzes, but are not made aware of their M. l.. The lectures involved concepts of problem solving with science applications. These lectures are given in a discussion format. The last lectures were followed by a post-test, TABE. The motivation to re-enter college was not taken lightly. Statistics can be seen in Table 1 and Table 4 below:

Table 1

Group A_TABE - Math Pre-test / Post-test (Independent Variable)

Variable #	Pre-Math	Post-Math	Increase/Decrease (-)
1	5.8	12.9	7.1
2	9.6	11.2	1.6
3	3.3	11.9	8.6
4	11.6	12.9	1.3
5	7.8	10.9	3.1
6	12.9	12.9	0
7	7.6	11.8	4.2
8	7.6	9.3	1.7
9	6.4	11	4.6
10	9.2	11	1.8
11	11.8	12.9	1.1
12	7.2	12.9	5.7

13	10.2	11	1.8
14	11.4	12.9	1.1
15	5.2	12.9	5.7
			mean = 3.51
			s = 2.68
			median = 2.70

Table 4

t-test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	3.513333333	2.206666667
Variance	7.181238095	8.129238095
Observations	15	15
Hypothesized Mean Difference	0	
Df	28	
t Stat	1.293350075	
P(T<=t) two-tail	0.206458978	
t Critical two-tail	2.048407115	

In the controlled group (Group B), a twenty minute lecture was conducted to emphasize benefits of M.I., such dominant intelligences being used to enhance math reasoning, criteria

set for channeling intelligences, dominant intelligence being raised to help others, and alternatives in place for people who can not channel intelligences. This lecture is given using a power-point presentation.

After the lecture, a twenty minute M.I. Inventory is administered, see Appendix B. Next, Gardner's eight intelligences are explained in detail. Gardner's theory explains how to enhance dominant intelligences and possible careers. He also lists some famous people with the specific intelligences. To do well in this course, MathB3, motivation and a sense of empowerment were important factors. Post-test scores and statistics for the dependent group can be seen in Table 2 and Table 4 below:

Table 2

Group B_TABE - Math Pre-test / Post-test (Dependent Variable)

Variable #	Pre-Math	Post-Math	Increase/Decrease (-)
16	4.2	7.5	3.3
17	10.8	12.9	2.1
18	3.3	11.9	8.6
19	10.6	9.8	-0.8
20	7.6	12.4	4.8
21	7.6	7.8	0.2
22	5.8	12.9	7.1
23	7.8	7.4	-0.4
24	7.8	11.4	3.6
25	9.8	9.8	0
26	8.2	7.6	-0.6

27	6.9	8.9	2
28	7.2	7.4	0.2
29	11.1	12.6	1.5
30	11.2	12.6	1.4
			mean = 2.21
			s = 2.85
			median = 1.50

Table 4

t-test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	3.513333333	2.206666667
Variance	7.181238095	8.129238095
Observations	15	15
Hypothesized Mean Difference	0	
Df	28	
t Stat	1.293350075	
P(T<=t) two-tail	0.206458978	
t Critical two-tail	2.048407115	

M.I. influence is weighted carefully using Statistical Measures of Central Tendency and a two sample t-test assuming unequal variances. Significance of the M.I. Inventory on Group B is compared to Group A post-test scores in deciding to reject or not reject the null hypothesis. More than 75% of students in Group A and Group B had an increase of at least one grade

level. The null hypothesis said Gardner's M.I. will enhance learning. Group A and Group B (independent/dependent) post-test scores were positive, therefore, the null hypothesis will not be rejected because there was not a significant difference in post-test scores, (either direction) see statistics in Table 3, Table 4 and Appendix E below:

Table 3

Group A and Group B TABE - Math Pre-test / Post-test (Statistics)

Group A	Group B
mean = 3.51	mean = 2.21
s = 2.68	s = 2.85
median = 2.70	median = 1.50

Table 4

t-test: Two-Sample Assuming Unequal Variances

	Variable 1	*Variable 2*
Mean	3.513333333	2.206666667
Variance	7.181238095	8.129238095
Observations	15	15
Hypothesized Mean Difference	0	
Df	28	
t Stat	1.293350075	
P(T<=t) two-tail	0.206458978	
t Critical two-tail	2.048407115	

Discussion (Research Questions)

Nevertheless, the research asks the following questions:

1. Can dominant intelligence be used to enhance math reasoning?

   The tables above used statistical measures of central tendency and a two sample t-test assuming unequal variances. Because, to describe the data accurately more measures beyond central tendency are needed. The standard deviations from Table 3 indicate that the difference between Group A and Group B is seventeen hundredths; and Table 4 indicates the difference between the variances to be approximately 0.948.Dominating intelligences can be used to enhance math reasoning.

2. Should criteria be set for channeling intelligences, and if so, which criteria?

   The tables above used statistical measures of central tendency and a two sample t-test assuming unequal variances. The mean from Table 3 displays the difference between Group A and Group B is approximately 1.30 (not equal). According to Table 4, t stat, which is approximately 1.293, is less than the critical value ± 2.048 and fall in the region of non-rejection (normal distribution). Yes, the statistics show that criteria should be set for channeling M.I.. The dominant intelligence is the standard used to enhance all others intelligences.

3. Can the dominant intelligence be raised to help others, and if so, how far?

   The tables above used statistical measures of central tendency and a two sample t-test assuming unequal variances. The median from Table 3 says the difference between Group A and Group B is 1.20. The p value (approximately 0.21) from Table 4 is grater than alpha (0.05), which leaves a 95% level of confidence. Table

1, Table 2, and Table 4 indicate that knowledge of dominant intelligence can be increased eminently to help others.

4. Are there any alternatives in place for individuals who cannot channel intelligences to mathematical reasoning? The tables above used statistical measures of central tendency and a two sample t-test assuming unequal variances. The mean from Table 3 indicates the difference between Group A and Group B is approximately 1.30. Table 3 means and results from Table 4 t-test make it apparent that there are alternatives in place for individuals who can not channel intelligences to mathematical reasoning, such as alternative delivery that appeals to students learning style (intelligence).

Summary

This study compared test results using statistics for Group A and Group B regarding the sharing of knowledge of the M.I. It also includes a discussion of research questions. One group (Group A) were not aware of their intelligences versus a second Group B who were aware of there intelligences through taking a Multiple Intelligences Inventory (M.I.). Post-test scores were compared between the two subject groups. The differences between the scores were not significant. Demographic information was given in words.

Chapter V: Summary, Conclusions and Recommendations

The effectiveness of Gardner's M. I. was measured in a mathematics course at a Midwest college for one semester. More effects of the study will be discussed in conclusions and Recommendations. Let us review the summary of the Study, conclusion, conclusion regarding research questions, see what recommendations related to this study lies ahead.

Summary of the Study

The purpose of this study was to investigate and document the achievement of adults in a pre-college math course using Howard Gardner's Multiple Intelligences to enhance learning. Because not acquiring math skills is a growing problem in the United States. Background information into studies such as the implementation of multiple intelligences has proven to be inconclusive by leading learning theorists; in addition, chapter 1 revealed that experts in the field of intelligences concluded that no theory explains all facets of intelligence. Chapter II, the review of literature evaluates the three learning styles, eight multiple intelligences as well as goals and characteristics of adult learners. It was also learned in the review of literature that Gardner's work has weakened Piaget's work by proving that a child can be at various stages of learning at different times. Gardner's theory acknowledges the fact that people learn in different ways and teachers must adapt to meet individual needs.

The disparity in math education is still growing. Pre-College math courses should focus on students' individual abilities to reason in solving problems. Individual plans should be designed using each student's intelligence to accomplish goals in a pre-college math courses.

Methods and procedures used in this study was to test the null hypothesis -M.I. enhancement of learning- by comparing two groups (independent/dependent) using the M.I. Inventory, statistical tables, charts, and by answering research questions such as, can dominating intelligence be used to enhanced mathematical reasoning? Enhancing learning using M.I. intelligences was viewed costly by the college, because of the rules of engagement related to individual education plans. After reviewing the literature on intelligences, it is clear that the US is waging war against people not acquiring mathematical skills.

Again, two randomly selected groups were compared; Group A and Group B. Each group was composed of fifteen students. One group was not aware of their intelligences versus a second group who were aware of there intelligences through a medium called the Multiple Intelligences Inventory (M.I.I.). Post-test scores were analyzed and compared between the two subject groups.

Major findings of this study using Howard Gardner's M.I.I. indicated no significant differences in Group A and Group B post-test scores. The differences between the scores were not significant; perhaps factors other than M.I. may have been responsible for improvement in post-test scores. Therefore, the null hypothesis (M.I. enhancement of learning) was not rejected.

The thought of returning to college, after being suspended may be significant to learning using Gardner's M.I. Inventory. Certain intelligences are significant for the subjects and situations requiring those intelligences. Also, this study did not show results for the general population. Experts in the field of intelligences agree that more research is needed on multiple intelligences to enhance adult learners. However, M. I. results and findings will be shared with the community.

Conclusions

Careful consideration should be given to the statistics used in this study, which indicate that M.I. enhances learning. Even though findings showed no statistical (significant) differences in post-test scores between Group A and Group B, there is a non-statistical difference. Students enjoyed the feeling of self-worth and respect for their unique intelligence. Again, motivation to return to college may be equivalent to knowing intelligences with the selected population for this study. The M.I. Inventory process provided positive feedback regarding what a person does to enhance their intelligences, possible careers, and knowledge of famous people. Because MathB3 offered participants a way to re-enter college and was given in an accelerated format, the results can not be generalized to other populations. However, M.I. does enhance learning regarding questions researched below:

Conclusion (Research Questions)

1. Can dominant intelligence be used to enhance math reasoning?

   Established by this study, it is very promising. For example, a person who is art smart may see math as a representation of a pictorial viewpoint. Another example, a student with mathematical/logical intelligences walks into a physics class and is told they need a math background to understand physics; their confidence rise. Yes, dominating intelligence can be used to enhance mathematical reasoning and is supported by this research.

2. Should criteria be set for channeling intelligences, and if so, which criteria?

   Criteria should be set for channeling intelligences using the individuals' dominant intelligences. For example, two individuals having different dominant intelligences

will use dissimilar measures to reach other various intelligences not dominant. Because each individual is unique like a set of finger prints, criteria should be set according to the person's uniqueness.

3. Can the dominant intelligence be raised to help others, and if so, how far?

As stated in the previous chapter - according to the statistics - dominant intelligence can be raised to help others. For example, a teacher of mathematics using different styles to reach students such audio, visual, tactile/kinesthetic and other deemed appropriate that work. The helping field such as teaching helps those capable to help themselves. Dominant intelligence be raised to help others, how far, depends on the individual.

4. Are there any alternatives in place for individuals who cannot channel intelligences to mathematical reasoning?

Yes, accommodations are made for individuals with special needs, such as alternative delivery. For example, a student who can not speak enrolled in a math course is assigned an interpreter-using sign language, if proper documentation is provided. Special accommodations are adhered to according to the American Disability Act of 1974.

Recommendations

This study showed that adult learning theory should be based on motivation, knowledge (intelligence), comprehension, application, evaluation, clarification, and creativity; although, most researchers have shown and proved that knowing one's intelligences enhances learning at an early age. As a child individuals tend to take more of a risk in terms of exploration. Older adults are less likely to assume baseless endeavors, even

though certain individual success may emerge. Fear of the outcome being favorable is clouded by ambiguity. Again, intelligence/learning and it is lifelong (Maehl, 2000).

Recommendations below are given based on the conclusion of this study. Pre-College math courses should focus on students' individual abilities to reason in solving problems. Individual plans should be designed using each student's intelligence to accomplish goals such as the questions and answers below:

Recommendations (Research Questions)

1. Can dominant intelligence be used to enhance math reasoning?

   Dominant intelligence can be used to enhance math reasoning. This study, although promising, it is not a reflection of dominant intelligences used in the general population. A study done on the general population might yield different results. Dominant intelligences should be researched in other areas of education.

2. Should criteria be set for channeling intelligences, and if so, which criteria?

   Criteria set for channeling intelligences are strongly recommended, especially when all other options fail. Specific criteria work for particular individuals and not others. New studies are needed regarding channeling information and its criteria.

3. Can the dominant intelligence be raised to help others, and if so, how far?

   Future studies of dominant intelligences being raised to help others will and should include technology. This study should be much more positive and intelligences levels higher when repeated in the future. Dominant intelligences used to help others should be thought of as natural and not special accommodations. Again, dominant intelligences can be raised to help others, how far, depends on the individual.

4. Are there any alternatives in place for individuals who can not channel intelligences to mathematical reasoning? Recommendations regarding accommodations for channeling intelligences are an individuals right. Channeling intelligences for individuals who can not should be seen as a different way to learn. It is important that different learning styles be recognized early and dealt with in an appropriate manner to facilitate channeling.

Recommendations for Further Research

In order for Multiple Intelligences to work beyond high school, certain stressors need to be removed. Responsibilities after becoming eighteen years old dominate the mind processing. Research indicates that the well-known and well tested formula of hard work for any endeavor is the prime determining factor of what makes learning accessible when all other things are constant. Multiple Intelligences has been proven by Gardner to work with people eighteen years of age and younger. Success in learning may be found higher in students with a support system and/or without all the responsibilities of adulthood. New research is needed in the area pertaining to all the research questions above for adult learners.

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Appendix: A: Informed Consent

INFORMED CONSENT

Dear Student,

I am currently doing graduate work in education at the University of Wisconsin Stout. This semester I am doing research on the implementation of multiple intelligences in the classroom to enhance student learning. I would appreciate your help with this research on students knowing and implementing their multiple intelligences.

I would like to include the results of a multiple intelligence inventory and posttest (Test of Adult Basic Education, TABE) in this research. There will be no additional work for you because the posttest -TABE - is already a requirement of MATHB3 for the pre-college division.

I need an hour of your time for this study and do not anticipate any foreseeable risk (no study is without minimal risk – such as psychological examination) and no dishonesty will be used. Participation is voluntary and can be withdrawn at anytime without penalty to you. Risk will be minimal. Advance notification of change will be given to the IRB. If significant changes occur affecting your willingness to continue participation, you may withdraw informed consent without penalty to your grade. I will not use your real name in this study, and will protect confidentiality. The effects of my research may genuinely improve participants' competence in this course and life in general. (Safeguards of special needs will be addressed and accommodated.)

"This study has been reviewed and approved by The University of Wisconsin-Stout's Institutional Review Board (IRB). The IRB has determined that this study meets the ethical obligations required by federal law and University policies. If you have questions, concerns, or reports regarding your rights as a research subject, please contact the IRB Administrator" Sue Foxwell, 152 Vocational Rehabilitation Building, University of Wisconsin Stout, Menominee, WI 54751, 715-232-2477, foxwells@uwstout.edu..

Please contact me at (414 - 445 – 3399 or jeffersc@matc.edu.) at anytime to request a copy of this informed consent form. If you give your permission to participate in my research project (the implementation of multiple intelligences in the classroom to enhance student learning), please print your name and sign below. Then turn this form in with your multiple intelligence inventories.

Again, your cooperation in this research would be greatly appreciated, thank you!

Sincerely,

Investigator: Charles Jefferson

Advisor: Michael J. Galloy
7 15/232-2108
galloy@uestout.edu

Course number: _____ Section: _____

Please print your name:_____ Date: _____

Participant's signature: _____

Witness signature: _____

All research will be conducted under MATC's Policy E0102. If you have any questions or would like a copy of the policy, please contact Charles Jefferson at 414 - 445 – 3399, jeffersc@matc.edu.

Appendix: B: A Simple Multiple Intelligence Inventory

A Simple Multiple Intelligence Inventory: An online questionnaire based on Howard Gardner's work on multiple intelligences.

Put an "x" (x) next to those statements which basically are true about you.

Linguistic Intelligence (Language, speaking, writing, etc.)

1.___I love books.
2.___I can mentally hear words even before I speak or write them.
3.___I often enjoys radio, CD's, and recording more than TV, movies, or plays.
4.___I like word games like Scrabble, Yahtzee, Anagrams, Crosswords, etc.
5.___I like to recite tongue twisters, silly rhymes, and puns.
6.___People often ask me to speak in common vernacular so they can understand me.
7.___English, and classes based on reading (like history) are generally easier for me than math or science.
8.___I read the billboards on the highway more than I look at the scenery.
9.___I often talk about things I've read or heard (more than what I've seen, or done).
10.__I am proud of what I write. Sometimes I get special recognition for my writing

SCORE: ___

Logical-Mathematical Intelligence (LM), Math and Science

1.___I can easily compute numbers in my head.
2.___Math and/or science are among my favorite school subjects.
3.___I enjoy games and brainteasers that involve math.
4.___I enjoy creating little "what if" experiments. (e.g. how much can I save if I skip buying desert at lunch for a week? What will happen to my average?
5.___ My mind searches for and finds patterns, rules, or logical sequences in things.
6.___I'm interested in new developments in science.
7.___I believe that almost everything has a rational explanation.
8.___I sometimes thinks in abstract concepts (rather than words or images).
9.___I like finding logical flaws in things people say or do (this doesn't mean being negative).
10.__ I feel I know something better when it has been measured, categorized, analyzed or qualified in some way.

SCORE: ___

Spatial Intelligence (Art, Design, etc.)

1.___I often see clear visual images when I close my eyes.
2.___I am sensitive to color.
3.___I like to take pictures with a camera or camcorder.
4.___I like jigsaw puzzles, mazes, or other visual puzzles.
5.___I have vivid dreams at night.
6.___I can generally find my way around when I am in new places.
7.___I draw and doodle.
8.___I like geometry better than algebra.
9.___I can easily visualize a birds-eye view of a location.
10.__I prefer books and reading materials that have lots of illustrations.

SCORE: ___

A Simple Multiple Intelligence Inventory

Bodily-Kinesthetic Intelligence (dance, gymnastics, sports, etc.)

1.___I participate in at least one sport or physical activity on a regular basis.
2.___I find it difficult to stay still for long periods of time.
3.___I like to use my hands creatively at activities such as sewing, or carving, carpentry or model building.
4.___My best ideas often come to me when I am out for a long walk, jogging, working out, or engaged in some other physical activity.
5.___I often like to spend my free time outdoors.
6.___I use hand gestures and body language when I talk to people.
7.___I like to hold or touch things to learn more about them.
8.___I like the daredevil rides (like roller coaster) at amusement parks, and other thrilling experiences (like surfing, or mountain biking).
9.___I am well coordinated.
10.__To learn a new skill I need to do it, rather than just hear about it or see it done.
SCORE: ___

Musical Intelligence

1.___I have a good singing voice.
2.___I can tell when a note is off-key or out of pitch.
3.___I listen to music a lot.
4.___My life would be much less happy without music.
5.___I often have a tune running though my mind.
6.___I can easily keep time with a song, tapping, playing a percussion instrument, etc.
7.___I know lots of melodies to songs or musical compositions.
8.___If I hear a song once or twice, I can usually play or sing most of the melody.
9.___I often make tapping sounds or sing or hum when I am studying or working.
10.__I play a musical instrument.
SCORE: ___

Interpersonal Intelligence (political, leadership, public relations, etc.)

1.___People come to me for advice, or to tell me their worries.
2.___I prefer group sports (like soccer or football) to solo sports (like jogging or swimming).
3.___I seek out friends of professional help (teachers, counselors, etc.) to help me solve my problems rather than trying to work it out by myself.
4.___I have at least three close friends.
5.___I prefer social games such as Monopoly or Magic over individual recreation like solitaire or video games (when played alone).
6.___I like to contribute ideas or projects in class, and I like to show others how to do things.
7.___I am a leader.
8.___I like being in a crowd.
9.___I like to get involved with clubs and other social gatherings.
10.__I'd rather spend my evenings at a party or with friends than be at home by myself.
SCORE: ___

A Simple Multiple Intelligence Inventory

Intrapersonal Intelligence (Insightful, spiritual, sympathetic)

1.___I like to meditate, pray, or just think about things
2.___I have received counseling or gone to groups to learn more about myself.
3.___I am able to handle setbacks. I am resilient.
4.___I have a special hobby or interest that keeps me pretty much to myself.
5.___I have a clear idea of who I am and what my talents or weaknesses are.
6.___I have personal goals which I think about often.
7.___I am insightful and can sympathize or empathize with other people's feelings.
8.___I am strong willed and independent.
9.___I keep a diary or journal of my inner life (thoughts and feelings.)
10.__I prefer school assignments that allow me to choose what I want to do.

SCORE: ____

Naturalistic Intelligence (a new addition to Gardener's Multiple Intelligence Inventory)

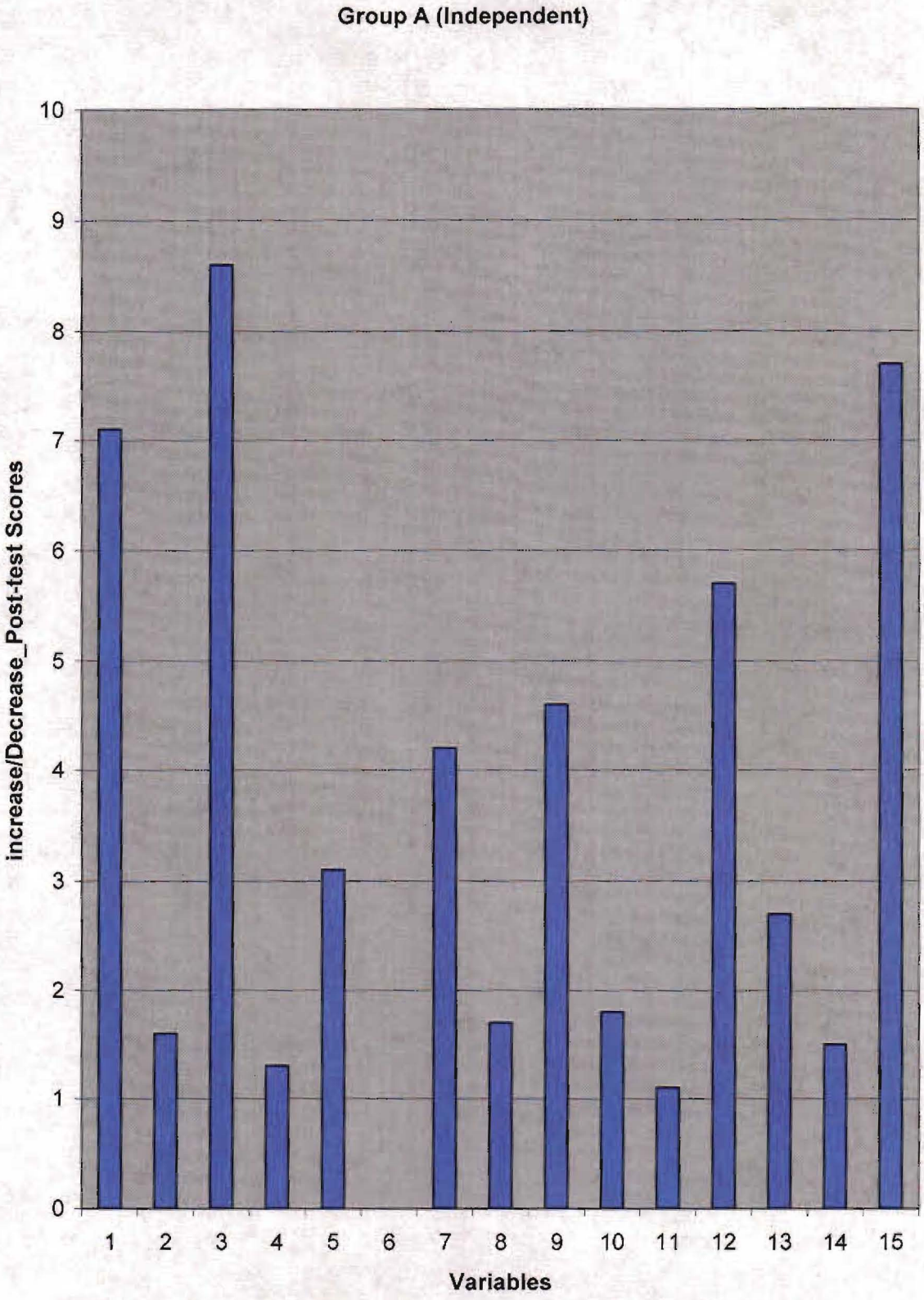
1.___I like to recycle things.
2.___I participate in or follow the news about a political activist group of some kind which supports ecology and/or natural living.
3.___I enjoy programs and/or magazines that have to do with nature.
4.___I enjoy hiking and camping.
5.___I like New Age products and ideas.
6.___I feed the birds or plan my flower garden to attract butterflies.
7.___I am concerned about the depletion of the rain forest, the ozone layer, and pollution.
8.___I am fascinated by native cultures that teach that man is part of nature.
9.___I like vegetarian food because it is healthier.
10.__I support human rights, animal rights, and protecting trees.

SCORE: ____

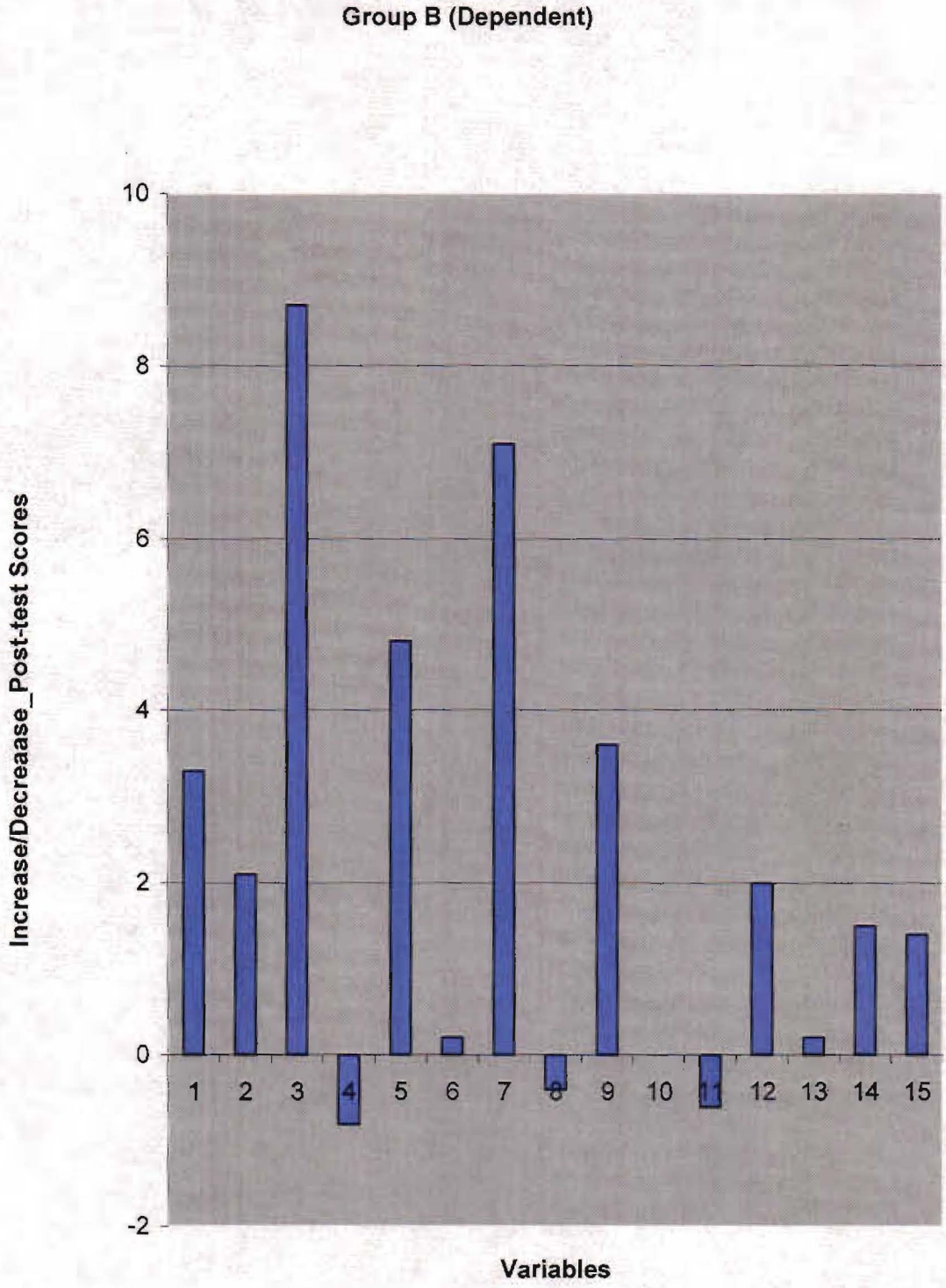
Could you please copy all your scores below?

Linguistic
Logical
Spatial
Kinesthetic
Musical
Interpersonal
Intrapersonal
Naturalistic

Appendix C: Group A (Independent)


Group A (Independent)
increase/Decrease_Post-test Scores
10
9
8
7
6
5
4
3
2
1
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Variables

Appendix D: Group B (Dependent)


Group B (Dependent)
Increase/Decreaase_Post-test Scores
10
8
6
4
2
0
-2
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Variables

Appendix E: Group A and B TABE - Math Pre-test / Post-test Scores

Group A and B TABE - Math Pre-test / Post-test Scores

Variable #	Pre-Math	Post-Math	Increase/Decrease
	Group A (Independent Variable)		
1	5.8	12.9	7.1
2	9.6	11.2	1.6
3	3.3	11.9	8.6
4	11.6	12.9	1.3
5	7.8	10.9	3.1
6	12.9	12.9	0
7	7.6	11.8	4.2
8	7.6	9.3	1.7
9	6.4	11	4.6
10	9.2	11	1.8
11	11.8	12.9	1.1
12	7.2	12.9	5.7
13	10.2	12.9	2.7
14	11.4	12.9	1.5
15	5.2	12.9	7.7
	Group B (Dependent Variable)		
16	4.2	7.5	3.3
17	10.8	12.9	2.1
18	3.3	12	8.7
19	10.6	9.8	-0.8
20	7.6	12.4	4.8
21	7.6	7.8	0.2
22	5.8	12.9	7.1
23	7.8	7.4	-0.4
24	7.8	11.4	3.6
25	9.8	9.8	0
26	8.2	7.6	-0.6
27	6.9	8.9	2
28	7.2	7.4	0.2
29	11.1	12.6	1.5
30	11.2	12.6	1.4

Group A, test values
mean = 3.51
s = 2.68
median = 2.70

Group B, test values
mean = 2.21
s = 2.85
median = 1.50