PREDOMINANT LEARNING STYLES AND MULTIPLE INTELLIGENCES OF POSTSECONDARY ALLIED HEALTH STUDENTS

by

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(Under the direction of Helen C. Hall)

ABSTRACT

In recent years, two theories have originated in an attempt to interpret human differences and to design educational models around these differences. These two theories are learning styles, which is grounded in the psychoanalytic community, and the theory of multiple intelligences, which attempts to reexamine the theory of measurable intelligence. In very demanding postsecondary allied health classes, it is important to find the most effective way to process large quantities of information in a short amount of time. Therefore, it is important to determine student's learning styles and learning environments in order to help students be successful in their studies.

The purpose of this study was to describe the learning styles and multiple intelligences of students in postsecondary allied health fields. Using the population of allied health students from six different diploma programs at a postsecondary institute in Northwest Georgia, a learning style questionnaire, a multiple intelligence test, and general survey was administered.

One learning style instrument, the Productivity Environmental Preference Survey, assessed individual's preferences in 20 areas. A second instrument, the Multiple Intelligences Development Assessment Scales, provided information regarding intellectual development, activities, and dispositions not generally available from standard intelligence and most aptitude tests.

The data was analyzed using SPSS, and descriptive statistics were used to summarize the data. Participation in four of the six allied health programs showed the strongest preference for highly structured learning activities. All of the six groups reported interpersonal and intrapersonal intelligence as the two most dominant intelligences. A one-way ANOVA was used to test the differences in learning styles based on age. In some of the age groups significant differences in learning styles occurred. The data indicated there were no statistically significant differences in multiple intelligences based on age.

INDEX WORDS: Learning styles, Multiple intelligence, Allied health, Postsecondary college, Multiple Intelligences Development Assessment Scales, Productivity Environmental Preference Survey

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DEDICATION

This work is dedicated to my family – my husband, Joel, my sons Josh and Brian and my mother, for their love and support through the years and through several degrees. The more time passes, the more I appreciate my wonderful family.

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CHAPTER 1

INTRODUCTION

In the early 1900s, Henry Ford formulated the concept of an assembly line. To lower the price of the automobile, Ford tried new ways to reduce production cost and created an assembly line in which each worker performed a particular task. The premise for this concept was "interchangeable parts," in which identical components could be substituted for one another and, ultimately large numbers of identical parts could be produced more economically and with a smaller workforce (Henry Ford Museum & Greenfield Village, 2000). This idea worked so well it was embraced by the educational system, which for many years treated students as elements riding on a conveyer belt through the educational factory-the track that has pulled students from kindergarten upwards. In much of education, like industry, students are mass produced entities (Guild & Garger, 1998). Students have been treated as interchangeable parts with the same kind of instruction for all. "Teachers and school represented endless repression, demands for conformity, and denial of the individual's right to a thought of her or his own" (Cohen, 1997, p. 61). One problem in education has been that all students do not all react to the same situation in the same way and, unlike the Henry Ford concept, people are not all cast in the same mold (Guild & Garger).

Rebecca Snyder (1999/2000) described the unique system of public education in the United States which attempts to educate all students equally from preschool through high school. Education in the United States is different when compared to other

countries, such as Japan, where students are tested at the end of elementary school and then tracked to a lower secondary school. Snyder concluded that the United States system presents difficulties because our population includes such a wide diversity of learners, and in order to be successful in educating all of our students, teachers need to be aware of individual learning styles and multiple intelligences. According to Curry, (1990) there are several problems when learning style theory is operationalized. One problem is confusion over the definition of learning style. Another concern is that there is an argument regarding the success of matching individual learning styles to curriculum and/or instructional methods.

Many educators use the "chalk and talk" method with their students. Teachers introduce new ideas by writing on the board and talking (Dunn, 1996). Students then are required to reinforce these concepts by reading and answering questions, many of which are deemed lower level questions (Guild & Garger, 1998). Singh (1998) said, "teaching in a majority of our business schools takes place in a structured framework with emphasis on lecturing. The learning paradigm in the classroom is pitcher and vessel-teacher pouring knowledge into empty vessels" (p. 5). When students are lectured on a subject, they may be overloaded with information that must be quickly processed in order to be tested at a later date. But, does this do much to help students understand the information? Although some students can demonstrate knowledge of facts, can they retain these facts and explain why and in what context these facts exist? Carvin (2000) suggested that perhaps this way of assessing gives educators an unreliable means of ranking students success, which is completely based on the teacher's focus on facts rather than application. A goal of educational testing today should be to sensitize the instructor to a particular

strength or ability of a student. It is thought that the testing movement in the United States has lost sight of this goal, especially in the use of intelligence testing (Carvin). Intelligence tests are indices of a child's learning strengths. Yet, the score the child obtains is most often used to determine the limits of the child's potential. Therefore, instead of promoting growth, intelligence tests are often used to stifle growth (Barbe & Swassing, 1979). Hendley (1996) reported in an interview with Woodie Flowers, a professor of mechanical engineering at the Massachusetts Institute of Technology and the winner of numerous teaching awards:

> "Chalk and talk" is not dead, but it is mortally wounded. We must learn the educational process so that we emphasize helping students learn to learn and more importantly, learn to think. It is simply not economically viable for a professor to stand in front of 30 students and, while some of them nap, "tell" students things that are available from many texts. (p. 2)

Many people are predisposed to learn in ways that are different from how other people in their peer group prefer to learn. What might be one student's weakness is another's strength. After all, no two people are alike, is a principle which includes differences in learning (Dunn, 1996).

Throughout the history of psychology, intelligence has been an important concept. Binet thought that intelligence could be represented by a single score, called IQ or Intelligence Quotient, that was derived from a written test score (Hatch & Gardner, 1996). An intelligence test could be construed as a narrow explanation of a person's wide range of abilities (Kearsley, 1994). The IQ test became a national standard along with the Scholastic Aptitude Test, or the SAT, which is used to measure students'

aptitude and/or intelligence (Carvin, 2000). The SAT analyzes two major abilities-mathematical and linguistic, which encompasses reading comprehension, grammar, and vocabulary. The SAT and the GPA is used by most colleges for admission (Education Testing Service, 1994) and are considered paradigms in predicting a students' future success (Macklem, 1990).

A new faction of educators has emerged that believe students should be judged by what they can do as opposed to what they cannot do, and teachers should focus on their student's abilities (Dunn, 1996). In the past 25-30 years, educators have become aware of cognitive and educational psychology research in the area of individual differences, learning styles, and multiple intelligences. Learning style models encourage teachers to adapt instruction to the ways in which individuals, rather than groups, learn (Dunn, 1990). These educators believe effective teaching combines several strategies, so that the student uses more than one sense at a time while learning (Rief, 1993). According to Setley (2000), "multi-sensory approaches work well because of the way our brain is organized. . . By using more than one sense we bombard our brain with the new information in multiple ways. As a result we learn better"(p. 1).

Sternberg (1997) said students are tested and classified in terms of their ability to memorize and, less importantly, their ability to analyze information. They are also taught and tested in ways that reward memory and analysis. Some students, however, excel in other abilities, such as musical aptitude and emotional intelligence, which are two abilities not considered as significant as the traditionally academically tested intelligences. There are many exceptions to the rule that IQ predicts success, particularly in a school setting. (Gardner; 1983; Goleman, 1995). Campbell (1994) stated:

> If we accept the idea that individuals have diverse cognitive profiles, then pedagogy, curriculum, and assessment will need to change so that students can learn and demonstrate their learning in different ways. Students deserve opportunities to work from their strengths, to enhance their areas of weaknesses, and to discover what they enjoy and love to do. (p. 4)

Many different learning style models have developed over the years, such as Dunn and Dunn's learning style model (Dunn & Dunn, 1993), Kolb's learning style model (Kolb, 1984), the Felder-Silvermann style model (Felder, 1996), and the Barbe and Swassing model based on modalities (Barbe & Swassing, 1979). Each of these theories offers an extensive approach to learning and teaching and can be a catalyst for positive student learning (Guild, 1997). Regardless of the type of learning model that is used, the objective of education should be to help students build their skills in both their strong and weak modes of learning (Guild). The goal is to make sure that the learning needs of students are met at least part of the time (Felder, 1996). Greg Kearsley (1994) reported:

> In modern theories of learning, intelligence is viewed as multidimensional and dynamic. Guilford divides intelligence into 150 specific abilities according to the nature of the operations, content and products required. Sternberg proposes that the three major components of intelligence are performance, metacognition, and knowledge. . . Cronbach & Snow argue that certain instructional approaches are more effective with some learners than others because of specific aptitudes. Piaget identified specific states in the development of intelligence in children. (p. 1)

Theorists agree that students possess different learning styles, which are characteristic strengths and preferences in the ways they take in and process information. Although most people can learn in a variety of ways-even in nonpreferred ways, each has their own preferred way, i.e. the way that is easiest to learn (Dunn, 1996). Some students like to focus on facts and algorithms, but others are better suited to math and theories. There are students who respond better to visual information, such as pictures, charts, and diagrams. Others learn more linguistically-written and spoken explanations. Some students learn actively and do well in a cooperative group, and others prefer to work individually (Felder, 1996).

If an educator's job is to facilitate successful learning opportunities for all learners, the teacher must know the learner, who encompasses innate personality traits and also learned cultural values. Research supports the relationship between culture and learning styles (Guild & Garger, 1998).

Since the IQ test onset in the early 1900s, the Intelligence Quotient represented a single written test score (Kearsley, 1994). Although many researchers have contradicted the single Unitarian IQ score, Gardner's (1983) theory of multiple intelligences proposed an entirely innovative way of thinking about intelligence. He maintained that intelligence is the ability to solve problems or fashion products that are valued in one or more cultural or community settings. Instead of a concept of intelligence, Gardner (1999a) proposed seven domains of intelligence, later amended to eight domains, each of which operates independently. Thus, a person can be strong or weak in any one intelligence, regardless of his or her ability in the other domains. Adults often display their intelligences in such specific ways. Gardner (1983) suggested that most students who achieve academic

success have done so because of their strengths in the linguistic and mathematical/logical intelligence.

Kerka (1986) reported that the evolving workplace is placing greater importance on an employee's ability to learn. Today's worker must adapt new and existing skills to different environments. Educators need to provide a learning environment which enables students to develop skills for problem solving and learning throughout their careers. In order to maximize their potential, students need to find out how they best learn, what determines certain strengths and weaknesses, and how to improve on their weaknesses. Technical institutes, community colleges, and other postsecondary institutions are obligated to educate students for careers in technical areas, which require mastery of both academic and vocational skills (Kerka).

There appears to be a relationship between a student's learning style and a teacher's teaching style based on the output of student skill achievement (Smith & Renzulli, 1984). Learning styles refers to the characteristic ways in which individuals transform data into information functional for that individual, and teaching styles are associated with different sets of classroom teaching behaviors. There is research addressing the question of how teaching and learning styles affect student outcomes, and research on the concept of matching students with instructional methods (Smith & Renzulli; Spoon & Schell, 1998) and other research studies regarding learning styles and application of the multiple intelligence theory for students in postsecondary technical institutes and allied health programs (Diaz-Lefebve & Finnegan, 1997; Linares, 1999; Orr, Park, Thompson, & Thompson, 1999; Spoon & Schell, 1998).

Some of the postsecondary allied health programs in Georgia include: (a) medical assistants, who perform clinical and administrative duties; (b) respiratory therapists, who assist in evaluating, treating, and caring for clients with breathing problems; (c) licensed practical nurses, who provide basic bedside care; (d) vascular technologists, who perform examinations determining how well the heart and blood vessels function; (e) diagnostic medical sonographers, who diagnose problems such as tumors and cysts, fetal development, etc.; and (f) radiological technologists, who produce images that are interpreted by a radiologist (Southwest Georgia Area Health Education Centers, 2000). Allied health programs in colleges and postsecondary institutes are in demand because of the need for health care workers (Shargey, 1988; Shay, 1994). Today, the number of allied health student programs are declining. There are an inadequate number of qualified applicants for admission into allied health programs. Allied health professions includes paramedical fields composed of professionals who assist the physicians and medical institutions in providing health care.

Students of these professions require extensive didactic and clinical instruction and must absorb large amounts of information (Rahr, 1987). Allied health programs traditionally require classes of technology, science, and math which could be very challenging if taken all at once. Since many postsecondary institutes require a full course load to be completed in two years, many students become discouraged, overwhelmed, and frustrated. Society expects health care workers to be professional, competent, and empathetic caregivers. Educators have a responsibility to conduct classes which accommodate variety of learning styles in order to best meet the learner's needs (Duncan, 1996). Allied health teachers with an understanding of students' learning styles

characteristics, can create an educational environment which facilitates students' educational goal achievement (Linares, 1999). Learning styles based instruction has been shown to have a significant influence on increases in academic achievement and improved attitudes toward school for students at different institutes and at various academic levels (Dunn, 1990). Guild (1997) elaborated:

> Currently, too many students are not learning successfully in our schools . . . Application of the theories of multiple intelligences, learning styles, and brain-based education offers more students the opportunity to succeed by focusing attention directly on how they learn. This priority is long overdue in our schools. We would be wise to keep the common principles of the theories of multiple intelligences, learning styles, and brain-based education in mind and not let competitiveness and differences among vocabulary and specific applications threaten the positive impact for teachers and students. (p. 31)

The literature indicates that learning styles studies have been conducted with children in grades K-12 and with a variety of types of students in institutions of higher learning. There is little information on multiple intelligences of students in allied health fields. It was not until the late 1970s that learning styles studies were conducted with allied health students (Rahr, 1987). To date, most studies have used Kolb's learning style instrument and Dunn and Dunn's, and Price's (PEPS) learning style instruments (Dunn & Griggs, 1995). If information regarding how students learn can be practically applied in a school environment, schools might better prepare students to meet their academic and professional challenges and thus contribute to eliminating the shortage of future health care workers (Shargey, 1988).

Problem Statement

There is evidence that shows an interest in the learning styles of students in allied health programs. There is paucity in the literature on the emphasis of the concept of individual differences (Dunn & Griggs, 1998). In order to best prepare allied health students for intense and difficult instruction in a short time frame, it is conceivable that students would benefit from awareness of their own particular learning style and multiple intelligences. Many students do not know the way that they learn best. If students knew their strong and weak learning styles, they might be able to apply their preferred learning styles to a specific situation and improve on their less preferred learning styles. Even though multiple intelligence theory is very different from learning styles, the student might be able to capitalize on their stronger intelligences and develop their weaker intelligences. If the learning styles and multiple intelligences of allied health students at a postsecondary college could be identified, there could be an easier transition for the students between high school and postsecondary college. This might result in more student success and thus eliminate the shortages in allied health globally.

It has been found that learning styles change as individuals get older. A student's learning style changes between elementary and middle school, then between middle school and secondary school. Learning styles continue to change in college and during adulthood (Dunn & Griggs, 1995). There is a need to determine if age is a significant factor in learning styles and multiple intelligences.

Purpose Statement

The purpose of this study was to determine the learning styles (measured with the PEPS Learning Styles Instrument, (1996) and to identify the multiple intelligences

(defined by Gardner, 1983, 1996, 1999a, 1999b) of students in postsecondary allied health fields. Results of this study may provide a better understanding of students' learning styles characteristics and multiple intelligences and assist faculty in maximizing the educational environment for the student, which would ultimately ease the students' way to achieving their educational goals. Specifically, answers to the following research questions were sought.

Research Questions

1. What are the learning styles as defined by the Productivity Environmental Preference Survey (PEPS) of postsecondary allied health students?
2. What are the multiple intelligences as determined by the Multiple Intelligence Developmental Assessment Scale (MIDAS) of postsecondary allied health students?
3. Are there statistically significant differences in learning styles among students based on age?
4. Are there statistically significant differences in multiple intelligences among students based on age?

Theoretical Framework

Learning styles and multiple intelligences theory are different, but in a school environment, which calls for the application of the theories, the outcomes look similar. Each of the theories is learner centered, the teacher is an insightful practitioner and decision maker, the student is also reflective, the whole person is educated, and each of these theories promotes uniqueness (Guild, 1997).

As individuals age learning styles and multiple intelligences change (Dunn & Griggs, 1995;Gardener, 1983). A student's learning style might change between elementary and secondary school and then change during adulthood (Dunn & Griggs).

Silver, Strong, and Perini (1997) reported that in recent years, two solid theories have originated in an attempt to interpret human differences and to design educational models around these differences. These two theories are learning style theory, which is grounded in the psychoanalytic community, and multiple intelligences theory, which reflects an attempt to reexamine the theory of measurable intelligence. Each person is unique, and although authors use different names for each learning style theory, many of the basic concepts are similar (Guild & Garger, 1998). The underlying theoretical framework for this study is from the Dunn and Dunn Learning Style Model (Dunn & Dunn, 1993) and Gardner's' (1983,1999a, 1999b) theory of multiple intelligences.

Learning Styles Theoretical Framework

In an interview with Brandt (1990), Pat Guild explained the three different applications that educators use for the learning styles approach. The first is a focus on the individual. Personal awareness is an aspect of all learning style theories, but supporters, such as Gregorc and those who work with Jung's theories, emphasize it more than others. The second is application to curriculum design and to an instructional process. The third application is diagnostic-prescriptive. Key elements of the individual's learning style are identified and those characteristics are matched to instruction, such as the method used by Dunn and Dunn.

Studies in learning styles originally developed as a result of interest in individual differences. However, there has been a division in the learning styles field resulting in a

misunderstanding of terminology and the wide variation in scope of behavior that is thought to be predicted by learning style models (Curry, 1983). Dunn (1990) addressed the reason that there is an abundance of learning styles models. She said different pioneers recognized individual differences based on their specific experiences, named the characteristics they observed, and described them in language that had meaning to them.

Dunn and Dunn Learning Style Model

Dunn (1990) explained that the different learning styles models are similar to each other because each respects the differences among individuals and advocates that teachers adapt instruction to how individuals learn. Most models are designed around one or two characteristics on a bipolar continuum, which suggests that people are either one way or another. Several comprehensive models, such as the Dunn and Dunn model include many characteristics.

Dunn and Dunn (1993) defined learning style as "the way in which each learner begins to concentrate on, process, and retain new and difficult information" (p. 2). The Dunn and Dunn learning-style model traced its roots to two distinct learning theories – cognitive-style theory and brain-lateralization theory. Cognitive-style theorists proposed that individuals process information differently on the basis of innate traits. As relationships among various cognitive-style theories were recognized, brain-lateralization theory materialized, which proposed that the two hemispheres of the human brain have different functions. This idea was also used to diagnose learning style prescriptions for individuals (Dunn, 1999/2000).

Dunn, Griggs, Olson, Beasley, and Gorman (1995) reported the Dunn and Dunn learning style model concentrates on identifying individuals' preference for instructional

environment, methods, and resources. It should be noted that a person's learning style might change over time. This is supported by the following presumptions. First, learning style is a biological and developmental set of personal characteristics (Thies, 1979). Therefore, it makes identical instructional methods and resources effective for some and not others. Second, most people have learning-style preferences which differ from others and the influence of accommodating these preferences can be measured. Third, the stronger the preference, the more important to provide compatible instructional strategies. Fourth, supporting individual learning-style preferences through supplemental instructional and counseling involvement may result in increased academic success and improved student attitudes toward learning. Fifth, when using matched learning-style approaches, students may attain statistically higher achievement and attitude test scores than students with mismatched treatments. Sixth, most teachers can learn to use learning styles in instruction. Seventh, most students can learn to benefit from learning-style strengths when concentrating on new or difficult material. Lastly, the less academically successful the individual, the more essential it is to accommodate learning-style preferences (Dunn et al., 1995).

Dunn, Dunn, and Price (1996) designed a learning style inventory for school-age learners (LSI) and a second instrument for adult learners (PEPS) (Gordon, 1998). Learning styles are described as an individuals' personal reaction to each of 21 elements when concentrating on new and difficult academic material. The 21 elements are in five different categories: (a) environmental, (b) emotional, (c) sociological, (d) physiological, and (e) psychological. To capitalize on their learning style, students need to be aware of their own (Dunn & Dunn, 1993). During the past 30 years, this

model has been developed, researched, refined, and utilized to observe many instructional practices in matching and non-matching treatments for students with diverse learning styles (Dunn, 1999/2000).

Multiple Intelligences Theoretical Framework

In the 1960s, psychologists accepted the work of Piaget, who said all normal children pass through stages of development at the same pace in all domains. By the 1970s, however, Piaget's version of universal development was questioned, especially the idea that a child's level of development in one domain failed to predict that child's level of development in other domains (Hatch & Gardner, 1996). In addition, research on the abilities of individuals who had suffered damage to the brain indicated that functioning in one area of the brain could be impaired, while other areas remain unaffected, signifying that different parts of the brain serve different functions (Gardner, 1983). These findings supported the idea that brain functions could develop independently. Therefore, as the universal account of development began to come undone, investigations of development in individual domains became more critical. It did not matter which domain was chosen for measurement if the ability was the same across all domains. However, for those who believed that abilities functioned and developed independently, focusing on a limited set of domains resulted in a distorted view of an individual's capability (Hatch & Gardner).

Howard Gardner (Theory of Multiple Intelligences)

Mettetal, Jordan, and Harper (1997) implied that Gardner's theory of multiple intelligences suggested a new way of thinking about intelligence. Instead of a general **g** factor, or unidimensional theory of intelligence, Gardner proposed that there were

different kinds of intelligence. Gardner's (1983) theory of multiple intelligences differed from traditional views that intelligence correlates to test scores across ages and that the **g** factor did not change much with age, training, or experience (Teele, 1994). Although the traditional school curriculum has emphasized verbal and logical-mathematical skills, Western culture values all intelligences. This is revealed by the appreciation shown for the types of intelligence required by athletes (bodily-kinesthetic), musicians (musical), and corporate leaders (interpersonal).

In Checkley's (1997) interview with Howard Gardner, Gardner defined intelligence:

> The human ability to solve problems or to make something that is valued in one or more cultures. As long as we can find a culture that values an ability to solve a problem or create a product in a particular way, then I would strongly consider whether that ability should be considered an intelligence. (p. 8)

Gardner (1983) started with seven intelligences. In 1997, Gardner added the eighth intelligence (Checkley, 1997). Guild and Garger (1998) described them:

1. Linguistic intelligence, in which language and words come easily to a person. The person has a sophisticated accessibility to language.
2. Logical-mathematical intelligence, in which a person can easily perceive quantitative relationships, particularly related to computations and scientific areas. The person is competent in their logic ability.
3. Spatial intelligence, in which a person has awareness of their own and others' position in space.

4. Bodily kinesthetic intelligence, in which a person has graceful body movements and awareness of positions in space.
5. Musical intelligence, in which a person is particularly sensitive to sound and has an ability to create and communicate through rhythmic patterns.
6. Interpersonal intelligence, in which a person understands and enjoys people, and relates to others easily.
7. Intrapersonal intelligence, in which a person is self-reflective and perceptive about personal abilities.
8. Naturalistic intelligence, in which a person is interested in and knowledgeable about the natural world.

Although Gardner does not produce, use, or endorse any MI inventories or tests, there have been several developed. Among these are Brandon Shearer's Multiple Intelligence Development Assessment Scales and Sue Teele's Teele Inventory of Multiple Intelligences (Chisholm – assistant to Gardner, personal communication, October 12, 2000).

Diaz-Lefebvre and Finnegan (1997) observed that the time is right for the community college to lead higher education in redefining what it means to be smart. Diaz-Lefebvre was instrumental in setting up a pilot program at Glendale Community College in Arizona using Gardner's theory. He used two components to reach students. First, was the administration of the Teele Inventory of Multiple Intelligences, and then the development of 15 different learning options for students. He cited student's final grades as evidence of the success of the pilot program (Diaz-Lefebvre, 1999). With the

help of multiple intelligences and learning style descriptions, teachers can purposely design ways to assess their student's mastery and competence.

Delimitations of the Study

This research will be de-limited to 108 allied health students enrolled in six different diploma or degree programs at a technical college in Northwest Georgia. The students were at least in their second quarter of study. Data collection strategies were restricted to administering the Multiple Intelligences Developmental Assessment Scale (MIDAS) and the Productivity Environmental Preference Survey (PEPS) to the students included in the study who volunteered and who were present at the time both instruments were administered.

Significance of the Study

The research shows an abundance of research concerning learning styles and multiple intelligences of school age children. There is a need for research on learning styles and multiple intelligences to be conducted at the postsecondary level. This holds true in the allied health professions, especially with the continual rise of the informational and technological explosion. It is necessary for students to use different strategies to accommodate their individual learning styles and multiple intelligences. In order to do this, students need to determine how they best learn. The instructor also needs to become aware of how their students best learn. Adapting the environment in postsecondary education to the students can be a way that technical colleges can best help students to become competent and effective learners. This study concentrated on gaining student

awareness of individual learning styles and multiple intelligences in the allied health profession at the postsecondary level.

Summary

Each student is taught a concept in the same way even though students do not respond to that same concept in the same way. In addition, certain tests and instruments demonstrate student knowledge, but not necessarily student understanding. A goal of educational testing and instruction should be to sensitize the instructor not only to student knowledge but also to individual strengths and preferences. In the last three decades, educators are becoming more aware of individual differences, learning styles, and multiple intelligences. As a result of this, students' learning needs are being met.

Today, there is a shortage of allied health workers. There are an inadequate number of qualified applicants for admission into allied health programs that require extensive didactic and clinical instruction in a relatively short period of time. Research shows if students and instructors have a better understanding of students' strengths, preferences, and multiple intelligences, increases in academic achievement and improved attitudes toward school will occur. The ultimate culmination being successful completion of allied health programs, which will produce viable employees in the health field.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Every learner from preschool through postgraduate levels of education is unique in ability and interest. In 1967, Rita and Kenneth Dunn researched the possibility that individual differences exist among students and used the term "learning styles" to describe these variables. They observed the diverse effects of exposure to identical methods and teaching styles on the same age and the same grade school children. Dunn and Dunn then examined the educational and industrial literature concerned on how people learn. They found a profusion of research, accumulated over an eighty-year period, that continually verified the individual differences among students in the way each learner begins to concentrate, process, absorb, and retain new and difficult information or skills. The last thirty-four years of research has shown individual differences among students exist–differences so extreme that using the same identical methods or procedures can promote achievement for some and inhibit it for others (Dunn & Dunn, 1993). Guild and Garger (1998) stated:

> Educators know that students learn in different ways: the experience of teaching confirms this every day. In addition, well-accepted theories and extensive research illustrate and document learning style differences. Most educators can talk about learning differences, whether by the name of learning styles, cognitive styles, psychological type, or multiple intelligences. (p. 13-14)

Research supports the applications of learning styles and multiple intelligences in

our classroom, including career technical education and allied health classrooms. This study is concerned with elements of learning styles and multiple intelligences of postsecondary allied health students. This chapter reviews the literature concerning learning styles and multiple intelligences. Starting broadly with the philosophy of education and how it is connected to career and technical education, this chapter describes how research in the field has grown to understanding learning as multidimensional and individualistic with genetic and environment influences. This literature review includes the following sections: (a) educational philosophy and theory; (b) definition of learning style and related research; (c) theories of intelligence; (d) Gardner's theory of multiple intelligence; (e) the unilateral theories of intelligence; (f) other multiple intelligence theories and instruments; and finally, (g) research on learning styles and multiple intelligences.

As Reese (2002) noted:

> Career and technical educators have probably been seeing these intelligences in students and helping them to find ways to best utilize these intelligences in a course of study and a careers. Researchers like Howard Gardner and Rita and Kenneth Dunn have given them names and created models that recognize our differences. But, understanding, accepting and respecting these differences, we acknowledge the importance of our individual strengths and talents. Those strengths and talents make us all valuable threads in the tapestry that make up our society. (p. 23)

Educational Philosophy and Theory

Much of the historical foundations and philosophical underpinnings of learning styles and multiple intelligences are common to each. They are based on the belief that all people are "unique". The recognition of individual differences is basic to an educator's philosophy.

Humanistic philosophers suggest that teachers show respect and kindness toward students. Instruction is geared appropriately to the development of the child (McNergney & Herbert, 1995). Humanism is relevant to learning styles and multiple intelligences because it shows the importance of the student, which is a critical point of these two constructs.

The phenomenologist searches for the understanding of the "original experience" and a return to the original, immediate data of consciousness (McNergney & Herbert, 1995). Gregorc (1979) used a phenomenological approach in his learning style theory:

> Learning style, from a phenomenological viewpoint, consists of distinctive and observable behaviors that provide clues about the mediation abilities of individuals. In operational terms, people through their characteristic sets of behavior "tell" us how their minds relate to the world and, therefore how they learn. These characteristic sets reflect specific mind-qualities that persist even though goals and content may change. (p. 19)

Constructivism is pragmatic in nature. Constructivists endorse ideas such as scientific method, problem solving, naturalism, and humanism, whereas pragmatism promotes continuous change and becomes a means for helping people adjust to society instead of changing it. Educators who advocate the use of learning style models and

methods used in developing multiple intelligences have elements of constructivism interwoven in their philosophy. Constructivism is the movement illustrating the cognitivist outlook (McNergney & Herbert, 1995). Educators who consider themselves cognitivists choose student-centered learning experiences. Constructivists say that what is known is constructed, since information is processed and altered through cognitive structures resulting in knowledge. The constructivist Jean Piaget said the cognitive materials needed for building knowledge are not predetermined but develop over time as the result of interaction with the environment (Duschl, 1992). Howard Gardner, the author of the multiple intelligence theory also draws heavily from constructivism (Ozmon & Craver, 1999).

Williams James said:

> Let A be some experience from which a number of thinkers start. Let Z be the practical conclusion rationally inferable from it. One gets to the conclusion by one line, another by another: one follows a course of English, another of German, verbal imagery. With one, visual images predominate: with another, tactile. Some trains are tinged with emotions, others not; some are very abridged, synthetic and rapid, others, hesitating and broken into many steps. But when the penultimate terms of all the trains, however differing inter se, finally shoot into the same conclusion, we say, and rightly say, that all the thinkers have had substantially the same thought. It would probably astound each of them beyond measure to be let into his neighbor's mind and to find how different the scenery there was from that in his own (cited in Guild & Garger, 1998 p. 61).

William James (1842-1910), the noted American psychologist, philosopher, and educator, quoted this more than a century ago. He used a pragmatic method to emphasize the right of individuals to create their own reality (McNergney & Herbert, 1995). James found his solution by focusing on experience instead of on intellectual ideas (O'Donaghue, 1998). Pragmatism is readily equated with "common sense". Pragmatism is "a philosophy that encourages us to seek out the processes and do the things that work best to help us achieve desirable ends" (Ozmon, & Craver, 1999, p. 128). Pragmatism is considered a 20th century philosophy, developed by Americans, although its roots can be traced back to British, European, and ancient Greek philosophical traditions. Pragmatism, also known as experimentalism, developed as early as the 1500s but became popular toward the end of the 1899s (Scott & Sarkees-Wircenski, 2001). James identified three differing styles-cognitive, conceptual, and affective-which were indicative of how individuals perceive, gain knowledge, and store information. For instance, some individuals make conclusions based on visual imagery, whereas others rely on tactual information. James' ideas were influential in forming modality research in which three perceptual modalities are addressed: (a) visual, (b) auditory, and (c) kinesthetic, an idea common in contemporary education (Shay, 1994).

In the early half of the 20th century, the progressive movement in American politics and social life influenced educators. Progressivism applied human and material resources to improve the American quality of life. Progressive ideals meant that student needs and interests should be the center of everything that happens in schools. Teachers relied more on class discussions and demonstrations than on direct instruction and rote learning. Teachers also experimented with individualized instruction that involved

students in practical experiences and relevant learning outside of the classroom. The role of the teacher became that as a facilitator and guide in order to help students maximize their potential (McNergney & Herbert, 1995).

The greatest advocate of progressive education was the pragmatist, John Dewey (1859-1952), whose Laboratory School at the University of Chicago scientifically tested child-centered curricula and instructional approaches. Dewey said a child's own instincts, activities, and interests should be the preparatory point of education. (McNergney & Herbert, 1995). Dewy placed heavy emphasis on how to think, rather than what to think. Believers in the progressive way of thinking view the curriculum as interdisciplinary, and subject matter taught with books as part of the learning process (Scott & Sarkees-Wircenski, 2001). Rahr (1987) discerned learning styles, as they are known, originated from the basic concepts of experiential learning developed by Dewey, Piaget, and Lewin. These concepts led to the basic learning style models now used by Kolb and Gregorc. Dewey is believed to have laid the foundation for experiential learning in higher education and believed experiential learning to be the process that links education, work, and personal development (Kolb, 1984).

As the United States crossed the threshold into the 20th century, changes were occurring in educational practice and thinking. Pragmatists preferred flexible methods; they determined there is no single way to educate children. Therefore, educators need to be aware of the many resources that can be used, either inside or outside of the school setting. Pragmatist educators gravitated toward a broad education rather than a specialized one and they preferred an expanded curriculum. Experimentation was suited to the pragmatist philosophy. Experimental education was essential; because it met the

need for flexibility in a shifting world and helped individuals understand the constant of change (Ozmon & Craver, 1999). Teele (1994) observed that Dewey stressed the need for curriculum to be connected naturally to the everyday life of the child. Dewey visualized a school with areas for children to connect their artistic, athletic, musical, scientific, mathematical, and creative talents to life's experiences. Teele further explained that Dewey described four instincts available to students in schools that were closely associated with Gardner's multiple intelligences. For example, the language instinct allowed students to express themselves, inquire and discover things, and was comparable to the linguistic and logical-mathematical intelligences. The art instinct enabled students to express themselves freely and was related to the spatial, musical and bodily-kinesthetic intelligences. Clearly, both Dewey and Gardner acknowledged the need to explore children's strengths and potentials in order to assist his or her growth.

As early as 1892, elements of learning style appeared in the research literature. Much of the research before 1940 concentrated on the relationship between memory and auditory or visual teaching methods. Researchers were engrossed in finding the one perceptual mode that would be influential in increasing learning (Keefe, 1979).

Career and technical education teachers instruct their students with a combination of written material, lectures, and hands-on training. The research shows that these educators are logically addressing the issue of their students' different learning styles and intelligences (Reese, 2002). " If students don't learn the way we teach them, then we will teach them the way they learn. In short, we must teach them how they learn so that they can teach themselves"(Marshall, 1990, p. 62). In addition to traditional methods, other ways teachers accommodate student's learning styles include: (a) hands-on learning,

(b) project-based learning, (c) mentoring and consulting, and (d) applications (Souders, & Prescott, 1999).

The theory of multiple intelligences and learning styles although similar, have many differences. Multiple intelligence concentrates on the content of learning and its relation to the disciplines. However, it does not deal with the individualized process of learning as learning style does (Silver, Strong, & Perini, 1997). Therefore, in dealing with the original broad statement of this chapter that: all individuals are "unique," the learning style theories and the theory of multiple intelligence might be where the paths separate in regard to the uniqueness of individuals. However, Silver, Strong, & Perini emphasized that learning styles and multiple intelligences complement one another:

Guild (1997) stated that there are many commonalities between multiple intelligences, learning styles, and brain-based education. These fields are distinct from one another, but yet in the practical milieu of the school classroom, the outcomes are related. She proposes several areas of overlap: (a) Each of the theories is learner and learner-centered; (b) the teacher is reflective and continually relates the appropriate applications to his or her own situation; (c) the student is also reflective and active in the planning and appraisal of the learning process; (d) the whole person is educated, and; (e) in each of the theories, teachers and students embrace diversity.

According to Guild and Chock-Eng (1998), learning styles and multiple intelligences have similar concerns. Guild and Chock-Eng stated:

> Finally, none of the original theories aims to be a cookbook approach to teaching. When a theory about how people learn turns into a standardized process, it is a contradiction in both philosophy and practice…The theorists and promoters of

> brain-based education, learning styles, and multiple intelligences can contribute to effective applications by pointing out the complementary aspects of their work…Currently, too many students are not learning successfully in our schools…Application of the theories of multiple intelligence, learning styles, and brain-based education offers more students the opportunity to succeed by focusing attention directly on how they learn…We would be wise to keep the common principles of the theories…in mind and not let competitiveness and differences among vocabulary and specific applications threaten the positive impact for teachers and students. (p. 40)

Guild and Chock-Eng (1998) further explained that none of these ideas claim to be the solutions to educational problems, nor the complete theory of effective teaching and learning. Those practicing these theories discard neither research nor the wisdom of the past. They integrate current practices into the applications of the theories. The researchers of the theories persistently explore and develop new ideas. Finally, none of the original theories aims to be a cookbook approach to teaching.

Guild explained in an interview with Brandt:

> We're beginning to be a little bit clearer about the difference between learning style and intelligence-people who have different styles can be equally intelligent. We're also understanding the relationship of culture and style–there are many diverse styles in any culture, but cultural values do impact a learner's style. It's the nature/nurture relationship. We know that some approaches for accommodating learning styles can produce impressive gains in achievement. We

know that attention to learning styles can impact school climate and staff and student morale. (p. 11)

Educators and philosophers still explore the nature of the learning process, the most effective way to deliver educational material, and the nature of the child involved in the learning process. Some educators and philosophers tend to support the idea the educational process should respond to the needs of the students. Others believe that the student should conform to the makeup to the educational program. Even though the methods used to reach this goal differs, however, the objective of helping the student obtain the best education possible is the same (Fouts, 2000).

Definitions of Learning Style and Related Research

One of the changes that must occur as the United States moves toward a more global, information-based economy with an increasingly diverse workforce is the need for better-trained, competent workers who are technology savvy (Gordon, 1998). Traditional methods of teaching are no longer acceptable. Many factors that influence the educational process have emerged from research on human developmental stages and life phases. Researchers claim that learning style is one factor influencing student educational performance and that learning style research could be used to create more positive, effective learning environments for all students (Swanson, 1995).

There are a wide varieties of definitions of the learning style construct. The definitions range from concerns about preferred sensory modalities (such as auditory, visual, tactile, etc.) to descriptions of personality characteristics that concentrate on behavior patterns in learning situations (such as structure versus flexibility). Other definitions have concentrated on cognitive information processing patterns, such as

Kolb's description of concrete versus abstract thinking abilities (Smith, & Renzulli, 1984). Individuals are classified on a number of scales according to how they receive and process information. Inventories and questionnaires are used to define a student's cognitive learning style (Gordon, 1998).

The terms "learning style" and "cognitive style" are often mistakenly treated as identical in the literature. However, learning style is thought to be a broader construct in that it includes the affective and physiological dimensions of motivation for learning. It also includes biologically based modes of response by gender, personal nutrition and health, and reaction to the physical environment (Shay, 1994). Prior to the mid 1970s, researchers experimented with the definition cognitive style. The definitions were different but similar in the respect that all were concerned with how the mind processed information or was affected by an individual's perceptions. In 1971, Prentice-Hall published three authors, Kolb, and Dunn and Dunn, who wrote about the new and innovative concept of learning style. Around this time, other researchers, such as Canfield and Lafferty, Gregorc, Schmeck, and Hunt developed different definitions, models, instruments, and techniques for assessing students' characteristics. In many ways these models differed, but they had similar components (Dunn, 1984).

The term "learning style" is too common to be useful to the practitioner. There are nearly as many definitions of learning styles as there are researchers. "A generic definition would be: Learning style is the way people absorb, process, and retain information" (DeBello, 1990, p.204).

Gregorc (1979) stated "Learning style…consists of distinctive and observable behaviors that provide clues about the mediation abilities of individuals….People through

their characteristic sets of behavior 'tell' us how their minds relate to the world and, therefore, how they learn" (p.19).

Keefe (1979) described it like this: "Learning styles are the characteristic cognitive, affective, and psychological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (p. 4). This quote appears quite often in the literature concerning the origination of different theories.

Schmeck defined learning strategies as a pattern of information-processed activity the learner uses to prepare for a task in rote memorization (DeBello, 1990). Rita and Kenneth Dunn described learning styles as an individual's personal reactions to each of 21 elements when concentrating on new and difficult academic knowledge or skills (Dunn & Dunn, 1993; Dunn, 1999/2000).

Curry (1983) used the simile of an onion to describe learning styles theory. The layers of the onion correlate to a person's different characteristics. The core of the onion simulates basic personality traits. Instruments developed from this perspective test the influences of basic personality on preferred approaches to obtaining and incorporating information. The next layer, information processing, is the individual's preferred intellectual approach to digesting information. The third layer is concerned with the social interaction of the students, and finally the outer layer is a multidimensional model, which addresses the variations among learners within the framework of the learning process concerned with the individual's preferred environment for learning.

Information regarding individual learning differences encourages a persistent investigation for the one "best" way for students to learn, teachers to teach, and

curriculum, but it is fruitless to search for the single best way to achieve a broad educational product because learners do not fit a single mold (Guild & Garger, 1998). Many educators have written powerfully about the value of diversity of teaching styles. There is no definitive evidence of one best way to teach, just as there is no substantiation of one best way to learn (Guild & Garger). Keefe and Ferrell (1990) summarized:

> Learning style, thus, is a complexus of related characteristics in which the whole is greater than its parts. Learning style is a gestalt combining internal and external operations derived from the individual's neurobiology, personality, and development and reflected in learner behavior. (p. 59)

Early and Current Researchers of Learning Styles and Learning Style Instruments

There are hundreds of leaning style models which tend to fall into one or more of the following categories: (a) personality and emotional models, (b) psychological, cognitive and information processing models, (c) social models, (d) physical models, and (e) environmental and instructional models (Given, 1996). Given summarized them as follows:

1. *Emotional/Personality Models of Learning Style.* In the early 1900s, Carl Jung divided major emotional and personality characteristics into four bipolar clusters, which eventually transferred into an assessment instrument by Isabelle Myers and Katherine Briggs. In 1984, David Kolb combined Jung's theory with concepts from Piaget, Dewey, and Levin to construct his learning style model. Anthony Gregorc said people can adjust to different circumstances in their less predominant channels as long as the dominant style has been allowed to develop. He also created a learning style model

combining Jungian concepts with phenomenology. Dunn and Dunn examined emotional factors of study including motivation, persistence, and responsibility.

2. *Sociological Approaches to Learning Style.* The Dunn and Dunn model used this approach as an essential component of their model. Their elements entail preferences for working alone, with one or more peers, in a team, with an adult or authority figure, or in a variety of social groupings. Another example of this type of learning style is the learning scales developed by Grasha, which included: independent, dependent, collaborative, competitive, participant, and avoidant learning patterns. Grasha and her associates' research found students learned best in settings where their social-emotional needs were met.
3. *Information Processing Approaches to Learning Style.* Predominant learning style models included in this category are independent bipolar dimension, such as sequential vs. simultaneous and field independent vs. dependent. This approach tends to be used by cognitive psychologists. Included in this category are Dunn and Dunn's model and Carl Jung's influence.
4. *Physical Approaches to Learning Style.* Learning styles are categorized by sensory modalities, which include visual, auditory, tactile and kinesthetic. One of the first in the field to develop an instrument for assessing modality strengths was Barbe and Swassing. The Dunn and Dunn model also includes elements in this category.

5. *Environmental/Instructional Approaches to Learning Style.* Environmental conditions have been found to affect learning. This aspect is addressed in one category of the Dunn and Dunn learning style instrument. Bernice McCarthy used an integration of Kolb's Jungian-based theory and research on brain hemisphericity to develop an instrument. Kathleen Butler, a student of Anthony Gregorc's, converted his theory into a practical instrument for teachers by expanding Gregorc's instrument to indicate its overlap with Bloom's hierarchy of thinking skills (Given).

Keefe (1979) explained Bloom's model of school learning. Bloom proposed three interdependent variables that account for the greatest degree of difference in student learning. The variables are: (a) cognitive entry behavior–which demonstrates how much the student has previously learned in regard to the projected learning, (b) affective entry characteristics-which is how motivated the student can be in order to engage in the learning process, and (c) quality of instruction. Bloom theorized that when all three variables are considered, learning will be at a high level with little disparity in student outcomes (Keefe).

Even though most teachers acknowledge the idea students learn in different ways, uniformity continues to govern in the educational system. Most schools still operate with a curriculum content, instructional methods, and assessment. Schools presently emphasize uniformity over diversity since it is easier to promote sameness over difference. There are teaching models that promote both consistent values and diversity (Guild & Garger, 1998). Experienced educators have discovered certain methods effectively work in teaching students. Therefore, educators determine what theories of

style they feel will work best after applying their personal philosophy coupled with their experience (Guild & Garger).

Dunn (1990) relayed the reason for so many learning style models: "Different pioneers recognized individual differences based on their particular experiences, named the characteristics they observed, and described them in nomenclature that made sense to them" (p. 15). Moving from the simple and rudimentary statement that people learn differently to concurring upon the development and use of an instructional model that encompasses the same elements has not been accomplished. Different learning style models concentrate on an assortment of different elements, domains, characteristics, etc. DeBello (1990) said recognizing that not all theorists use the same terms in describing learning assessment, their observation and assessment methods may differ. Some of the models are multidimensional, including cognitive, affective, and psychological characteristics, and other models are limited to just one variable.

Griggs, Griggs, Dunn, & Ingham (1994) stated that Kolb's LSI and Schmeck's Inventory of Learning Processes focus on information processing using one variable related to how individuals learn. The Myers-Briggs Type Indicator focuses on personality using one variable related to how individuals learn (Myers & McCaulley, 1985). Witkin's Embedded Figures Test Indicator focuses on social dimension using one variable related to how people learn. DeBello (1990) cited the Dunn and Dunn model as the only one out of three models that is comprehensive–using many variables.

According to Guild and Garger (1998) there are basically five ways to assess style. The first and most common is through self-report inventories. These inventories ask a person to rank responses to either questions and/or words. They assess the

person's style through the example of the responses. Using this type of instrument, people give information directly. However, these instruments may show possible discrepancies, as if the responses are reflective of idealistic thinking rather than reality.

A second type of learning styles assessment is a test of a particular skill or task. Here, a specific task has been shown to correlate with style characteristics, and the degree of success with the task indicates the person's style. An advantage of this type of assessment is objectivity, but a disadvantage is limitations to measurement of skills in a specific task, and inferred extensions (Guild & Garger, 1998).

A third way to assess learning style is to interview the person. The fourth way to assess style is to observe the person. A disadvantage of these two ways is in both cases an observer can bias the results. The last way to assess an individual is to view the outcomes of a person's behavior. Tasks that are simple and successful for an individual indicate that person's pattern and approach. There is no instrument 100 % valid. Therefore, authors of different learning style instrument suggest the use of more than one type of method of assessment (Guild & Garger, 1998).

Myers-Briggs Indicator (MBTI)

The MBTI has been used in studies involving allied health students. Hicks (1997) reported that in 1950 Myers tested over 5,000 medical students from 45 schools in a longitudinal study that lasted 12 years. In another longitudinal study that lasted 17 years, over 32,000 students and practitioners in health professional and related health fields were tested. Hicks determined that there were differences. Over one-half of the student sample was Extraversion, Sensing, Feeling, and Perception (ESFP), a type that is

attracted to business and medicine. The majority of teachers were Extraversion, Sensing, Feeling, and Judging (ESFJ).

In one of the original studies conducted to examine learning styles, the MBTI was used in conjunction with another learning style inventory. Rezler and French (1975) found specific characteristics of differences between Medical Technology and Occupational Therapy students. Of the Medical Technology students, 43% were ISTJ (introvert-sensing-thinking-judging) or ISFJ (introvert-sensing-feeling-judging). This led to the conclusion that the introvert, practical, structured, fact-oriented student was attracted to the Medical Laboratory Sciences. In addition, the Occupational Therapy students had a common pattern which was absent from the other allied health students. Forty-five percent of students were either ENFP (extrovert-intuitive-feeling-perceptive) or ESFP (extrovert-sensing-feeling-perceptive). Perhaps, a conclusion from this was that Occupational Therapy attracted significantly more extroverted, imaginative, emotional, spontaneous, and flexible students than the other fields used in this research. The four scales of the MBTI showed higher percentages of feeling vs. thinking scores in all the groups of students; judging vs. perception in all but one group of students; an almost equal distribution between extroversion and introversion, with extroversion predominating in the professions which require more direct patient contact; and almost equal distribution between sensing and intuition (Rezler & French).

David Kolb (Learning Style Inventory)

The Learning Style Inventory is based on the theory of experiential learning. Kolb (1984) said: "Experiential learning theory offers something more substantial and enduring. It offers the foundation for an approach to education and learning as a lifelong

process that is soundly based in intellectual traditions of social psychology, philosophy, and cognitive psychology" (p. 3). The core of the model is a description of the learning cycle of how adult experience is translated into concepts, which are used then as guides in the choice of new experiences (DeBello, 1990). The theory deals with style and with the basic question of learning and individual development. Kolb drew from the work of Dewey, who stressed the necessity for learning to be grounded in experience; Lewin, who highlighted the importance of an individual to be active in learning; and Piaget, who described intelligence as the result of the interaction of the person and the environment (Swanson, 1995). By combining insights from many disciplines, Piaget hoped to create a broader understanding of how the mind works, especially how ideas and concepts develop (Tryphon & Vonèche, 1996).

The purpose of Piaget's theory is to describe and explain how knowledge develops (Glaser, 1978). According to Kolb (1984), Piaget's stages of learning and cognitive development are divided into four stages. Each stage represents underpinnings of Kolb's theory. In the first stage, sensory-motor, the child is concrete and active – learning through senses. The second stage, representational, the child is reflective, concrete, and creating images. The third stage, concrete operations, the child begins to understand the concept of abstract and theory, and starts possessing inductive reasoning. By the time of the fourth stage, formal operation, at 12 to 15 years old, the child is active, reflective and begins to develop logic and deductive reasoning.

Felder (1996) described Kolb's model as classifying students as having a preference for: concrete experience or abstract conceptualization (how information is taken in) and active experimentation or reflective observation (how information is

internalized). Kolb (1984) described learning as a cycle in four steps. It begins with concrete experience, which is a full involvement in the experience. The next step is reflective observation, thinking about the experience from different perspectives. The third step is abstract conceptualizion, creating principles that incorporate observations into theory. This leads to active experimentation where the learner uses these generalizations as guides to further action, resulting in another concrete experience (Kolb). From the combination of these points, Kolb developed four learning styles. The first group, divergers, perceives information concretely and process it reflectively. The second group, assimilators, perceives information abstractly and process it actively. The third group, convergers, perceives information abstractly and process it reflectively. Accommodators are the final group. They perceive information concretely and process it actively (Swanson, 1995).

Joyce-Nagata (1996) used Kolb's Learning Style Inventory to identify the learning styles of traditional baccalaureate nursing students, registered nurse baccalaureate students, and baccalaureate nursing students holding a previous non-nursing degree, and nursing educators. There was variation in the students' preferred learning style, but the majority were abstract learners and tended to be reflective observers.

In allied health education, traditional classroom learning is combined with clinical experiences. The clinical environment and the traditional classroom setting are distinct. Accordingly, the preferred way in which students process information may be different in both settings and determining the consistency of an individual's learning style across these two distinct learning surroundings may be important. With this idea in mind, Coker

(2000) examined the learning styles of undergraduate athletic training students to determine their consistency in traditional classroom versus clinical settings. It was determined learning styles were transformed depending on the domain in which the student was learning.

Anthony Gregorc (Gregorc Style Delineator)

Anthony Gregorc also used Jungian concepts and created a bidimensional model based on phenomenology (Given, 1996). Gregorc (1979) stated: "Learning style, from a phenomenological viewpoint, consists of distinctive and observable behaviors that provide clues about the mediation abilities of individuals" (p. 19). Mediation, according to Gregorc, links the brain to the environment. The two mediation abilities that seem to have the greatest effect on learning are the mediation abilities of order and perception. Gregorc referred to the "four channels" through which the mind receives and expresses information most efficiently as mediation abilities (Gordon, 1998).

Perceptual abilities are the means by which one grasps information. The two qualities that emerge from this are abstractness and concreteness. Ordering abilities are the ways which one arranges, references, and disposes of information. The two qualities that emerge are sequence and randomness. The pairing of these qualities merge to four distinct transaction ability channels designed as: concrete/sequential, abstract/sequential, abstract/random, and concrete/random (Gregorc, 1982). While everyone may exhibit all four patterns to some degree, most exhibit inclinations toward one or two. For instance, concrete/sequential learners acquire knowledge through direct hands-on experience. Concrete/random learners are typified by experimental attitudes. Abstract/sequential learners are characterized as having excellent decoding abilities with written, verbal, and

image symbols and prefer to learn in a rational and sequential manner. Abstract/random learners are differentiated by their attention to human behavior. They prefer to receive information in an unstructured manner (DeBello, 1990). The Gregorc Style Delineator is designed to assess a person's perceptual and ordering abilities (Gregorc). This is a self-report instrument based on a rank ordering of four words to each of 10 sets. Observation and interviews are suggested to aid in categorizing learning preference patterns. This instrument is for use with upper middle grades to adult levels (Dunn, DeBello, Brennan, Krimsky, & Murrain, 1981).

The Gregorc mediation ability theory was selected as the theoretical framework for an investigation of learning styles of practical and baccalaureate nursing studies. A difference was shown between practical nursing students and baccalaureate students. The study revealed the importance of using multiple teaching methods to reach all types of students and all levels of nursing students (Duncan, 1996).

Predominant learning styles of business education, health occupations, and trade and industrial programs students' enrolled at all postsecondary institutes in Arkansas were identified using the Gregorc Style Delineator. As a result of this assessment, some students were designated as bimodal, in which a student was dominant in two learning style categories. The findings of this study indicated that concrete/sequential was the most predominant learning style among postsecondary students. However, there was enough variation in the learning styles of postsecondary students that it was recommended that teachers recognize the importance of accommodating and encouraging students with different learning styles. It was also determined there were significant

differences between genders in the abstract/sequential, abstract/random, and concrete/random learning style categories (Orr, Park, Thompson, & Thompson, 1999).

Swassing, Barbe, & Milone Index (SBMI)

Barbe and Swassing (1979) were the first researchers to develop a standardized performance measure of learning style based on modality strength. Modalities are defined as the channels through which individuals receive and retain information. They include three elements–sensation, perception, and memory. The educationally relevant modalities are visual, auditory, and kinesthetic.

A modality strength and a modality preference is not the same. A modality strength means superior functioning in one or more perceptual channels. A modality preference is just a preference and is usually measured by self-report instruments (Barbe & Milone, 1981). Auditory learners use their voices and their ears as the primary mode for learning. Some learners find their visual modality is stronger in helping them understand and remember new concepts. Some people learn better when they touch and are physically involved in what they are learning. Many successful learners can function in more than one modality. An individual's dominant modality is that channel through which information is processed more proficiently. Many people also contain a second modality (Guild & Garger, 1998).

Barbe and Milone (1981) supported the idea that student modality strength should be considered in instructional planning. Barbe and Swassing (1979) reported:

> Modality-based instruction is a method of teaching that reflects the two major concerns of educators. It is effective in that it capitalizes upon children's

strengths to accomplish the primary goal of education. Just as important, it is efficient, and does so with a minimum of expense. (p. 75)

McCarthy's 4MAT System

In 1979, McCarthy was awarded a grant to bring together several leading researchers in learning styles and brain functioning. From the exchange of ideas among these experts, she eventually developed her own approach to explaining individual differences in learning (Guild & Garger,1998). She used a variety of learning style models but focused primarily on Kolb's construct that all people sense and feel, observe and think, and experiment and act (DeBello, 1990). The two major premises apparent in the 4MAT System are: (a) People have major learning styles and hemispheric processing preferences; and, (b) if multiple instructional strategies are designed and used in a systematic framework to teach to these preferences, teaching and learning will be enhanced (McCarthy, 1990).

McCarthy described four types of learners. In Quadrant I, Type I learners are those who perceive through concrete experience and process through reflective observation. Type II learners, located in Quadrant II are those learners that perceive through abstract conceptualization and process through reflective observation. In Quadrant III, Type III learners perceive through abstract conceptualization and process through active experimentation. In Quadrant IV, Type IV learners perceive through concrete experience and process through active experimentation. Each of these learners develop their unique pattern to learning (Guild & Garger,1998).

McCarthy was interested in the research in studies of brain hemisphericity and findings that the right and left hemisphere of the brain focuses on different tasks. She

explored how the right and left hemisphere would function for these unique learning styles, which resulted in the imposing of the right and left specialization on each of the four learning styles, known as the 4MAT System (Guild & Garger, 1998).

Dunn, Dunn, & Price/Learning Style Inventory (LSI)/Productivity Environmental Preference Survey (PEPS)

Dunn (1996) stated: "Many people prefer to learn in ways that are different from how other people of the same class, grade, age, nationality, race, culture, or religion prefer to learn. How people prefer to learn is their learning style preference" (p.1). Using the framework of learning styles can help students achieve. At least 70 % of students cannot remember 75 % of what they either hear or read. These learners do not possess a high self-esteem in a classroom dominated by listening and reading. Therefore, it is important to identify students' learning styles to determine their perceptual strengths and to teach them how to become academically successful and independent (Dunn).

The Dunn and Dunn learning style model has roots in cognitive style theory and brain-lateralization theory. The cognitive style theorists suggest individuals process information due to inborn traits, while brain-lateralization theorists maintain the two hemispheres of the brain have different functions (Dunn, 1999/2000).

Dunn and Dunn are well established in the subject of learning styles. They have been widely published in educational journals, written many books, and presented seminars throughout the country (Guild & Garger, 1998). Professionals interested in learning styles throughout the world attend their annual institute on learning styles in New York City.

Dunn (1999/2000) said all learning style variables do not affect everyone. Therefore when using only a single or dual dimensional model, the particular variable that might be best for student learning may not be included in that model. Because of the many variables used in the learning style instrument (PEPS), justification for using that model in the proposed study has been recognized as being helpful to instructors.

The LSI and PEPS are believed to be the first comprehensive approaches in the assessment of an individual's learning and productivity style. The LSI is given to students in K-12, and the PEPS is the adult version and may have applications outside of the school setting. Both of these inventories are based on the same theoretical framework and deal with most of the same elements. Questions concerning each of the areas are answered and the selected responses tend to reveal characteristics that are very personalized and when combined, represent the way in which an individual desires to concentrate, learn, and work, when engaging in complicated cognitive tasks (Dunn, Dunn, & Price, 1996).

The PEPS (Dunn, Dunn, & Price, 1996) identifies an adult's personal preference for each of 20 different elements and was developed through a content and factor analysis. It determines how adults prefer to function, concentrate, learn, and perform in their occupational or educational activities in four different areas. The areas are immediate environment (sound, temperature, light, and design), emotionality (motivation, responsibility, persistence, and need for structure or flexibility), sociological needs (self-oriented, peer-oriented, authority-oriented, or learn in several ways such as alone, with peers, or authority figures), and physical needs (perceptual preferences, time of day, intake, and mobility). Questions in each of these areas are included in the instrument.

The responses from the test questions are computer scored, and the results specify which elements are important to a person's learning. Therefore, a teacher can focus on the learning styles of all students throughout the day and verify or modify the inventory profile with observations of the students' actual classroom behaviors. The computer scoring provides a group summary sheet, which allows teachers to quickly determine which students have learning style preferences without inspecting each student's profile. Therefore, the teacher can adapt methods, physical environments, groups, and strategies to accommodate the class as a whole (Guild & Garger, 1998).

There were 42 experimental studies based on the Dunn and Dunn Learning Style Model conducted between 1980-1990. These were identified in order to determine the value of teaching students through their learning style preference. The findings suggest that matching students' learning styles preferences with educational instructional methods compatible with those preferences was beneficial to their academic achievement (Dunn, Griggs, Olson, Beasley, & Gorman, 1995).

According to Dunn & Griggs (1998), a literature search revealed 78 studies that were conducted in the fields of nursing, medicine, dentistry, medical technology, and dental hygiene. In these studies, Kolb's Learning Style Inventory was the most frequently used, followed by Dunn, Dunn, and Price's PEPS, Gregorc's Style Delineator, the Myers-Briggs Indicator, Schmeck's Inventory of Learning Processes, Zenhausern's Hemispheric Preference Test, Canfield's Learning Style Inventory, and other various instruments. It is believed by the pioneers of learning styles that responding to students' learning styles is beneficial to both the learning and teaching process. Therefore, it was disappointing to find just a few experimental studies that addressed the effects of

matching various instructional modes to differing learning style patterns among students (Dunn & Griggs, 1998).

Guild and Garger (1998) suggested when choosing a model educators should be respectful of individual difference and the choice must rely on the educator's own professional judgment, informed by their own style, their own professional experience, and their students' needs. It is contrary to believe that any one learning style theory or instrument will be appropriate to each individual. The many models of style provide a source of resources for schools, and it is the educator's responsibility to determine which theory will provide the needed approach for each particular circumstance. It is more important to accept individual differences than the application of a specific model (Guild & Garger).

Theories of Intelligence

A question pondered by psychologists is: Are we who we are because of our nature or our nurture? A central focus of this inquiry is the concept of intelligence (Diaz-Lefebvre, 1999). Diaz-Lefebvre reported that when a group of 24 prominent theorists were asked to define intelligence, they gave 24 varied definitions.

Sir Francis Galton introduced the psychometric approach and definition of intelligence in 1883, creating the term 'eugenics' to describe the science of improving the hereditary qualities of the human race through controlled mating. His work became the basis for the conviction that intelligence is inheritable, fixed, general in nature, and measurable (Finnegan, 1999).

The definition of intelligence has wielded a remarkable influence on society since the turn of the 20th century. The dominant perspective of intelligence has influenced all

policies concerning education, industry, immigration, and military service. The psychometric approach is the oldest and most criticized definition of the construct of intelligence. This approach uses psychological tests to quantify intelligence. In the late 1960s, a process oriented intelligence, which focused on the processes underlying performance became a popular view (Finnegan,1999).

Goddard claimed intelligence was unitary. Binet thought intelligence consisted of several abilities. The key person who agreed with Goddard's viewpoint was Charles Spearman, the formulator of Spearman's *g* for general intelligence. Sometimes *g* is acknowledged as a general intelligence. It is referred to as the name of the general factor that accounts for a good or poor performance across a variety of tests (Perkins, 1995).

Binet and Simon (1973) gave no formal definition to the word intelligence. In their studies, they sought to find the natural intelligence of the child, and not his or her degree of culture. In order to do that, an instrument was developed that measured the intellectual development of young children. The purpose of the intelligence test was to identify children who were mentally deficient and provide them with corrective services. Eventually this emphasis shifted to differentiating among normal children.

It was determined that although intelligence tests made helpful predictions of academic achievement, as Binet has originally intended, they often failed to predict success in other academic disciplines. Therefore, other types of tests were tried for the assessment of aptitudes for those abilities. The implication was these abilities were outside the domain of intelligence, a conclusion that has been shown to be incorrect (Guilford, 1976).

In order to determine intelligence, one needs evaluation and assessment. These terms are used interchangeably, but they have different definitions. In education, assessment is a continuous process of observing, describing, and verifying achievement. Assessment is active and multidimensional and always should be linked to learning. Evaluation is more closely associated with an objective measurement. It is a more summative assignment, which ultimately identifies what educator's term "success". Evaluation often is linked to standardization and not directly connected to learning. Assessment, in contrast, can be sensitive to individual learning differences (Guild & Garger, 1998). There has been controversy over two terms evaluation and assessment concerning student outcome.

Exploring the use of a model to categorize intellectual factors into a system, Guilford (1976) attempted to organize the intellectual factors using his structure-of-intellect model. His analysis produced over 100 factors of cognitive ability, as compared with an original single factor, which was used to construct intelligence tests. The model is three-dimensional representing ways in which abilities differ from one another. The model consists of five kinds of operations, four substantive kinds of information or "contents", and six formal kinds of information or "products." Each intellectual ability involves a combination of one kind of operation, one kind of content, and one kind of product (Guilford, 1979).

Gardner (1983) said that since the rise of the Greek city-state, a set of ideas stressed the existence and importance of mental powers, which included rationality or intelligence. For most of human history, there was no scientific definition of intelligence. Toward the late 19th century, psychologists tried to define intelligence technically with

the use of intelligence tests. The first generation of proponents of intelligence described the concept as a single, general capacity for conceptualization and problem solving. Gardner proclaimed the concept of multiple intelligences was an old one (Gardner).

Thurstone (1938) acknowledged that experimental work in the world of psychological testing was hindered by the use of paper-and-pencil tests. His hope was to reduce the amount of testing with paper-and-pencil tests and use individual tests with more advanced procedures. He recognized in his studies the general factor of Spearman had not been found and that area of intelligence was more specific than general. His test consisted of verbal, mathematical, spatial, auditory, rhythm, mechanical, and visual elements.

In the 1960s, the view of "universal development" in which all children passed through stages of development at the same pace in all domains reigned. The version was questioned in the 1970s, when studies found that a child's development in one domain failed to predict the child's level of development in other domains. Gardner and his colleagues focused on development in a number of artistic domains. They found with age controlled, the achievement of a developmental landmark in one domain was largely autonomous from achievement of a developmental landmark in another domain. For many years, it was believed ability was the same across numerous domains. Therefore, it did not matter greatly which domain was measured. Gardner's work showed incongruity with this view (Hatch & Gardner, 1996). Glaser (1978) reported:

> Many factors are forcing a breakdown between the traditionally separate areas of the psychometrics of individual differences and experimental psychology. These include questions about the use of and theoretical basis for tests of intelligence,

> research on the interaction between individual differences and instructional variables, investigations of the process aspects of intellectual development, and cross-cultural studies of cognitive performance. These factors are making it necessary and possible for us to understand intelligence and aptitude in different ways than we have in the past and to change the way in which individual differences might be viewed and assessed for the purposes of education….The nature of the cognitive processes involved in the performance of test tasks used to measure and define intelligence is being investigated. (p. 4)

Schools today place two abilities at a premium: memory abilities and abstract analytical abilities. According to Sternberg (1998), ability tests measure the skills which are learned from school instruction such as recalling information. Achievement tests then assess the degree to which the abilities have been applied. There is concern that memory and analytical abilities are not necessarily the ones that matter most in the life activities. Intelligence in everyday life requires a broader range of abilities than what is measurable by today's test standards. Because tests, class assignments, and teaching methods usually focus on the linguistic and logical-mathematical intelligence, many talents, gifts, and abilities of the students who are stronger in the other intelligences often are missed. To provide opportunities for all students to succeed, curriculum, instruction, and the assessment process must be redesigned in order to meet the needs of all students (Teele, 1996).

Sternberg (1996) asserted that IQ is predictive, but the prediction is weak. No matter what kinds of outcomes are discussed with IQ, statistically conventional academic

intelligence tests account for less than 10 % of the individual variation differences in actual performance.

Gardner's Theory of Multiple Intelligence

Multiple intelligences theory is a cognitive model, which describes how people use their many different intelligences to solve problems. This approach demonstrates how the human mind correlates to the contents of the world (Armstrong, 1994).

Howard Gardner has been studying human potential for learning and the details of the human mind and brain, which he communicated in his book, *Frames of Mind*, in 1983. There, Gardner described different perspectives on intelligence. Gardner challenged the idea that intelligence could be objectively measured and limited to a single number or "IQ" score. He took the traditional view of society's emphasis on linguistic and mathematical intelligences and added five more intelligences (Guild & Garger, 1998). Gardner (1996) stated:

> I have read and heard individuals talk about "multiple intelligence" as if there were a single intelligence, composed of many parts-in direct contradictions to my claim that there exist a number of relatively autonomous human intellectual capacities…though I never asserted that there were fewer than seven intelligences. (p. 202)

Gardner (1983), originally described seven intelligences: linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal. Gardner's model is backed by a foundation that combines physiology, anthropology, and personal and cultural history. He based these distinctions on studies that were supported by studies in child development, cognitive skills under conditions of brain damage,

psychometrics, changes in cognition across history and within cultures, and psychological transfer and generalization (Silver, Strong, & Perini, 1997). These intelligences were revised in the late 1990s with the addition of naturalistic intelligence, which is the special ability to recognize and classify elements of the natural world and also the possibility of existential intelligence (Checkley, 1997; Gardner, 1999a). Gardner (1999b) discussed existential intelligence: "The core ability is the capacity to locate oneself with respect to the furthest reaches of the cosmos.…There exists a species potential or capacity to engage in transcendental concerns that can be aroused and deployed under certain circumstances" (p. 2).

Gardner's multiple intelligence theory changed its focus slightly when he revised his theory and introduced the possibilities of three new intelligences (Gardner, 1999a). His theory has not changed from its original. It has evolved.

According to Gardner, although the intelligences are structurally separated from each other, they rarely operate independently. In the individual, multiple intelligences are used congruently and balance each other as the person develops skills or solves problems (Brualdi, 1998).

Schools often have felt obligated to help students develop self-esteem and a feeling of accomplishment. Gardner's Theory of Multiple Intelligences provides a theoretical foundation for recognizing that students possess different abilities and talents (Brualdi, 1998; Wiseman, 1997). Multiple intelligences does not require a renovation of curriculum. It purely provides a framework for augmenting instruction and a language to describe one's endeavors. Unlike much of educational reform, it is not narrow in nature. Its broad insight into human strengths does not determine what and how to teach. It gives

educators a complex mental model from which to build curriculum and improve as instructors (Campbell, 1997).

It is the responsibility of the school to ensure that students learn. Teele (1996) identified four domains that affect the elements in an educational environment. These domains were the physical setting, organizational factors, human aggregate, and social climate. The intelligences have been associated with these domains in order to create quality-learning environments built on the belief all students can and will learn. This model provided opportunities for students to be taught in the way they can best learn. The four domains interact with each other and ultimately create a personalized learning situation for all students.

Students possess multiple intelligences. Therefore, it is not possible for a teacher to accommodate every lesson to all the intelligences and learning styles of the students (Brualdi, 1998). The teacher can show students how to use their more predominant intelligences to aid them in understanding. The literature is replete with methods in setting up an MI classroom, activities for teaching to multiple intelligences in a classroom, and designing alternative assessment processes that reflect students' work (Campbell, 1994; Armstrong, 1994).

Educators, such as Armstrong and Lazear, took Gardner's theory and applied it in the school setting with classroom activities and assessment proceedings. Schools have restructured curriculum and instruction to accommodate the multiple intelligences, and educators have made overtures in responding to their students needs (Guild & Garger, 1998).

Application of career and technology education to Gardner's theory of multiple intelligences can be seen in the different classrooms. For instance, agriculture may require naturalistic and kinesthetic intelligence; family and consumer sciences may require artistic and interpersonal intelligence. Instructors of career and technology education have seen these intelligences in students and need to help them find ways to best use these intelligences in school and ultimately in a career (Reese, 2002).

Other Multiple Intelligence Theories and Instruments

Sternberg's (Triarchic Theory)

> Unitarianism may work as a religion, but it hardly provides a sound basis for a science of intelligence. For decades intelligence tests have been selling the public on the notion that a single test score–the IQ–reveals the single basic fact about people's intelligence. Yet there is little evidence that any scientist studying intelligence–past or present–actually has believed it is just a single thing. All the same, the idea has a long history. (Sternberg, 1988, p. 8)

Sternberg (1996) expanded the definition of intelligence to include the idea of "successful intelligence". He distinguished between academic intelligence and successful intelligence. Successful intelligence is the kind of intelligence one needs to succeed in life. It is the translation of essential skills and abilities into routines leading to proficient everyday performances in every aspect of daily living. Successful intelligence involves the acquiring and using what one needs to know to succeed in a particular situation that is not taught explicitly and that usually is not verbalized.

Sternberg (1988) defined intelligence as: "purposive adaptation and shaping of real-world environments relevant to one's life. Stated simply, it is mental self-management" (p. 72).

Sternberg (1998) said the problem with traditional education is that the same skills needed to succeed in one area also are needed to succeed in other areas. He cited an example of scientists who need abstract-thinking skills, but without creative skills to create new ideas and the practical skills to gain acceptance of their often-unconventional ideas, they are unsuccessful. He stated the skills that are valued the most in the traditional school curriculum seem to be those that often matter the least in life.

The triarchic theory of human intelligence is explained in three manifestations: the relationship to the internal world of the individual and the kinds of mental processes and strategies that result in intelligent thinking; the relationship of intelligence to the external world of the individual and how the environment affects intelligence; and the relationship of intelligence to experience (Sternberg, 1988).

According to English (1998), Sternberg's theory presumes that students exhibit at least three kinds of intelligence: creative, practical, and analytical. She further stated Sternberg believed we should encourage children to recognize and maximize their leading intelligence and include creativity and practical intelligences as critical goals. Creative activities relate to the abilities to create, invent, imagine, and design. Practical activities are designed around application abilities. Analytical activities focus on comparing, analyzing, evaluating, critiquing, and judging ideas (English).

Goleman's Emotional Intelligence

The emotional intelligence theory originated as a contrast to the narrow view of intelligence. Goleman (1995) argued emotional intelligence–which includes self-control, zeal, persistence, and the ability to motivate oneself are skills. Goleman proposed we have two brains, two minds, and two different kinds of intelligence–rational and emotional and how we do in life is determined, not only by IQ, but emotional intelligence as well.

Bodine and Crawford (1999) defined emotional intelligence as the intelligent use of emotions–intentionally making emotions work for an individual by using them to help guide the behavior and thinking in ways that enhance the ability to satisfy basic needs and to obtain certain desires.

There are new discoveries about the brain. In humans, the amygdala, an almond shaped cluster of interconnected structures situated above the brainstem, acts as a storehouse of emotional memory. Understanding the interplay of brain structures that rule emotions can help subdue more destructive emotional impulses or serve as an opportunity to shape children's emotional habits (Goleman, 1995).

Academic intelligence has little to do with emotional life. There are widespread exceptions to the rule that IQ predicts success. IQ contributes about 20 % to factors that determine life success, leaving 80 % to other forces. High IQ is no guarantee of prosperity, prestige, or happiness in life, but our schools and our culture is consumed with academic abilities and ignores emotional intelligence, a set of traits that also influences our personal fate. Emotional life is a domain which requires a unique set of

competencies and how adept a person is at this is crucial to understanding why one person thrives in life while another, of equal intellect, does not (Goleman, 1995).

Perkins' Learnable Intelligence

Perkins (1995) identified three distinct kinds of intelligence: (a) fixed neurological intelligence, genetically determined, (b) specialized knowledge and skill, strategies, and metacognitive practices that can be learned through instruction, practice, and experience, and (c) reflective intelligence, the ability to become aware of one's mental habits and exceed limited patterns of thinking. Learning can advance reflective intelligence considerably. However, the three dimensions of the neural, experiential, and reflective intelligence work together, even as diverse as they are. The reflective intelligence has the strongest opportunity to amplify human intellect by allowing people the opportunity to make wise decisions, solve technical problems, find creative ideas, etc. (Perkins). Perkins (1995) contended intelligence can be taught, primarily through reflective intelligence, which could have a transformative impact on many learners' lives.

Multiple Intelligence Instruments

Unlike learning style instruments, there are not a preponderance of instruments used in determining multiple intelligences. Two of the best-known instruments are the Multiple Intelligence Developmental Assessment Scales (MIDAS) (Shearer, 1997) and the Teele Inventory of Multiple Intelligences (TIMI) (Teele, 1994). Neither the TIMI nor the MIDAS indicate what intellectual strengths the responder possesses. The TIMI measures the preference of the responder using a pictorial inventory. The MIDAS, which Diaz-Lefebrve (1999) attempts to infer intelligences from peoples' descriptions of activities they enjoy and talents they possess. There is no multiple intelligence

assessment tool that is considered 100 % accurate. An outside examiner who has means of testing how well a person uses each intelligence can only determine actual measurement of intellectual. Whichever instrument is used, results should be considered useful information for appraising and personalizing learning strategies for the student (Diaz-Lefebrve, 1999).

Multiple Intelligence Developmental Assessment Scales

The instrument that will be used in the proposed study is the Multiple Intelligence Developmental Assessment Scales (MIDAS), developed in 1987 by Shearer. MIDAS profiles are available for students (K-12, college undergraduate, and graduate students), teachers, organizations, and employees for management personnel. The results are helpful for planning curriculum, instruction, career decisions, job training, team building, and personal development (MIDAS consultation and research, 2000). The questionnaire is based upon Gardner's (1983) theory of multiple intelligences.

A MIDAS Profile provides information regarding a person's intellectual disposition in each of the areas identified by Gardner: linguistic, logical-mathematical, spatial, musical, kinesthetic, interpersonal, and intrapersonal. The questions inquire about activities of everyday life requiring cognitive ability, involvement, and judgment. Fifty-seven items inquire about the person's level of skill or performance of an activity, such as musical or sports ability. Thirty-eight items ask the respondent to evaluate the time duration of a particular activity, such as the length of a friendship. Eleven items inquire about the person's displayed enthusiasm (Shearer, 1997).

The Teele Inventory of Multiple Intelligences

The Teele Inventory of Multiple Intelligences (TIMI) was developed in 1992. It examines the dominant intelligences of students and has been used at all grade levels, including institutions of higher education. The instrument reliability was established through test-retest studies and is used in more than 1,000 different public and private school settings throughout the United States and in seven other countries (Teele, 1996).

The TIMI is a forced-choice pictorial inventory consisting of 28 A or B picture choices. The pictures show panda bears performing various activities representing characteristics of each of the seven intelligences. Student responses are calculated and scored to reveal totals in seven intelligences (the eighth intelligence, the naturalist, is not yet included in the inventory). The top four totals suggest dominant, or preferred, intelligences. It takes approximately 30 minutes to administer and score the inventory (Diaz-Lefebvre, 1999). According to Teele (1996), in an analysis of more than 6,000 answer sheets, it was determined that students at the elementary school level demonstrated a much stronger preference for linguistic and logical-mathematical intelligences than students at either the middle school or high school levels. Middle level and high school students were strongest in interpersonal, bodily-kinesthetic, spatial, and musical intelligences. It is ironic students enter early grades with a strong preference in linguistic and logical-mathematical intelligences and 12 years later these two intelligences have declined even though they still are used primarily as assessment in our educational system (Teele).

Other instruments used in measuring multiple intelligences

The Multiple Intelligences Challenge (MIC) and the Self Evaluation of Seven Useful Abilities (SEVAL) instruments were described by Osborne, Newton, & Fasko (1995). The two instruments were used in a study to assess the use of multiple intelligence assessment instruments as predictor measurements of achievement. Students from two introductory college psychology courses participated in the study. The MIC was developed by Walters in 1992 and consists of 79 questions that offer between 7 and 18 alternatives to nine different situations. Responders choose one or more alternatives within each situation best describing the responder's abilities in that situation. It is recognized that the responder's choices describe the responder's strengths and weaknesses and indirectly evaluate the aptitude for each of Gardner's seven intelligence categories. Summing all questions related to a given MIC category derives scores for each intelligence category. The SEVAL, developed by Osborne and Osborne presents a definition for each of the seven sets of core components. The responder's task is to rate themselves on a 10-point (1-low to 10-high) scale on each of the seven abilities. After completing the seven individual 10-point scales, responders order the seven abilities overall as they apply to themselves with seven being the highest and one being the lowest ranking for each ability. The results indicate that both the MIC and SEVAL are weak assessment instruments and do not support the hypothesis that they are predictors of academic success (Osborne et al.).

Sternberg's triarchic theory of intelligence has a test evaluating his theory that concentrates on memory-analytical, creative and practical abilities which are each measured in four different ways–verbally, figural multiple-choice items, quantitatively,

and via essays. The goal of the test is to obtain a better account of a child's ability than would be possible from conventional testing (Sternberg,1998).

Research on Learning Styles and Multiple Intelligences

Dunn (1999/2000) reported that males and females frequently learn differently from each other. Males tend to be more kinesthetic, tactual, and visual, and tend to need more movement in an informal environment. Males also are more nonconforming and peer motivated than females. Females tend to be auditory, conforming, authority-oriented, and need less movement than males.

Significant differences in learning-style preferences were revealed in correlational studies of the five major cultural groups within the United States, which included Native Americans, Hispanic Americans, African Americans, Asian Americans, and European Americans. Although in each cultural group there were multiple styles, patterns suggest there were greater-than-average preferences for selected learning-style elements within each cultural group (Dunn & Griggs, 1995).

Honigsfeld (2000) investigated learning style differences among a sample of adolescents from five different countries, and analyzed the similarities and differences by age, gender, and academic achievement level within and among the groups of students. It was concluded no two individual learning style profiles were identical and no two groups of students within the same age, gender, achievement, or country had the same set of learning style characteristics.

The results of a study (Martin, 1999) in which a multiple intelligence inventory was developed showed different findings based on gender in some of the intelligences. It

was speculated intelligences might be gender-specific to the social, physical, and academic development of both sexes.

Sternberg (1997) outlined a study in which the hypothesis was that students learn and perform better when they are taught in their own learning style strengths. One of the findings showed the four high ability groups of high school students that were used differed in their racial, ethnic, and socioeconomic composition. The high-analytic groups were composed mostly of white, middle-to-upper-middle-class students. The high creative and high-practical groups were much more diverse racially, ethnically, socioeconomically, and educationally. This suggests if the range of abilities were expanded when testing, the range of students that were identified as smart would be expanded.

Career and technical education can be provided at the secondary and postsecondary level, which provides learning experiences for students that explore careers and also helps the student prepare for employment. Career and technical education programs make use of real-life situations in the classroom along with supervised work experiences. Health occupations is the career and technical education program in which students explore different allied health programs. There are many job opportunities for the student in allied health, and they can range from professional specialties (physicians, therapists, dentists, etc.); service (nursing assistants, home health, dental assistants, etc.); administrative (medical secretaries, medical receptionists, etc.); technical and related support (laboratory technologists, surgical technologists, radiological technologists, etc.); executive, administrative, and managerial (top

executives); and precision, production, craft, repair (dental lab technician, opticians, etc.) (Scott & Sarkees-Wircenski, 2001).

Prior to 1974, Rezler and French (1975) reported there had not been any studies of students to examine learning preferences. Their study examined data which pertained to the learning preferences of students in seven allied health professions and if students with particular learning preferences and particular personality types were attracted to specific allied health professions. It was determined further studies were needed to substantiate the findings, and the validity and reliability of the instrument used in the study needed to be further substantiated.

Dunn and Griggs (1998) reported the examination of the literature in the health professions over the past 20 years indicated recognition of the importance of the learning-style construct. There were 78 studies conducted on learning styles in the allied health field between 1978 and 1997. The learning style instrument most frequently used was Kolb's Learning Style Inventory, followed by Dunn, Dunn, and Price's PEPS. The majority of the studies were correlational in method. The next most frequently-used design was predictive with researchers attempting to identify the learning-style characteristics of high achievers or those in various medical specialties. Even though researchers in the health professions show indications of their interest in the learning styles of students, there seems to be an attitude that, once the learning style of the student is diagnosed, there is one best instructional mode for that student. What appears to be lacking in much of the research is an accent on the concept of individual differences and that students in the health professions show a wide variety of learning-style preferences that need to be accommodated in the instructional process (Dunn & Griggs).

When students become aware of their individual learning styles, academic performance increases and anxiety is lowered when students are made aware of the stimuli they need for their learning experience. A study was conducted with nurse anesthesia students. The results indicated students who were aware of their learning styles demonstrated less anxiety over those who did not. This indicates that learning styles are an important component in making learning and instruction more conducive to the needs of each student (Garcia-Otero & Teddlie, 1992).

In a 1997 study conducted by Miller, achievement and attitudes of college students enrolled in an ultrasound program were significantly higher when instructional methods, which correlated to the student's learning style, were utilized instead of traditional methods of instruction. Two classes were given the Productivity Environmental Preference Survey (PEPS) to identify learning-style strengths. Afterwards traditional lessons were rotated with lessons using lessons and strategies conducive to the Dunn and Dunn learning style model.

In 1991, a study was conducted by LaMothe, Billings, Belcher, Cobb, Nice, & Richardson. This study was influential in the learning styles concept because it identified the learning style differences among 400 nursing students by age, class level, type, gender, and at-risk potential while establishing the reliability and validity of the Productivity Environmental Preference Survey (PEPS) instrument.

In research conducted by Dunn and Stevenson (1997), it was found that if college students are taught to study and do their homework based on their identified learning style preferences, higher grades are achieved. This proposes that the homework

prescriptions discussed in conjunction with the Dunn and Dunn learning style model may affect grades positively.

One major purpose of community college has been to provide a simple and trouble free entry to postsecondary education by nontraditional students. However, access alone does not validate the existence of these institutions. Instead, successful student learning determines their merit. A study was conducted by Mickler and Zippert (1987) to examine the effects of adjusting teaching methods to correspond with the learning preferences of students enrolled in a community college. After the Productivity Environmental Preference Survey (PEPS) was administered, students were assigned to experimental or control groups based on those results. Teaching strategies for the experimental group were adjusted, whereas the control group was taught by the traditional lecture method. The results demonstrated that the assessment of learning styles of adult students resulted in significantly higher gains in achievement scores when teaching methods were modified to correspond to their learning preferences.

As community college leaders enter the twenty-first century, a wide range of effort is being aimed at providing new and exciting ideas of learning. Some of these are exploring how different intelligences lead students to deal with and learn academic subjects differently (Diaz-Lefebvre, Siefer, & Pollack, 1998).

In college classrooms, there are too many students who are overlooked because they do not fit into a traditional lecture delivery system. These students lack the strongly emphasized linguistic and/or mathematical "intelligence". To overcome this disservice to students, Diaz-Lefebvre undertook a two year MI Pilot study at Glendale Community College. This study incorporated MI learning options into introductory psychology

classes, followed by a current 10 subject interdisciplinary MI Expansion Project (Diaz-Lefebvre & Finnegan, 1997). In the pilot study, students were assessed in their preferred intelligences and then were given a variety of learning options to select. Each of the learning portions were academically grounded in the textbook and classroom materials covered in the course. The students were allowed to select from a variety of options that helped them comprehend the material. Having access to traditional instruction, such as tests, book reports, etc., or nontraditional methods, such as collages, dance, and musical application, students were assessed (Diaz-Lefebvre, 1998). Diaz-Lefebvre (1999) enthusiastically recommends using this educational model. He says his role as a teacher changed from being an information and fact giver to more of a motivator, facilitator, evaluator, and friend to students.

Finnegan's (2000) study investigated the effects of learning options based on the theory of multiple intelligences in the college classroom. The subjects included 72 students and three professors from a community college. Each professor instructed two similar classes within their subject area. In one class, they implemented traditional methods and in the other, they used traditional methods with learning options. Even though there were no significant differences reported between the two instructional groups in relationship to student academic achievement, students in the group with learning options reported higher motivation to learn academic content. The professors reported greater levels of enthusiasm using learning options compared to traditional teaching methods.

Therapeutic recreation therapy is one of the many allied health fields. A study was done using therapeutic recreation undergraduate students incorporating both

qualitative and quantitative methods (Hironaka-Juteau, 1999). The purpose of the study was to understand the impact on students using lessons designed in a multiple intelligence theory approach. Student responses suggested that learning from a MI perspective showed a greater student awareness toward themselves and others, helped in students' attentiveness and focus, and resulted in a greater enjoyment of hands-on activities (Hironaka-Juteau).

Research of learning styles and multiple intelligences of the college students has materialized in the last few decades. The data to date show that if an individual's learning style and multiple intelligences are known and accommodated with instructional strategies based on their learning styles and multiple intelligences the results is increased achievement and student satisfaction.

Review of Literature Summary

It is important for instructors to know how to maximize learning for students, especially due to recent discoveries of the human brain (Dunn, Thies, Honigsfield, 2001). Neuroscientists now know that 30-60 % of brain functioning capabilities are attributed to heredity and 40-70 % is environmental dependent. Teachers can provide positive learning conditions through climate setting and by supplying appropriate experiences (Martin, 1999).

There is much confusion encountered in the education world concerning the distinct differences in learning styles and the theory of multiple intelligences. Additionally, there are misunderstandings between the different learning style models. The theory of multiple intelligences and learning styles are very different. Multiple intelligence concentrates on the content of learning and its relation to the disciplines.

However, it does not deal with the individualized process of learning as learning style does (Silver, Strong, & Perini, 1997). Silver, Strong, & Perini emphasize that learning styles and multiple intelligences complement one another:

> Without multiple intelligence theory, style is rather abstract, and it generally undervalues context. Without learning styles, multiple intelligence theory proves unable to describe different processes of thought and feeling. Each theory responds to the weaknesses of the other; together, they form an integrated picture of intelligence and difference. (p. 25)

This study purports to delineate the different learning styles and multiple intelligences possessed by postsecondary allied health students. In so doing, it was anticipated that once students apply strategies appropriate to their learning styles and multiple intelligence, student achievement would increase, and the students would continue to reap the benefits to aid them in different life skills throughout their life. Reese (2002) asked:

> Is there one "right" way to learn? Most educators and researchers who have studied different learning styles say that there is no "right" or "wrong" way to learn, and there are no "good" learning styles or "bad" learning styles. A good learning style is what works for an individual student. So, whether, the student reads it, draws it, builds it, claps it or even sings it, the point is to *learn* it. A student who has found the style of learning that best suits his own intelligence has found the "right" way to learn. (p. 23)

Past studies (LaMothe et al., 1991; Miller, 1997; Dunn &Griggs, 1998;

Orr, Park, Thompson, & Thompson, 1999; Shaver, 2000) identified unique learning styles of health science students in disciplines such as nursing, sonography, radiography, etc. These studies have provided educators with a profile of learners' needs. Some of these studies addressed identification of predominant styles for students, while others examined demographics such as age, gender, cultural differences, or combinations of the above. In most cases, the literature showed significant improvements for those who developed learning styles adaptations.

To date, there are no studies found which address the multiple intelligences and learning styles of allied health students in the six different fields in which this research is based, thus presenting an opportunity for research that addresses new and vital information for those involved in the health sciences. If these characteristics can be identified in students, this knowledge could be used to further develop appropriate instructional resources and teaching strategies, and ease the learning process for students in their education environment.

CHAPTER 3

METHOD

Introduction

The preceding chapter presented a review of related literature, which supports the need for research. This chapter is concerned with the research methodology used in the study. The study examined the allied health students' learning styles and multiple intelligences employing two self-report inventories. A questionnaire was also administered to obtain demographic data and as a basis to examine differences.

Fraenkel and Wallen (1990) stated that causal-comparative research determines the cause or consequences of differences that already exist and are sometimes viewed as a form of associational research. For example, in this study, if different learning styles exist in various allied health fields, one might try to determine the reason for, or the results of, this difference. However, the difference between the groups has already occurred, and therefore, is studied in retrospect. Fraenkel and Wallen referred to this as ex post facto research, in contrast to an experimental study, in which the researcher creates a different treatment between or among groups and then compares their performance to determine the effects of the treatment. In this study an ex post-facto research design was used in which the learning styles and multiple intelligences of allied health students in six different programs were identified. The study also investigated whether significant differences in learning styles and multiple intelligences occurred with differences in age. The study used a descriptive design.

Purpose of the study

The purpose of this study was to determine the learning styles (measured with the PEPS Learning Styles Instrument, 1996) and to identify the multiple intelligences (Gardner, 1983, 1999a, 1999b) of students in postsecondary allied health fields. Using the population of allied health students from six different degree or diploma programs at a technical college in Northwest Georgia, a multiple intelligence test, learning styles inventory, and general demographic survey were administered. Results of this study may provide a better understanding of students' learning styles characteristics and multiple intelligences and may assist faculty in maximizing the educational environment for the student, which ultimately would help the students' in achieving their educational goals. Described in this chapter are the major components of the research design including the population, design, instruments, measures, and procedures for data collection and analysis.

Research Questions

1. What are the learning styles as defined by the Productivity Environmental Preference Survey (PEPS) of postsecondary allied health students?
2. What are the multiple intelligences as determined by the Multiple Intelligence Developmental Assessment Scale (MIDAS) of postsecondary allied health students?
3. Are there statistically significant differences in learning styles among students based on age?
4. Are there statistically significant differences in multiple intelligences among students based on age?

Research Design

The purpose of this descriptive study was to identify learning styles and multiple intelligences of allied health students. The population included students enrolled in diploma and degree programs in allied health programs at a technical college at least in their second quarter of study. The college has a large allied health constituency, which includes courses of study leading to a technical certificate, diploma, or an associate degree. The research study employed two different instruments, both of which are self-report instruments, one on multiple intelligences (Multiple Intelligence Development Assessment Scales), and one on learning styles (Productivity Environmental Preference Survey). A short questionnaire designed to collect student demographics was administered as well.

Population and Sample

The technical college used in this study is a public, coeducational, two-year postsecondary institution located in northwest Georgia established in 1962 through the joint efforts of the Chamber of Commerce, local business and industry, city and county Boards of Education, and city and county Boards of Commissioners. The technical college is part of a statewide network of 33 postsecondary technical colleges operating under the auspices of the Georgia Board of Technical and Adult Education. From an initial enrollment of 231 full-and part-time students, the technical college has grown and today the school serves more than 8,000 students annually through day, evening, and off-campus credit, noncredit, and adult education programs. The technical college prides itself on: (a) contributing to the economic and workforce development of northwest Georgia by providing quality adult literacy education, (b) continuing education,

customized business and industry training and, (c) technical education at the certificate, degree, and diploma levels (Coosa Valley Technical College, 2001).

The enrollment categories and credentials awarded for degree, diploma, and certificate programs include starting with the credentials of greatest educational magnitude: (a) degree credit–includes programs and courses which typically range from 90 to 125 quarter credit hours leading to an associate of applied technology degree; (b) diploma credit–includes programs and courses which usually range from 60 to 125 quarter credit hours leading to a diploma upon completion, and; (c) certificate credit–includes programs and courses of study ranging from 15 to 59 quarter hour credits which leads to a technical certificate. There were 3200 students enrolled in degree, diploma and certificate program at the time of the study (T. Resch, personal communication, January 21, 2002).

The sample consisted of students of six allied health programs. These programs were chosen because they include a variety of different disciplines. Also, these programs are more demanding of students and have a greater intensity of actual course work than the certified programs because they range from four quarters to eight quarters. Certified programs are shorter in length. Some of the programs also require previous graduation from a medical program. In addition, the sample size would be larger using a diploma and degreed program in conjunction, instead of singly, which might give researchers more confidence in the results obtained. However, there are not enough students in either the degreed programs or diploma programs to separate them into research categories.

The majority of allied health fields require a degree, diploma, or a certificate in order to allow a health care worker to be legally employed. Certification exams are

routinely taken in all fields, which in some cases lead to state licensure (U.S. Department of Labor, 2002/2003).

The technical college serves adults in a three county area. Applicants must be 17 years of age or older to be admitted to any of the health occupations programs. In order to be admitted to associate degree programs, students must have a high school diploma or a GED. Non-high-school graduates are admitted to all of the diploma/certificate programs as either regular or provisional students (Coosa Valley Technical College, 2001).

The programs used in the study were degree or diploma programs. The six programs selected for this study included: (a) medical assisting, (b) radiology/radiographic technology, (c) respiratory technology, (d) diagnostic medical sonography, (e) vascular technology, and (f) licensed practical nursing. In order to receive either a degree or a diploma from the technical college, the student needs at least 60-quarter credit hours. The associate of applied technology programs includes: (a) radiologic technology, (b) respiratory therapy, and (c) vascular technology. The diploma programs include: (a) diagnostic medical sonography, (b) medical assisting, (c) practical nursing, (d) radiologic technology, and (e) vascular technology. Students can obtain either a degree or diploma from radiologic technology, respiratory therapy, or vascular technology. Some students did not participate because of logistical problems, such as class conflicts, clinical rotation, and lack of interest. First quarter students were not utilized at all because they were in core classes.

The Occupational Outlook Handbook (U.S. Department of Labor, 2002-2003) describes these careers:

1. Medical assistants perform both clinical and administrative duties for offices and clinics of physicians, podiatrists, chiropractors, and optometrists. Their clinical duties can include preparing patients for examinations, taking vital signs, assisting with first aid, collecting and processing specimens, and performing tests ordered by the physician. Their administrative duties can include scheduling appointments, preparing and maintaining patient records, typing records, processing insurance forms, and arranging hospital admissions. The medical assistant serves as the liaison between the physician and any outside clientele.
2. Respiratory therapists assist in evaluating, treating, and caring for clients with breathing problems. Respiratory therapy technicians provide specific, well-defined respiratory care procedures under the direction of respiratory therapists and physicians. Some of the duties of respiratory therapists include measuring lung function, analyzing blood samples for gases, monitoring life support equipment, and using equipment that delivers oxygen or enhances breathing.
3. Licensed practical nurses (LPNs) care for the sick, injured, convalescent, and disabled under the direction of physicians and registered nurses. They provide basic bedside care and also may give injections and medications. LPNs take vital signs and observe patients and report adverse reactions to medications or treatment. They often are employed in hospitals, doctor's offices, and home health agencies. They change dressings, evaluate patient needs, implement care plans, and supervise nursing assistants. In a medical office setting, they may

make appointments and keep patient records. In a home setting, under the supervision of physicians and/or registered nurses, LPNs instruct family members on nursing care and may also prepare meals.

4. Vascular technologists are also known as cardiovascular technologists. They assist physicians in diagnosing and treating cardiac and peripheral vascular ailments and may specialize in invasive cardiology, echocardiography, and vascular technology. Cardiovascular technologists specializing in invasive procedures assist physicians with cardiac catheterization procedures in which a catheter is wound through a patient's blood vessel from a spot on the patient's leg into the heart. Cardiovascular technologists who specialize in vascular technology often run noninvasive using ultrasound instrumentation. Some vascular technologists assist physicians in diagnosis of disorders affecting circulation. Using ultrasound instrumentation, they record vascular information, such as vascular blood flow, cerebral circulation, peripheral circulation, and abdominal circulation.
5. Diagnostic medical sonography, commonly referred to as ultrasonographers, helps to diagnose such problems as abdominal tumors and cysts, abnormal fetal development, and poorly functioning heart valves. Sonographers prepare patients, explain procedures, position patients, and obtain medical images used for diagnosis. Sonographers submit patient records, sonographic data, and their observations for review and interpretation by a physician. Sonographers also are responsible for some preliminary image interpretation. In addition to working

directly with patients, diagnostic medical sonographers keep patient records and adjust and maintain equipment.

6. Radiologic technologists take x-rays and administer nonradioactive materials into patients' blood streams for diagnostic purposes. They produce radiographs of parts of the human body for use in diagnosing medical problems, which are interpreted by a radiologist. Using their knowledge of radiation, equipment, and anatomy, they produce images with the correct detail and contrast. They process and evaluate film, and educate patients on procedures. Radiologic technologists understand both the benefits and hazards of radiation and are experts in safeguarding their patients and personnel from excessive radiation exposure. The students enrolled in these programs must take a minimum of five quarters for medical assisting, a minimum of eight quarters for radiological technology, a minimum of five quarters for practical nursing, a minimum of five quarters in vascular technology in the diploma track and seven quarters in the degree track, a minimum of six quarters for diagnostic medical sonography, and a minimum of eight quarters for respiratory therapy to complete their program. Several of the programs require previous graduation from a medical program (Coosa Valley Technical College, 2001).

Students in all of the six programs were asked to complete the PEPS learning styles instrument and the MIDAS test for Multiple Intelligences. Demographic data was also collected from the participants.

Table 1 shows the breakdown of students by program and gender for the students at the technical college who participated in the study.

Table 1

Number of Participants by Major and Gender

Major	Female	Males	Total
Medical Assisting	24	0	24
Respiratory Therapists	5	1	6
Practical Nursing	39	3	42
Vascular Technology	9	0	9
Diagnostic Medical Sonography	12	1	13
Radiologic Technologists	12	2	14
Total	101	7	108

The number of females participating was 101, which was 94% of the total population. Males were not represented in two of the programs.

The Vascular Technology program is the newest allied health program offered at the technical college, which might account for the smaller numbers participating. The Practical Nursing program, the largest of all the programs was comprised of 42 students. The total of students participating in this study was 108.

As of spring quarter, 2002, there were approximately 249 students enrolled in the six programs (T. Resch, personal communication, January 21, 2002), which included students in core classes. The study used students who were participating in clinical rotations. The age of the students vary significantly within the different programs.

Occasionally, based on previous knowledge of a population and the specific purpose of the research, investigators use their personal judgment to judge whether a particular sample will be representative–this is called purposive sampling (Fraenkel & Wallen, 1990). The relatively small numbers of students in the different allied health programs in the study dictated that a random sample could not be used. Therefore, it was assumed the study would be a purposive sampling, giving the researcher the opportunity to use previous knowledge of a population and personal judgment to determine whether or not a particular sample will be representative. The researcher used personal judgment in deciding that the sample would consist of only degreed and diploma program.

Moore (2000) explained that when variables are confounded, it means their effects on a dependent variable cannot be distinguished from each other. It is for this reason that the proposed study did not use a stratified sample. In order to increase sample size, one might use other technical colleges with either the same allied health programs or additional allied health programs. There are no other schools in the state that have the six programs that the technical college has to offer. Therefore, the distribution of students in the programs would be different. In addition, regional differences might confound the study (Keppel, 1991). Short of administering tests of multiple intelligence and learning styles to students in all allied health programs throughout the state, the researcher decided this process would serve the study objectives. There was also the constraint on time and expense to consider.

Instrumentation

Two self-report instruments were used. The Productivity Environmental Preference Survey (PEPS) by Dunn, Dunn, and Price was used to identify the learning

styles of the students and the Multiple Intelligence Developmental Assessment Scales (MIDAS), developed by Shearer (1994) was used to identify the multiple intelligences of the students. The two instruments will be discussed separately in the next two sections. The study also employed a questionnaire for student demographic data (Appendix A).

Productivity Environmental Preference Survey (PEPS)

The Dunn and Dunn learning style model focuses on identifying an individual's preferences for instructional environments, methods, and resources and is based on the following assumptions: (a) individuals are capable of learning; (b) most people have learning style preferences, but an individual's learning style preferences differ; (c) the stronger the preference, the more important it is to provide instructional strategies geared toward the preference; (d) accommodating individual learning style preferences through corresponding instructional interventions shows increased academic achievement and improved student attitudes toward learning; (e) students attain higher achievement and attitude test scores when approaches are matched to students' learning styles; (f) most students can learn to benefit from their learning style strengths when concentrating on new or difficult material; and (g) most teachers can learn to instruct using different learning styles and the less successful the student is in their academic studies, the more important it is to provide learning style preferences (Dunn, Griggs, Olson, Beasley, & Gorman, 1995).

The PEPS (Dunn, Dunn, & Price, 1996) identifies an adult's personal preference for each of 20 different elements and was developed through a content and factor analysis. It was chosen because it is specific to adults, assesses twenty variables of learning preference, has been found to be valid and reliable, and is one of the first

comprehensive approaches to identifying an adult's individual productivity and learning style. It determines how adults prefer to function, concentrate, learn, and perform in their occupational or educational activities in four different areas. The areas are immediate environment (sound, temperature, light, and design), emotionality (motivation, responsibility, persistence and the need for structure or flexibility), sociological needs (self-oriented, peer-oriented, authority-oriented, or learn in several ways such as alone, with peers, or authority figures), and physical needs (perceptual preferences, time of day, intake and mobility). Questions in each of these areas are presented. Each administration takes 15-20 minutes and is scored by computer scanning. Participants may be given the inventory in writing, by computer, on tape, or orally. A five-point Likert type scale is used and the questions range from "strongly agree" to "strongly disagree" to "I don't know". Participants are encouraged to give their first reaction to each question as if they were learning new or difficult material. The raw score is the sum of an individual's responses to each of the items within an area. Individuals having a standard score of 40 or less or 60 or more find that particular variable important when they study or work. If scores fall between 40 and 60, the individual determines how much that variable is important to them. Other learning style preferences are usually more important (Dunn, Dunn, & Price, 1996). The terms to describe the preferences are defined by Dunn, Dunn, and Price (1996):

1. Noise level Preference: People with PEPS scores below 40 in this category prefer quiet learning environments; people who score above 60 prefer learning environments with some background noise.

2. Light Preference: People with scores below 40 prefer dimly lit learning environments; people who score above 60 prefer brightly lit environments for learning activities.
3. Temperature Preference: People with scores below 40 prefer cool learning environments; people who score above 60 prefer warmer environment.
4. Design Preference: People with scores below 40 prefer informal instructional settings that have soft seating in a casual arrangement; people who score above 60 prefer more traditional settings with more structure to seating and desk arrangement.
5. Motivation: People with scores below 40 tend to be less motivated by academics; people who score above 60 prefer academics and tend to prefer self-pacing and self-designed activities.
6. Persistence Preference: People with scores below 40 have tendency for low persistence for a learning activity; people who score above 60 demonstrate a need to persist until the assignment or activity is complete.
7. Responsible/Conforming Preference: People with scores below 40 prefer to conform to assignments when the topic of personal interest; people who score above 60 tend to conform in any educational venture regardless of its relevance to their own interest.
8. Structure Preference: People with scores below 40 prefer less structured learning processes versus persons who score above 60 who prefer extreme structure in learning activities with clearly stated objectives.

9. Alone/Peer Preference: People with scores below 40 prefer to learn alone; people who score above 60 prefer to learn while interacting with a group of peers.
10. Authority Preference: People with scores below 40 prefer no authority person when learning; people who score above 60 prefer an authority presence in order to remain on the learning task.
11. Several Ways: People with scores below 40 prefer consistent learning sequence; people who score above 60 prefer variety in learning activities and want change in presentation style and classroom activity.
12. Auditory Preference: People scoring above 60 recall 75% of what they hear.
13. Visual Preference: People who score above 60 recall 75% of what they see.
14. Tactile Preference: People scoring above 60 recall 75% of what they touch.
15. Kinesthetic Preference: People scoring above 60 recall 75% of what they do.
16. Intake Preference: People scoring above 60 prefer food or drink when learning. These people prefer to snack in order to maintain their focus on a subject.
17. Time of Day Preference: People scoring below 40 prefer evening hours versus people who score above 60 who prefer morning hours for learning.
18. Mobility Preference: People with scores below 40 prefer remaining still during learning sessions and are comfortable for normal periods of class time versus people who score above 60, who prefer physical movement and need to stand.

In a 1991 study conducted with nursing students, the validity of the PEPS was established. Using similar procedures to Price, Dunn, and Dunn, validity was established for all 20 factors of PEPS except for the subscale, afternoon. Most of the scales also met the standards for minimal reliability (.70) for new instruments (LaMothe, et.al., 1991;

Price, 1996). In 1987, Curry reviewed 21 different learning/cognitive style models through psychometric analyses and reported the Dunn and Dunn model had one of the highest reliability and validity ratings (DeBello, 1990).

According to *The Thirteenth Mental Measurements Yearbook* (Impara & Plake, 1998), the review of listed studies did not provide support to the validity of the PEPS. Validity seemed to be overlooked in reports from the PEPS instrument. However, in direct opposition to this is a multitude of reports confirming the reliability and validity of the Learning Style Inventory/Productivity Environmental Preference Survey (DeBello, 1990; Dunn, 1990; Tendy & Geiser, 1998/1999). According to Given (1996), this is a problem of many learning style instruments. Should practitioners discard the idea of learning styles? According to studies by Lemire, the authors' own validity and reliability research indicated there is stability in the concept of learning styles, so the answer is "not yet" (Lemire, 1995; cited in Given, 1996).

THE MIDAS (Multiple Intelligence Development Assessment Scales)

1. Shearer developed the MIDAS in 1987 (MIDAS consultation and research, 2000). The MIDAS is not an objective test of intelligence, because findings are compiled from the perceptions of a knowledgeable observer or person completing the test. The MIDAS provides information regarding intellectual development, activities and dispositions not generally available from standard intelligence and most aptitude tests. The MIDAS questionnaire by Shearer is based on the theory of multiple intelligences as described by Howard Gardner (1983) and has questions concerning the first eight intelligences.

MIDAS profiles are available for students (K-12, college undergraduate, and graduate students), teachers, organizations, and employees for management personnel. The results are helpful for planning curriculum, instruction, career decisions, job training, team building, and personal development (MIDAS consultation and research, 2000). The MIDAS is a 119-item self-report describing, in qualitative and quantitative terms, a person's intellectual disposition. In addition, there are multiple sub-scales. Only the 8 main scales (musical, kinesthetic, logical-mathematical, spatial, linguistic, interpersonal, intrapersonal, and naturalistic) were considered. A five-point Likert scale is used with each item allowing a range, i.e. all the time (4) to never (0). Respondents may also chose a 6^{th} option of "I don't know" (Shearer, 1997; B. Shearer personal communication, May 31, 2001). A MIDAS Profile provides information regarding a person's intellectual disposition in each of the eight areas identified by Gardner: linguistic, logical-mathematical, spatial, musical, kinesthetic, interpersonal, and intrapersonal, and includes questions of the naturalistic type. The questions inquire about activities in everyday life requiring cognitive ability, involvement, and judgment. The statistical report uses numbers to specify levels of developed skill in each multiple intelligence. The scores range from 1-100. The book provided with the instrument state that the numbers indicate the level of development of the particular intelligence. Scores from 1-40 show low development, from 40-60 show moderate development, and from 60-100 show high development of intelligence (Shearer, 1996).

Reliability studies: Shearer (1997) explained that four studies have examined the internal consistency of the items within each scale of the MIDAS. The overall Alpha coefficients for the eight scales range from .78 for kinesthetic to .89 for the aggregated

data. Kinesthetic is the only scale where the reliability is slightly below the desired level of .80. Three studies were conducted to determine if respondents change their ratings during a second completion of the questionnaire. The results indicated adequate stability in raters' responses during a second completion. Two studies of agreement between raters were conducted in order to estimate the reliability of an informant's response and to obtain indications of construct validity. The pair-wise agreement rate for individual items was found to be in the 75% to 85% range. Raters were able to agree within 10 scale points about 65% of the time. One hundred and nineteen college students completed the MIDAS to test for cultural bias. Of this group, 49% were African-American and 42% were Caucasian. The data indicates the MIDAS can be reliable for both groups. Intrascale reliabilities were calculated and alpha's ranged from a low of .83 for kinesthetic and linguistic to a high of .91 for intrapersonal. These results indicate strong internal consistency for the eight scales (Shearer).

Validity Studies: The validity of the MIDAS scales was examined during six studies. The results of these investigations are summarized in terms of content validity, construct validity, concurrent validity, predictive validity and contrasted criterion groups. Construct validity is obtained through the accumulation of evidence from diverse sources. An initial research question was to determine if the MIDAS could distinguish eight distinct constructs as described by the theory of multiple intelligences. The initial exploratory factor analysis involved 349 participants and indicated the questionnaire could distinguish the seven hypothetical constructs. Concurrent validity was established in terms of how well the MIDAS scales correlated with objective tests of similar constructs. Fifty-six participants were recruited who completed the MI questionnaire

along with the interest inventory at home prior to testing. The resulting correlational values and their pattern between MI main scales and cognitive achievement and aptitude tests met or exceeded research expectations except for the interpersonal scale and the Social Translations test. In predictive validity, 224 students in 13 classes attending two large universities voluntarily completed the MIDAS. Intact classes were chosen where it was thought that instructors would have knowledge of each student and his/her skill level in the specified intelligence. The results indicated the professors' ratings and the students' self-report MIDAS scores agreed 86% of the time within one category. The overall results indicated that college students' self-ratings on the MIDAS were in close agreement with measurements provided by expert raters. Further research is necessary to determine if the MIDAS is too inflexible in its scores. The MIDAS scores for the various student groups in the above-described study were then contrasted and compared to decide if the pattern of scores for well-defined ability groups met practical expectations. The overall magnitude of the mean MIDAS scores were consistent with what would be expected of college students thought to be either high or low in various skills. The results of these six studies indicated the MIDAS has adequate reliability and sufficient constructs and criterion validity to conclude that when validity indicators were considered, the MIDAS provided a realistic approximation of the respondent's intellectual nature in the eight designated areas (Shearer, 1996).

Data Collection

All allied health students that were in a degree or diploma allied health program were asked to participate in the research project. The study included only those students who agreed to participate. Students were permitted to refuse to participate in the study. This investigation was conducted in June of 2002. For the data collection, permission

was secured from the president of the technical college for the investigator to administer two instruments, one on student learning styles, and one on multiple intelligences and to collect student data in the six degree and diploma programs in the allied health constituency at the technical college (Appendix B, Appendix C). The researcher gained approval from The Institutional Review Board at the University of Georgia. Instructions were given to the participants and their answer sheets were returned to the researcher along with their Informed Consent Form (Appendix D). The investigator previously had been involved in a Dunn and Dunn Learning Style Institute, which gave the investigator knowledge of administering and interpreting the instrument. In order for the investigator to administer and interpret the MIDAS instrument, a certification process had to be met.

The students were invited to a lunch seminar provided by the researcher and during lunch students completed the tests and the survey. On the survey, students were asked questions pertaining to their gender, age, and ethnicity. At the time of instrument administration, written permission was requested from each student to allow the review of his or her test scores by the researcher and the instructor. The total test and survey time was approximately 60 minutes. The tests were collected and sent to MI Research and Consulting, Incorporated for the MIDAS instrument and to Price Systems, Incorporated for the PEPS instrument for bulk scoring. The researcher provided the instructors with the test results and interpretation of the scores for their students when the results were scored. The researcher also met with three of the programs to explain the results. It is important to provide an interpretation of the results to each of the students because this step is significant in assisting the student's understanding of his or her personal strengths.

Data Analysis

Raw scores for the 20 learning-style variables on all the valid PEPS and raw scores for eight different intelligences measured with the MIDAS, along with

demographic data for each of those students, were entered into a database. The Statistical Package for the Social Sciences (SPSS) for Windows (version 10) was used for statistical analyses. The following statistical procedures were used to answer the four questions and identify which learning style elements and multiple intelligences significantly discriminated between or among the groups by age:

1. For Questions 1 and 2, descriptive statistics were employed for the PEPS instrument and the MIDAS and included the mean, medium, mode, standard deviation, and range of scores of the students in the six allied health programs at the technical college.
2. For Questions 3 and 4, a one-way analysis of variance (ANOVA) was calculated using the subscales of the PEPS instrument and the subscales of the MIDAS instrument as the dependent variable. The independent variable was the six groups of ages of the students. If statistical significant differences were found, follow-up post hoc comparisons were done using the Bonferroni test.

Summary

The purpose of this descriptive study was to identify learning styles and multiple intelligences of allied health students. The population included students enrolled in diploma and degree programs in allied health programs at the technical college at least in their second quarter of study. The six programs selected for this study included: (a) medical assisting, (b) radiology/radiographic technology, (c) respiratory technology, (d) diagnostic medical sonography, (e) vascular technology, and (f) licensed practical nursing. The total of students participating in this study was 108. Two self-report instruments were used. The Productivity Environmental Preference Survey (PEPS) by

Dunn, Dunn, and Price (1996) was used to identify the learning styles of the students and the Multiple Intelligence Developmental Assessment Scales (MIDAS), developed by Shearer was used to identify the multiple intelligences of the students. Descriptive statistics were employed for the MIDAS and PEPS instruments for the first two questions. A one-way analysis of variance (ANOVA) was calculated using the subscales of the MIDAS instrument and the subscales of the PEPS instrument for the last two questions. The dependent variables were the subscales of the instruments. The independent variable was the ages of the students.

CHAPTER 4

DATA ANALYSIS

Introduction

The purpose of this descriptive study was to identify the learning styles and multiple intelligences of allied health students. In addition, the study investigated differences between the multiple intelligences and learning styles profiles and different age groups of students in six different allied health programs.

The data for the study were collected using the Productivity Environmental Preference Survey (PEPS), (Dunn, Dunn, & Price, 1996) and the Multiple Intelligences Development Assessment Scale (MIDAS), (Shearer, 1994). The data were analyzed using SPSS software, version 10. Descriptive statistics were used to summarize the data. A one way Analysis of Variance (ANOVA) was used to test for differences between age groups and the student's multiple intelligences and the student's learning styles.

Demographics

There were 129 students from 6 different medical programs eligible for participation in the study. One hundred eight students volunteered to participate in the study, which accounted for 84% of the total possible population. The final group included 24 Medical Assisting students (96%), 42 Practical Nursing students (91%), 14 Radiology Technology students (50%), 6 students from Respiratory Therapy (60%), 13 Sonography students (100 %), and 9 students from Vascular Technology (90%). Seven males (6%) and 101 females (94%) participated in the study.

The other demographic characteristics of interest in this study included age and ethnicity. Student's ages ranged from 18 years to 54 years with 28 years as the mean (Table 2). The largest percentage of students in the study were in the age group, 21-25, N=39 (36%), and the smallest percent was the 36-40 age group (4%).

Table 2

Number of Participants by Medical Groups and by Age

	Age Groups						
Medical Groups	16-20	21-25	26-30	31-35	36-40	Over 40	Total
Medical Assisting	7	5	4	1	3	4	24
Practical Nursing	8	13	10	7	0	4	42
Radiology Technology	4	6	0	2	1	1	14
Respiratory Therapy	0	3	1	0	0	2	6
Sonography	0	6	3	1	0	3	13
Vascular Technology	2	6	0	1	0	0	
	21	39	18	12	4	14	108

The ethnicity of the participants at the technical college are summarized in Table 3. The African American students totaled 14% of the participants with almost one-half of the sample in the Practical Nursing program. Eighty-five percent of the population were Caucasian students with almost 31% of the total population in the Practical Nursing program. The Hispanic group made up less than 1% of the population.

Table 3

Number of Participants by Medical Groups and Ethnicity

	Ethnic Groups			
Medical Groups	African American	Caucasian	Hispanic	Total
Medical Assisting	4	20	0	24
Practical Nursing	8	33	1	42
Radiology Technology	0	14	0	14
Respiratory Therapy	0	6	0	6
Sonography	2	11	0	13
Vascular Technology	1	8	0	9
Total	15	92	1	108

Research Questions

The following sections address each of the research questions used to direct this study. Each section presents data and analyses associated with the question.

Research Question 1

The first research question was "What are the learning styles as defined by the Productivity Environmental Preference Survey (PEPS) of postsecondary allied health students?"

In order to answer this question, SPSS statistical software, version 10 was used to calculate the mean scores for each student. To determine a group profile, a mean of the

group results for each learning style was calculated. Descriptive statistics including mean and standard deviation are provided in the following tables. Reported standard scores range from 20 to 80 with a mean of 50 and a standard deviation of 10. Scores above 60 indicated a high preference in a particular variable. Scores less than 40 indicated a low preference toward that variable (Price, 1996). Values between 40 and 60 are considered on a continuum and may be compared relative to other variables (Price).

1. Medical Assisting. Table 4 presents the descriptive statistics for the medical assisting group by learning styles. Strongest characteristics of the Medical Assisting group are expressed numerically. Medical Assisting students showed a strong preference for highly structured learning activities (*M*=60.96, *SD*=8.78, *n*=24) that are activities which have a patterned sequence of events in which expectations have been clearly communicated. Afternoon was the preferred time of day for learning (*M*=59.79, *SD*=13.23, *n*=24). These students indicated preference for physical mobility during learning sessions and for engagement in physical mobility while learning (*M*=59.00, *SD*=7.32, *n*=24). The availability of intake of food or beverages was also an important preference for this group of students (*M*= 58.04, *SD*=8.68, *n*=24). The dominant perceptual strength for this group was kinesthetic (*M*=55.42, *SD*=11.24, *n*=24). Medical Assisting students indicated that they learn best with an authority figure present (*M*=56.71, *SD*=7.82, *n*=24).

Table 4

Mean and Standard Deviation on the PEPS of Medical Assisting Students

Areas	Source	*M*	*SD*	*n*
Environment	Noise Level	52.17	6.93	24
	Light	46.58	11.84	24
	Temperature	48.29	9.23	24
	Design	47.50	11.16	24
Emotionality	Motivation	50.04	6.40	24
	Persistent	53.75	6.75	24
	Responsible	46.92	8.48	24
	Structure	60.96	8.78	24
Sociological	Alone/Peers	53.38	11.16	24
	Authority figure	56.71	7.82	24
	Several ways	45.29	8.99	24
Physical	Auditory	55.00	11.24	24
	Visual	46.58	8.32	24
	Tactile	51.33	9.10	24
	Kinesthetic	55.42	3.82	24
	Intake	58.04	8.68	24
	Evening/Morning	46.17	9.79	24
	Late Morning	44.58	9.77	24
	Afternoon	59.79	13.23	24
	Needs Mobility	59.00	7.32	24

2. Practical Nursing. The descriptive statistics related to students in the Practical Nursing program are presented in Table 5. The dominant preferences of the Practical Nursing group are displayed numerically. This group of students also showed a strong preference for highly structured learning activities (*M*= 58.86, *SD*=7.79, *n*=42), which have a patterned sequence of events in which expectations have been clearly communicated. Afternoon was also the preferred time of day for learning (*M*=59.45, *SD*=9.50, *n*=42). These students also indicated a preference for physical mobility during learning sessions (*M*=56.33, *SD*= 6.10, *n*=42). Practical Nursing students indicated that they learn better with another student or a few students that complement his/her sociological characteristics. The dominant perceptual strength for this group of students was auditory, (*M*=56.69, *SD*=8.48, *n*=42), meaning that in general, these students remember 75% of what is heard. Lecture, music, and taped presentations will all provide useful reinforcement of new material. Auditory learning is followed by kinesthetic preferences (*M*= 52.05, *SD*=6.57, *n*=42).

Table 5

Mean and Standard Deviation on the PEPS of Practical Nursing Students

Areas	Source	*M*	*SD*	*n*
Environment	Noise Level	54.02	6.13	42
	Light	52.48	7.05	42
	Temperature	46.57	8.83	42
	Design	46.36	7.98	42
Emotionality	Motivation	50.60	5.39	42
	Persistent	53.71	5.86	42
	Responsible	49.00	7.95	42
	Structure	58.86	7.79	42
Sociological	Alone/Peers	55.45	8.96	42
	Authority figure	54.88	7.54	42
	Several ways	45.31	9.98	42
Physical	Auditory	56.69	8.48	42
	Visual	48.38	8.27	42
	Tactile	49.71	6.49	42
	Kinesthetic	2.05	6.57	42
	Intake	53.52	8.35	42
	Evening/Morning	45.24	8.01	42
	Late Morning	48.21	6.70	42
	Afternoon	59.45	9.50	42
	Needs Mobility	56.33	6.10	42

3. Radiology - Descriptive statistics for the Radiology students and learning styles is presented in Table 6. The dominant characteristics of the Radiology group are displayed numerically. Radiology students in this study displayed a strong preference for highly structured learning activities (*M*=64.83, *SD*=9.13, *n*=14), that is, planned and sequential routines of study in which expectations and events have been clearly communicated. These students were highly social and preferred activities that involve or include the supervision or participation of an authority figure, teacher, or supervisor (*M*=59, *SD*=10.00, *n*=6), as well as the involvement of peers (*M*=56.00, *SD*=10.97, *n*=14) in their learning activities such as small group activities or techniques. This group's scores indicated they preferred learning during the afternoon hours (*M*=56.83, *SD*=15.70, *n*=14), as did the other groups. The availability of intake of food, snacks and beverages (*M*=61.67, *SD*=5.09, *n*=14) was also an important preference for this group of students. The combined group prefers mobility during learning activities (*M*=55.67, *SD*=4.50, *n*=14). Radiology students had a strong perceptual capability in the tactile perception (*M*=57.33, *SD*=9.83, *n*=14), which can be using manipulative and three-dimensional materials that are touchable and movable as well as readable.

Table 6

Mean and Standard Deviation on the PEPS of Radiology Students

Area	Source	*M*	*SD*	*n*
Environment	Noise Level	54.33	7.61	14
	Light	50.50	8.60	14
	Temperature	46.00	10.95	14
	Design	47.33	8.91	14
Emotionality	Motivation	49.83	5.46	14
	Persistent	54.67	2.58	14
	Responsible	48.00	4.38	14
	Structure	64.83	9.13	14
Sociological	Alone/Peers	56.00	10.97	14
	Authority figure	59.00	10.00	14
	Several ways	47.50	7.26	14
Physical	Auditory	54.83	12.04	14
	Visual	49.33	10.39	14
	Tactile	57.33	9.83	14
	Kinesthetic	53.17	4.92	14
	Intake	61.67	5.09	14
	Evening/Morning	46.50	10.25	14
	Late Morning	51.67	7.53	14
	Afternoon	56.83	15.70	14
	Needs Mobility	55.67	4.50	14

4. The learning styles preferences of Respiratory Therapy students are summarized in Table 7. Respiratory students in this study displayed a strong preference for highly structured learning activities, (*M*=57.50, *SD*=8.40, *n*=6), that is planned and sequential routines of study in which expectations and events have been clearly communicated. These students also express a preference for movement and mobility and activity while learning (*M*=56.67, *SD*=6.94, *n*=6) as well as involvement of their peers (*M*=55.29, *SD*=9.33, *n*=6). The table also shows that they preferred learning during afternoon hours (*M*=59.36, *SD*=9.39, *n*=6). These students had the highest mean score of perceptual capability in the area of auditory (*N*=54.57, *SD*=13.46, *n*=6), meaning that in general, these students remember 75% of what is heard. Lecture, music, and taped presentations will all provide useful reinforcement of new material, followed by kinesthetic (*M*=54.36, *SD*=5.36, *n*=6), which should provide opportunities for real and active experiences for planning and carrying out student objectives.

Table 7

Mean and Standard Deviation on the PEPS of Respiratory Therapy Students

Area	Source	*M*	*SD*	*N*
Environment	Noise Level	52.86	4.55	6
	Light	46.29	11.53	6
	Temperature	49.71	12.33	6
	Design	42.79	10.13	6
Emotionality	Motivation	53.14	6.88	6
	Persistent	53.64	6.72	6
	Responsible	48.86	7.91	6
	Structure	57.50	8.40	6
Sociological	Alone/Peers	55.29	9.33	6
	Authority figure	51.93	8.93	6
	Several ways	48.07	7.71	6
Physical	Auditory	54.57	13.46	6
	Visual	52.14	9.72	6
	Tactile	51.79	6.47	6
	Kinesthetic	54.36	5.53	6
	Intake	52.57	9.80	6
	Evening/Morning	44.50	5.64	6
	Late Morning	49.64	10.82	6
	Afternoon	59.36	9.39	6
	Needs Mobility	56.57	6.94	6

5. Table 8 provides descriptive statistics regarding the learning styles of Ultrasound students. Ultrasound students in this study display a strong preference for highly structured learning activities (*M*=59.92, *SD*=8.66, *n*=13), that is, planned and sequential routines of study in which expectations and events have been clearly communicated. The group's score indicated a preference for movement and mobility and activity while learning (*M*=56.38, *SD*=8.69, *n*=13) and also indicated they prefer learning during afternoon hours (*M*=59.85, *SD*=11.50, *n*=13). The students were highly social and preferred activities that involve or include the supervision or participation of an authority figure, teacher, or supervisor (*M*=57.77, *SD*=11.05, *n*=13), as well as the involvement of peers (*M*=54.46, *SD*=15.21, *n*=13). Ultrasound students had a strong perceptual capability in the area of auditory presentation (*M*=61.08, *SD*=9.49, *n*=13), meaning that in general, these students remember 75% of what is heard. Lecture, music, and taped recordings all provide useful reinforcement of new material. Auditory learning was followed by kinesthetic preferences (*M*=57.31, *SD*=3.12, *n*=13).

Table 8

Mean and Standard Deviation on the PEPS of Ultrasound Students

Area	Source	*M*	*SD*	*n*
Environment	Noise Level	48.23	5.15	13
	Light	49.92	9.11	13
	Temperature	50.00	12.27	13
	Design	47.23	8.82	13
Emotionality	Motivation	51.08	6.68	13
	Persistent	49.85	9.19	13
	Responsible	45.54	8.49	13
	Structure	59.92	8.66	13
Sociological	Alone/Peers	54.46	15.21	13
	Authority figure	57.77	11.05	13
	Several ways	45.38	9.84	13
Physical	Auditory	61.08	9.49	13
	Visual	42.38	7.44	13
	Tactile	51.08	6.78	13
	Kinesthetic	57.31	3.12	13
	Intake	52.69	7.76	13
	Evening/Morning	45.62	9.69	13
	Late Morning	44.23	8.86	13
	Afternoon	59.85	11.50	13
	Needs Mobility	56.38	8.69	13

6. Table 9 provides descriptive statistics regarding the preferred learning styles of Vascular Technology students. Strong characteristics of these students are expressed numerically. Vascular Technology students in this study displayed a strong preference for highly structured learning activities (*M*=59.67*, SD*=6.22 *n*=9), that is, planned and sequential routines of study in which expectations and events have been clearly communicated. The group's score indicated a preference for movement and mobility and activity while learning *(M*=55.89, *SD*=6.25, *n*=9) and also indicated they preferred learning during afternoon hours (*M*=58.11, *SD*=12.33, *n*=9). The students were highly social and preferred activities that involve or include the supervision or participation of an authority figure, teacher, or supervisor (*M*=56.56, *SD*=6.97, *n*=9), as well as the involvement of peers (*M*=57.89, *SD*=13.03, *n*=9). Vascular Technology students had the strongest perceptual capability in the area of kinesthetic presentation (*M*=54.33, *SD*=5.34, *n*=9). Using the kinesthetic perception it is important to provide opportunities for students for real and active experiences. Seeing projects in action and becoming physically involved are appropriate activities for these individuals. This group of students indicates a sharp preference for persistent (*M*=54.89, *SD*=5.11, *n*=9), in which supervision and assistance is provided only when necessary. Strategies for this include designing learn-term assignments. Vascular Technology students indicate a preference for an "informal" (design) climate (*M*=39.67, *SD*=7.23, *N*=9) while learning new, difficult material. To provide this atmosphere, soft chairs and couches, pillows, some, color, lounge furniture, and indirect lighting

should be used. It should be noted that scheduling difficult tasks should be permitted in evening hours (M=43.56, SD=6.62, n=9).

Table 9

Mean and Standard Deviation on the PEPS for Vascular Technology Students

Area	Source	*M*	*SD*	*N*
Environment	Noise Level	51.00	5.68	9
	Light	54.67	9.27	9
	Temperature	48.44	8.73	9
	Design	39.67	7.23	9
Emotionality	Motivation	50.89	5.04	9
	Persistent	54.89	5.11	9
	Responsible	49.56	6.54	9
	Structure	59.67	6.22	9
Sociological	Alone/Peers	57.89	13.03	9
	Authority figure	56.56	6.97	9
	Several ways	46.22	11.86	9
Physical	Auditory	51.89	10.24	9
	Visual	42.00	11.96	9
	Tactile	49.78	7.12	9
	Kinesthetic	54.33	5.34	9
	Intake	50.33	7.04	9
	Evening/Morning	43.56	6.62	9
	Late Morning	48.33	12.99	9
	Afternoon	58.11	12.33	9
	Needs Mobility	55.89	6.25	9

Research Question 2

The second research question was, "What are the multiple intelligences as determined by the Multiple Intelligence Developmental Assessment Scale (MIDAS) of postsecondary allied health students?"

In order to answer this question, SPSS statistical software, version 10 was used to calculate the mean scores for each student. In order to determine a group profile, the researcher calculated a group mean for each multiple intelligence. The group results provided mean scores for each multiple intelligence ranging from 0-100. Scores from 1-40 show low development, from 40-60 show moderate development, and from 60 to 100 show high development of intelligence (Shearer, 1996). The researcher selected the highest and lowest levels of development of each group (Malm, 2002). Table 10 presents the individual medical group means for each of the multiple intelligences. The statistical analyses of group means are as follows:

1. Medical Assisting: These 24 students' highest three mean scores were for interpersonal, intrapersonal, and naturalistic. This student groups' lowest mean scores were musical, kinesthetic, and spatial
2. Practical Nursing: These 42 students' highest mean scores were linguistic, interpersonal, and intrapersonal. The three lowest mean scores were musical, kinesthetic, and naturalistic with kinesthetic having the lowest mean score
3. Radiology: These 14 students' mean scores were linguistic, interpersonal, and intrapersonal with interpersonal having the highest mean score. The lowest mean scores were kinesthetic, spatial, and naturalistic.

4. Respiratory Therapy: These six students' highest mean scores were interpersonal, intrapersonal, and naturalistic. Interpersonal intelligence had a mean score of 60.30. The lowest mean scores were musical, kinesthetic, andspatial.
5. Sonography: These 13 students' highest mean scores were interpersonal, intrapersonal, and naturalistic. The three lowest scores were musical, kinesthetic, and spatial. The difference between the highest mean score and the lowest mean scores are useful in indicating clear strengths and weaknesses for this student group.
6. Vascular Technology: These nine students' highest mean scores were linguistic, interpersonal, and intrapersonal with interpersonal having the highest mean score of 56.86. The lowest mean scores were musical, spatial, and naturalistic with naturalistic having the lowest mean score of 39.41. The difference between the highest mean score to the lowest mean score are useful in indicating clear strengths and weaknesses for this student group.

An examination of the data for the medical groups in the study revealed several patterns (Table 11). All six groups had the highest mean scores in interpersonal intelligence. An additional distribution pattern emerged when the lowest mean scores for the six groups were examined. Five out of the six groups had low scores in musical, kinesthetic, and spatial intelligence. Three of the medical groups reflected their lowest n scores in kinesthetic intelligence. Two of the medical groups reflected their lowest mean scores in musical intelligence.

Table 10

Mean and Standard Deviation on the MIDAS Score by Medical Programs

Program	N	Musical *M* *(SD)*	Kinesth. *M* *(SD)*	Logic-Math *M* *(SD)*	Spatial *M* *(SD)*	Linguist. *M* *(SD)*	Interper. *M* *(SD)*	Intraper. *M* *(SD)*	Natural. *M* *(SD)*
Medical Assisting	24	43.6 (19.87)	36.72 (18.99)	45.3 (15.28)	42.64 (22.57)	43.83 (17.43)	52.72 (16.15)	45.93 (13.60)	48.1 (24.66)
Practical Nursing	42	39.33 (18.20)	33.37 (20.93)	46.1 (16.37)	43.22 (18.52)	48.94 (17.21)	55.63 (16.56)	51.13 (13.46)	37.64 (22.10)
Radiology	14	45.54 (20.23)	37.65 (16.94)	43.77 (19.23)	43.16 (15.23)	48.02 (20.46)	49.21 (12.41)	48.09 (12.73)	38.45 (20.26)
Respiratory Therapy	6	36.12 (21.42)	47.92 (18.21)	55.35 (15.39)	45.65 (21.87)	50.5 (13.60)	60.3 (7.02)	57.12 (7.13)	57.75 (16.37)
Sonography	13	35.57 (19.97)	38.15 (22.15)	42.19 (17.11)	39.28 (17.43)	44.51 (12.70)	58.68 (11.69)	51.17 (13.64)	42.89 (20.93)
Vascular Technology	9	42.09 (10.37)	44.52 (13.22)	47.61 (10.73)	41.14 (14.09)	54.42 (13.59)	56.86 (12.69)	51.56 (6.57)	39.41 (12.32)

N=Number of student respondents *M*=Mean *(SD)*-Standard Deviation

Table 11

Summary of Three Highest and Three Lowest Mean Scores for Student Sample

Program	N	Musical	Kinesth.	Logic-Math	Spatial	Linguist.	Interper	Intraper.	Natural
Medical Assisting	24	L	L		L		H	H	H
Practical Nursing	42	L	L			H	H	H	L
Radiology	14		L		L	H	H	H	L
Respiratory Therapy	6	L	L		L		H	H	H
Sonography	13	L	L		L		H	H	H
Vascular Technology	9	L			L	H	H	H	L

N=Number of student respondents

Intrapersonal intelligence was reported in all groups as one of the three highest groups scores. However, the purpose of identifying strengths in the groups is important in recognizing patterns in other higher mean scores. In all the groups linguistic and naturalist intelligence were present in three out of six groups for the highest three mean scores. It is important to note that Logical-Mathematical intelligence was not reported in either the high or low mean scores in any of the six groups.

As indicated earlier, the developer of the MIDAS scale used for this research provided interpretative information to the participants in this research study. Cut off scores for the eight intelligences specified 0-40 was "low", 40-60 was "moderate", and 60-100 was "high". Only one group showed means above 60 for interpersonal intelligence. There was an assortment of means under 40. Three out of the six groups had means below 40 in musical intelligence. Four out of the six groups had means below 40 in kinesthetic intelligence. The Sonography group had a means below 40 in spatial intelligence, and three out of the six groups had means below 40 in the naturalistic intelligence.

Even though there appears to be common higher and lower intelligence development, an overall inspection indicated that the intelligences are distributed throughout this population with the majority in the "moderate" range. In the 108 mean scores from the research data, only 10 % (*n*=11) were low (below 40) and less than 1% (n=1) were high (above 60). This indicated that 89% of the mean scores were in the moderate range (40-60). In the moderately high range (above 50), 12% fell into this category (*n*=13).

Research Question 3

The third question addressed was "Are there statistically significant differences in learning styles among students based on age?"

In order to answer this question, SPSS statistical software, version 10 was used to compute a one-way Analysis of Variance (ANOVA) in order to determine if there were any statistically significant differences in the scores of 108 students in six different medical groups included in the study.

The ages of the students were divided into six different age groups indicated by Table 12 (Resch, 2002). The largest age group was the 21-25 year group, and the smallest age group was the 36-40 year group.

Table 12

Summary of Student Age Groups

Age Groups	Age in years	*n*
1	16-20	21
2	21-25	36
3	26-30	22
4	31-35	11
5	36-40	4
6	Over 40	14

A one-way Analysis of Variance (ANOVA) was used to determine if there were statistically significant differences in learning styles mean score based on age. With an alpha level of .05, the effect of age was statistically significant for five learning styles, including light, F (5,108) =2.72, p=.024; design, F (5,108) =2.79, p=.021; responsible, F (5,108) = 2.961, p= .015; evening/morning, F (5,108) =3.79, p=.003 and afternoon,

$F(5,108) = 3.26$, $p = .009$. The effect of age was not statistically significant for the remaining 15 learning styles.

Bonferroni post hoc tests were computed on the five learning styles where statistically significant differences were found. The Bonferroni adjusts the alpha level in family wise comparisons reducing the risk for a Type I error.

With an alpha level of .05, the effect of age between the ages 26-30 (M=51.83, SD=7.50) and greater than 40 (M=54.50, SD=7.23) was not statistically significance (p=.070) for light. With an alpha level of .05, the age group 21-25 (M=43.42, SD=8.09) preferred a more informal design than the over 40 group(M=53.50, SD=8.76) (p=.007). With an alpha level of .05, the age group 26-30 (M=52.45, SD=6.62) was more responsible or conforming than the younger age group (M=44.95, SD=7.31) (p=.021). With an alpha level of .05, the age group 16-20 (M=42.57, SD=6.94) compared to the over 40 age group (M=52.21, SD=7.27) preferred to learn in the evening (p=.008), and the 26-30 age group (M=43.14, SD=8.86) preferred learning in the evening as compared with the over 40 age group (M=52.21, SD=7.27) that preferred learning in the morning (p=.014). With an alpha level of .05, the age group 16-20 (M=62.62, SD=6.73) preferred learning in the afternoon over the over 40 age group (M=50.57, SD=9.04) (p=.018) that had no clear preference, and the 26-30 age group (M=60.86, SD=11.83) preferred to learn in the afternoon over the 40 age group (M=50.57, SD=9.04) which had no preference and fell in between the two groups (p=.019).

Research Question 4

The fourth question addressed was "Are there statistically significant differences in multiple intelligences among students based on age?"

In order to answer this question, SPSS statistical software, version 10 was used to compute a one-way Analysis of Variance (ANOVA) to determine if there were statistical differences in the scores of 108 students in six medical groups included in the study.

The ages of the students were divided into six groups. The largest number of participants were in the 21-25 year group, and the smallest number in the 31-35 year group.

In order to determine if there were statistically significant differences in multiple intelligences mean score based on age, an Analysis of Variance (ANOVA) was calculated. There were no statistically significant differences ($p<.05$) in multiple intelligence based on age.

Summary of Data Analysis

This chapter reported the data analysis conducted in this study. The PEPS instrument and the MIDAS instrument were given to 108 students in six different medical groups. The student respondents were 94% female (n=101) and 6% males (n=7). The range of student's ages were 18 years to 54 years in five different age groups with a mean of 27.8. The largest group was the 21-25 age group (36%). Caucasian students made up the majority of the students (85%), followed by African American students (14%). In order to answer each of the research questions, data was analyzed using descriptive statistics and a univariate Analysis of Variance (ANOVA).

Research Question 1 was answered using descriptive data. Group profiles were analyzed by using the highest mean scores and the lowest mean scores for each of the medical groups and the 20 learning styles preferences. The data indicated there were patterns within each of the student groups in the study. Four of the six groups showed the

strongest preference for highly structured learning activities; for two groups, it was the second strongest preference. Additionally, other strong preferences that were evident in all the groups were afternoon learning, the need for mobility, and the preference for an authority figure to be present. All of the groups showed the lowest preference for visual perception.

Research Question 2 was answered using descriptive data. Group profiles were analyzed by using the three highest and the three lowest mean scores for each of the medical groups and eight multiple intelligences. All of the six medical groups reported consistently interpersonal and intrapersonal intelligence in their highest three intelligences. In addition, musical, kinesthetic, and spatial intelligence were reported in the lowest three in five out of the six medical groups. Logic-Mathematical intelligence was not prevalent in any of the medical groups highest or lowest three.

Research Question 3 was addressed using a univariate Analysis of Variance (ANOVA). The data indicated there were 5 learning style preferences statistically significant differences based on age. The post hoc test confirmed this finding in four out of five post hoc tests run.

Research Question 4 was addressed using a univariate Analysis of Variance (ANOVA). The data indicated there were no statistically significant differences in multiple intelligences based on age.

CHAPTER 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This chapter presents a summary of the study's findings and their significance to the four research questions. Conclusions from the data collected and recommendations for practice and further study are offered.

In recent years, two theories have originated in an attempt to interpret human differences and to design educational models around these differences. One is the theory of learning styles, which is grounded in the psychoanalytic tradition, and the other theory of multiple intelligences, which attempts to reexamine the theory of measurable intelligence (Silver, Strong, & Perini, 1997).

The purpose of this study was to determine the learning styles (measured with the PEPS Learning Styles Instrument, 1996) and to identify the multiple intelligences (defined by Gardner, 1983, 1999a, 1999b), of students in postsecondary allied health fields.

The rationale for this study was that in very demanding postsecondary allied health classes, it is of utmost importance to find the most effective way to process large quantities of information in a short amount of time (Linares, 1999). When students are lectured on a subject, they are overloaded with information which must be quickly processed in order to be accessed at a later date. Students are predisposed to learn in a variety of ways. Therefore, it is important to address the individual differences so the

students may be successful in their studies (Dunn, 1996). A review of literature indicated a lack of research on learning styles and multiple intelligences conducted at the postsecondary level.

Four research questions were established based on the purpose of the study. Research Question 1 centered on identifying the learning styles of the six groups of postsecondary allied health students. Research Question 2 sought to identify the multiple intelligences of the six groups of postsecondary allied health students. Question 3 attempted to determine the differences in learning styles among students based on age. Research Question 4 sought to determine significant differences in multiple intelligences among students based on age.

The population for the study consisted of students enrolled in six allied health programs at a technical college in Northwest Georgia. The six programs selected for this study included: (a) medical assisting, (b) radiology/radiographic technology, (c) respiratory technology, (d) diagnostic medical sonography, (e) vascular technology, and (f) licensed practical nursing. The programs used in the study were degree or diploma programs. All students in the program in their second quarter or more were given an opportunity to participate. Some students did not participate because of logistical problems, such as class conflicts, clinical rotation, and lack of interest. First quarter students were not included at all because they were in core classes. There were 108 students who participated in the study which included 101 females and seven males.

The data collection process proceeded as follows. Permission was secured from the president of the technical college for the investigator to administer two instruments, one on student learning styles, and one on multiple intelligences in June 2002. The study

included only those students who agreed to participate. Data were collected from students in the six degree and diploma programs in allied health. Approval of the research was granted by the Institutional Review Board at the University of Georgia. The students were invited to a lunch seminar provided by the researcher and during lunch students completed the tests and the survey. Instructions were given to the participants and their answer sheets were returned to the researcher along with their Informed Consent Form. On the survey, students were asked questions pertaining to their gender, age, and ethnicity. The MIDAS instruments were collected and sent to MI Research and Consulting, Incorporated and the PEPS were sent to Price Systems, Incorporated for bulk scoring. The researcher provided the instructors with the test results and interpretation of the scores for their students.

Raw scores for the 20 learning-style variables on all the valid PEPS and raw scores for eight different intelligences measured with the MIDAS, along with demographic data for each student, were entered into a database. The Statistical Package for the Social Sciences (SPSS) for Windows (version 10) was used for statistical analyses. Descriptive and inferential statistical procedures were used to answer the four questions and identify which learning style elements and multiple intelligences significantly discriminated between or among the groups by age. For Questions 1 and 2, descriptive statistics were employed for the MIDAS and the PEPS instruments and included the mean, standard deviation, and range of scores of the students in the six allied health programs at the technical college. For Questions 3 and 4, a one-way analysis of variance (ANOVA) was calculated using the subscales of the MIDAS instrument and the subscales of the PEPS instrument as the dependent variable. The independent variable

was the ages of the students. Where statistical differences were found, follow-up post hoc comparisons were done using the Bonferroni test.

Summary of Findings

The following conclusions are based on the analysis of the data. It is important to note that since the results of the survey are from two self-reported questionnaires, it is inappropriate to state that one group has a higher tendency for a particular learning style or a higher or lower intelligence in a particular domain. In the first two research questions, the researcher identified patterns within the individual groups and within total group rather than between the groups.

Research Question 1:

What are the learning styles as defined by the Productivity Environmental Preference Survey (PEPS) of postsecondary allied health students?

In order to determine the distribution of learning styles from the data it was necessary to examine the program group mean scores. Medical Assisting students showed strong preferences for highly structured learning activities. Afternoon was the preferred time of day for learning. The students needed physical mobility during learning sessions and prefer to engage in physical mobility while learning. The availability of intake of food or beverages was also an important factor along with the presence of an authority figure. The dominant perceptual strength was kinesthetic.

Practical nursing students also show strong preferences for highly structured learning. Afternoon was also the preferred time of day for learning. These students also needed physical mobility during learning session. Practical Nursing students learn better with another student or a few students that complement his/her sociological

characteristics. The dominant perceptual strength for this group of students was auditory. Auditory learning was followed by kinesthetic preferences.

Radiology students displayed strong preferences for highly structured learning activities. These students were highly social and preferred activities that involved the participation of an authority figure. They preferred to involve their peers in their learning activities such as small group activities or techniques. This group's scores indicated they preferred learning during the afternoon. The availability of intake of food, snacks, and beverages was an important preference for this groups of students. The combined group preferred mobility during learning activities. Radiology students in this area had strong perceptual capability in the tactile perception.

Respiratory students in this study displayed strong preferences for highly structured learning activities. These students also expressed a preference for movement and mobility and activity while learning as well as involvement of their peers. They preferred learning during afternoon hours. These students had the strongest perceptual capability in the area of auditory, followed by kinesthetic learning.

Ultrasound students in this study displayed strong preferences for highly structured learning activities. The group's score indicated a preference for movement and mobility and activity while learning and also indicated they prefer learning during afternoon hours. The students were highly social and preferred activities that involved or included the supervision or participation of an authority figure, teacher, or supervisor, as well as the involvement of peers. Ultrasound students in this study had the strongest perceptual capability in the area of auditory presentation. Kinesthetic learning followed auditory learning.

Vascular Technology students in this study displayed strong preferences for highly structured learning activities. The group's score indicated a preference for movement and mobility and activity while learning and also indicated they preferred learning during afternoon hours. The students were highly social and preferred activities that involved or included the supervision or participation of an authority figure, teacher, or supervisor, as well as the involvement of peers. Vascular Technology students in this study had the strongest perceptual capability in the area of kinesthetic presentation. This group of students was more persistent, in which supervision and assistance is provided only when necessary.

In examining these scores, several patterns emerged. All the groups had strong preferences for highly structured learning activities. The need for structure is an indicator for the use of workbooks, lesson plans that follow a consistent routine, PLS or programmed learning sequence projects, and other highly structured learning activities. The groups were all afternoon learners. All of the groups indicated a preference for movement and mobility and activity while learning. Most of the groups needed the supervision or participation of some type of authority figure as well as involvement of their peers. When developing lab activities that require independent activity, these learners preferred an authority figure to maintain some presence as a facilitator. Five out of the six groups had kinesthetic learning as their first or second strongest perceptual capability. Three out of the six groups had auditory as the predominant perceptual capability. Instructors who conduct lecture as the primary activity in the classroom could incorporate demonstrations, the use of scientific models to be handled by students, and offer tapes as study tools for individual use.

Research Question 2:

What are the multiple intelligences as determined by the Multiple Intelligence Developmental Assessment Scale (MIDAS) of postsecondary allied health students?

In order to determine the distribution of multiple intelligences from the data it was necessary to examine the individual group mean scores. The highest three and the lowest three group means were selected as an approach to identify the level of development in each intelligence for each group. A report of the statistical analyses of group means follows:

Medical Assisting students' highest three mean scores were for interpersonal, intrapersonal, and naturalistic. This student groups' lowest mean scores were musical, kinesthetic, and spatial.

Practical Nursing students' highest mean scores were linguistic, interpersonal, and intrapersonal. Interpersonal had the highest mean score, and the range between the highest mean scores was almost seven points. The three lowest mean scores were musical, kinesthetic, and naturalistic with kinesthetic having the lowest mean score. The differences between the highest mean scores and the lowest mean scores are useful in indicating clear differences in development of specific intelligences.

Radiology students' mean scores were linguistic, interpersonal, and intrapersonal with interpersonal having the highest mean score. The lowest mean scores were kinesthetic, spatial, and naturalistic.

Respiratory Therapy students' highest mean scores were interpersonal, intrapersonal, and naturalistic. Interpersonal intelligence had a mean score of 60.30. Scores above 60 indicate a high preference in a particular area. The three lowest mean

scores were musical, kinesthetic, and spatial. Musical intelligence had the lowest mean score with a mean score of 36.12. Scores less than 40 indicate a low preference toward that variable.

Sonography students' highest mean scores were interpersonal, intrapersonal, and naturalistic. The highest mean score was interpersonal with 58.68, and the range from the highest mean score and the third highest mean score was over 14. The three lowest scores were musical, kinesthetic, and spatial. The lowest mean score was musical with a 35.57.

Vascular Technology students' highest mean scores were linguistic, interpersonal, and intrapersonal with interpersonal having the highest mean score of 56.86. The lowest mean scores were musical, spatial, and naturalistic with naturalistic having the lowest mean score of 39.41.

An examination of the data for the medical groups in the study revealed several patterns. Interpersonal intelligence was reported in all groups as the highest group scores. People working in the allied health field have much contact with the public, and these fields are considered people service-oriented fields. Therefore, seeing interpersonal intelligent as one of the top three intelligence in the six allied health groups is not surprising. Intrapersonal intelligence was reported in all groups as one of the three highest group scores, which might account for the sensitivity of students pursing allied health professions.

An additional distribution pattern emerged when the lowest mean scores for the six groups were examined. Five out of the six groups had low scores in musical, kinesthetic, and spatial intelligence. Kinesthetic intelligence was the lowest mean score

for three medical program groups. This should not be confused with the kinesthetic learning style. Two of the medical groups reflected their lowest mean scores in musical intelligence.

However, the purpose of identifying strengths in the groups is important in recognizing patterns in other higher mean scores. In all the groups linguistic and naturalist intelligence were present in three out of six groups for the highest three mean scores. The six programs and the careers for which students are prepared to be employed stress effective verbal and written communication in preparation for dealing with patients. Therefore, this might explain the high linguistical intelligence.

Even though there appears to be within the medical research groups' common higher and lower intelligence development, an overall inspection indicated that the intelligences are distributed throughout this population. In the 108 mean scores from the research data, 89% of the mean scores were in the moderate range (40-60).

Research Question 3:

Are there statistically significant differences learning styles among students with different characteristics such as age?

The SPSS statistical software, version 10 was used to compute a one-way Analysis of Variance (ANOVA) in order to determine if there were any statistically significant differences in the PEPS scores of 108 students in six medical groups included in the study.

There were statistically significant differences for five learning style preferences including light, design, responsible, evening/morning, and afternoon. There were no statistical significance ($p<.05$) in the other 15 learning styles based on age.

Bonferroni post hoc studies were computed on the five preferences. Light was shown as having no statistically significance ($p<.05$) in the post hoc test.

Research Question 4:

Are there statistically significant differences in multiple intelligences among students with different characteristics such as age?

The SPSS statistical software, version 10 was used to compute a one-way Analysis of Variance (ANOVA) in order to determine if there were statistically significant differences in the MIDAS scores of 108 students in six medical groups included in the study. An Analysis of Variance (ANOVA) was computed. There were no statistically significant ($p<.05$) differences in multiple intelligences based on age.

Conclusions

The following conclusions were derived following this summary of finding

1. All six of the medical program groups showed their highest learning styles in learning in a structured setting, a need for physical mobility, and learning in a small group environment. The programs the allied health students were enrolled in are programs with heavy didactics in a short amount of time requiring students to seek structure. Human anatomy and science is built on structure which may further emphasize the need for this learning style. Many allied health programs require sedentary workers, but all of the programs require mobility on the part of the worker which may be a reason why these programs looked inviting to these students. Group work is very common in clinical and laboratory settings which may be why learning in a group setting is so important. Also, interpersonal skills

rated high in this study which may also account for the popularity of working in groups.

2. In this study the results from the MIDAS and the six allied health groups showed that interpersonal skills were rated the highest intelligence. This would be important in any of these particular fields which require a great deal of patient contact. People with interpersonal skills must fulfill a need to help people. They have to make patients feel comfortable and at ease. Good and accurate communication is a must in this field and health care workers must be able to give correct information to both patients and doctors. Intrapersonal skills in most of the six programs was rated as the second highest intelligence. Healthcare workers must receive self satisfaction in helping mankind and making a contribution to society.

3. The findings of this study recorded differences in learning styles based on age. This is consistent with other research (Dunn, 1999/2000; Dunn & Dunn, 1993). Accumulation of life experience as you age will have an influence. As one ages, the efficiency of physiology of the human body deteriorates which may require different needs.

4. Based on differences in preference for the learning style of design of the classroom and responsible, it was determined the over 40 age group had a preference for more traditional teaching methods.

Recommendations for Practical Application

These recommendations were based on the findings and conclusions of this study. One of the main purposes of this research study was to add to the body of knowledge

concerning learning styles and multiple intelligences. The focus of the study in the technical college was an effort to provide more learning choices for the non-traditional students and the student who needs different strategies to help reach future occupational goals.

1. Research has shown that adapting to learning styles and the use of multiple intelligence gains in achievement for college students and adult learners (Mickler & Zippert, 1987; Dunn & Griggs, 1999; Diaz-Lefebrve, 1999). Suggestions to improve allied health programs include increasing instructor awareness of learning styles and multiple intelligence principles, appraising the learning styles of students and identifying student multiple intelligence, providing study prescriptions to students, adapting the classroom to meet students needs, working with students to increase their awareness of the types of learning styles and multiple intelligence, and developing skills in less preferred learning styles and multiple intelligence.
2. In-service education can be offered to instructors about the possibility of incorporating learning styles and the use of multiple intelligence in a classroom setting. If instructors knew how to assess their own learning styles and multiple intelligences, better understanding about learning style and multiple intelligence might be accrued.
3. It is recommended that allied health instructors evaluate the learning styles and multiple intelligences of all incoming students. Using the PEPS instrument and the MIDAS instrument, instructors are able to quickly learn about new students entering the classroom, which might provide different perspectives about the

needs of individual learners. Teachers can encourage the development of all intelligences and all learning styles in their students. Every student should be given information about their learning styles and a profile of their different intelligences. This might help the student develop methods to study and learn when the classroom design does not accommodate their particular strength.

4. Instructors might adapt the classroom to meet the needs of the different learning styles and multiple intelligences of their students. Instructors might offer different teaching strategies to the students and different choices to the students about their learning situation, such as the possibility of either working independently or in a group situation. Classroom activities can be structured to accommodate the visual, auditory, tactile, or kinesthetic learner, or students strong in different intelligences, such as music, spatial, kinesthetic, etc.
5. It would benefit students if they were encouraged to develop their less preferred learning styles and multiple intelligences. Combining the different strengths would increase the student's performance in learning and develop a more holistic, well-rounded individual who would be entering the job market after graduation.

Recommendations for Further Research

These recommendations were based on the findings and conclusions of this study.

1. More research is needed in the multiple intelligences and learning styles of students in postsecondary education. Research is not only needed at the technical college with diploma and degree programs but at the four-year college with bachelor's degree programs. Perhaps if instructors had information concerning

learning styles and multiple intelligences they could tailor their instruction to suit the needs of their students.

2. There is a need to compare the differences in identifying multiple intelligences and learning styles of students in allied health programs with students in different career programs at both the technical college level and the four-year college.
3. Since the learning styles and the multiple intelligences of allied health students for this group of students have been identified, it might be appropriate to study different interventions in the classroom aspect and begin experimentation with classroom instruction and classroom design and devise studies using control groups against experimental groups using this plan.
4. Studies should be employed to explore student learning styles and predominant multiple intelligences compared to instructor teaching styles and instructor predominant intelligences. One might discover if those teaching styles are congruent with student's needs.
5. An investigation might be conducted using a different instrument in multiple intelligence and a different learning style instrument.

The process of completing this study has heightened awareness in allied health programs at a postsecondary college with students, administrators, and instructors. It is hoped that this study has provided the force needed for implementation of teaching strategies that might make a difference for the non-traditional adult learner.

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APPENDIX A

DEMOGRAPHIC SURVEY

To the Survey Participant:

This survey is being conducted as part of a Doctoral candidate's project in Occupational Studies at the University of Georgia. The purpose of the study is to examine Predominant Learning Styles and Multiple Intelligences of postsecondary allied health students.

Before you begin, please fill out the following information:

Name_____

Quarter entered Coosa Valley Technical College_____

Program enrolled:

__Medical Assisting
__Licensed Practical Nursing
__Diagnostic Medical Sonography
__Respiratory Therapy
__Radiology/Radiographic Technology
    __Diploma
    __Associate's Degree
__Vascular Technology
    __Diploma
    __Associate's Degree

Your gender: Female__ Male__

Age at last birthday: __

Ethnic Origin/Descent:
__African American
__Asian American
__Caucasian
__Hispanic
__Other (Please Specify_____

APPENDIX B

Ellen Katzowitz
2570 Chimney Springs Drive
Marietta, GA 30062
April 15, 2002

Mr. Craig McDaniel
President
Coosa Valley Technical College
One Maurice Culberson Drive
Rome, GA 30161

Dear Mr. McDaniel:

This letter is in follow-up to a conversation you had with Teresa Resch concerning my doctoral research at the University of Georgia.

This past fall, I was a part of the in-service at Coosa Valley Technical College where I gave two presentations on learning styles and personality testing to the faculty. The faculty seemed excited about the possibilities of obtaining more information about different ways to help their students.

I am a doctoral student at the University of Georgia in the Department of Occupational Studies. The purpose of my doctoral research will be to describe the multiple intelligences of students in postsecondary allied health fields, and to determine if allied health students demonstrate similar learning styles. I am eager to use Coosa Valley Technical College for my research.

I am hoping to use the entire population of allied health students from the six different degree or diploma programs at Coosa Valley Technical College, to administer a multiple intelligence test, learning styles questionnaire, and general survey concerning age, gender, and ethnicity during a catered lunch seminar June 5 and June 6, 2002. This data will be used solely for my doctoral dissertation. An ex post-facto research design will be used, in which causal comparative research will investigate whether differences between the independent variables-which includes the different allied health programs at the postsecondary college-has resulted in an observed difference in the dependent variables which includes students' learning styles and multiple intelligences. The study will use a descriptive design. To complete the statistical analysis portion of this study, one-way ANOVAs will be employed, along with independent-sample *t* tests.

Thank you for your cooperation in this matter. Results of this study may provide a better

understanding of students' learning styles characteristics and multiple intelligences and assist faculty in maximizing the educational environment for the student, which would ultimately ease the students' way in achieving their educational goals.

Sincerely,

Ellen Katzowitz
M.T.(ASCP), M.Ed., Ed.S

APPENDIX C

May 23, 2002

Ms. Ellen Katzowitz
2570 Chimney Springs Drive
Marietta, GA 30062

Dear Ms. Katzowitz,

Please accept this correspondence as granting permission for you to conduct your doctoral study of Coosa Valley Technical College's Allied Health students, within the guidelines set forth by the University of Georgia for conducting research on live subjects.

Please coordinate your activities through Dr. Teresa Resch, Director of Instruction, or Dr. Dottie Gregg, Vice President of Instruction. If I can be of further assistance, please let me know.

Sincerely,

Craig McDaniel
President

FCM/hp

cc. Dr. Teresa Resch

APPENDIX D

STUDENT CONSENT FORM

I _____agree to participate as a subject in a research process entitled "Predominant Learning Styles and Multiple Intelligences of Allied Health Students of Postsecondary Allied Health Students". This study will investigate the different learning styles and multiple intelligences of students in six different allied health programs.

This project will be conducted by Ellen Katzowitz, a graduate student at the University of Georgia's Department of Occupational Studies under the direction of Dr. Helen Hall at the University of Georgia's Department of Occupational Studies. Dr. Hall can be reached at (706) 542-4472. The address is 203 River's Crossing, Athens, GA 30602-4809. No other sponsorship or funding is involved in this research project.

I understand that my participation is entirely voluntary; I can withdraw my consent at any time without penalty and have the results of my participation, to the extent that it can be identified as mine, returned to me, removed from the research records, or destroyed.

The following points have been explained to me:

1. The purpose of this study will be to identify the multiple intelligences and the learning styles of students in postsecondary allied health fields. Using the population of allied health students from six different degree or diploma programs at a Coosa Valley Technical College, a multiple intelligence test, learning styles questionnaire, and a general survey concerning age, gender, and ethnicity will be administered. Although this research is not likely to benefit me personally, the results of this study may provide a better understanding of students' learning styles characteristics and multiple intelligences and assist faculty in maximizing the educational environment for the student, which would ultimately ease the students' way in achieving their educational goals

2. The procedures are as follow:

   If I choose to participate in this project, I understand that I must 18 years of age or older and that I will be asked to complete a learning style inventory, a multiple intelligence inventory, and a demographic data survey. The learning style inventory will identify my preferred learning style. The multiple intelligence instrument will identify the many different intelligences I might possess. The demographic survey will be used to determine my age, ethnicity, and gender for research analysis. The whole procedure will take about one hour. The forms will be completed on a day, which will be announced by the teacher. Completion of

these forms will in no way affect the grade I will receive in my class. If I choose to participate in this project I will be asked to complete a learning style instrument, multiple intelligence instrument, and a demographic survey.

3. No discomforts or stresses are foreseen.

4. No risks are foreseen.

5. The results of this participation will be confidential, and will not be released in any individually identifiable form without my prior consent, unless otherwise required by law. If I wish to share the results of my test with my instructor I will indicate by placing a check in front of the statement and sign my name in the space provided at the end of this consent form. __Yes __No. The researcher will return original questionnaire and test scores upon coding the information. The test scores will then be destroyed in a year.

I understand the information gathered from me will not be reported to anyone outside the research project in any manner, which personally identifies me unless otherwise indicated by my signature below. A report of general and combined results from participants in this project will be prepared for the Department of Occupational Studies in the College of Education at the University of Georgia and may be submitted to a professional publication or conference at a later time. The test results will be given to each participant and the researcher will keep all completed tests for one year. All test results will be destroyed in June 2003.

6. The researcher will answer any further questions about the research, now or during the course of the project and can be reached at (770) 641-9718.

The researcher, Ellen Katzowitz, has offered to answer any questions that I have about my involvement in this project. I understand that I may end my participation at any time. Whether I choose to participate at all, or decide not to continue at a later time, it will have no effect on the services available to me at Coosa Valley Technical College.
I understand that a signed statement of informed consent is required of all participants in this project. My signature indicates that I understand and voluntarily agree to the conditions of participation described above, and have received a copy of this form.

Signature of Researcher. Date

Signature of Participant. Date

PLEASE SIGN BELOW IF YOU WILL ALLOW OR NOT ALLOW RESULTS TO BE RELEASED TO INSTRUCTOR
___I will allow researcher to release the results of my tests to my instructor

_____
Signature of Participant. Date

___I will not allow researcher to release the results of my tests to my instructor

_____

Signature of Participant. Date

PLEASE SIGN BOTH COPIES OF THIS FORM. KEEP ONE AND RETURN THE OTHER TO THE INVESTIGATOR.

For questions or problems about your rights please call or write: Chris A Joseph, Ph.D., Human Subjects Office, University of Georgia, 606A Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-6514; E-Mail Address IRB@uga.edu.

Multiple intelligence profiles of athletic training students. The Internet Journal of Allied Health Sciences and Practice, 11(1), 1â€“9.Google Scholar. Lance, J., & Kitchin, P. (2007). Promoting the individual learning styles of masters students studying marketing-related modules through the use of YouTube video-clips. Investigations in university teaching and learning, 4(2), 111â€“125.Google Scholar. Lawrence, A. A. (2014).Â On the relationship between Iranian EFL learnersâ€™ multiple intelligences and their learning styles. Theory and Practice in Language Studies, 5(4), 784â€“791.CrossRefGoogle Scholar. Patton, M. Q. (2015). Predominant learning styles and multiple intelligences of postsecondary allied health students. Ellen C Katzowitz. 2002. View 5 excerpts. Cites background. Highly influenced. Developing employability and job-related skills at mobile learning environments:a case study at an industrial training centre.Â An examination of the relationship among student learning style, instructor learning style, and student performance in a Georgia technical college. Stanley Craig Lawson. 2011. View 5 excerpts. Cites background. Highly influenced. Effects of a Self-Reflective Learning Process on Student Art Performance. When researchers have tried to identify learning styles, teach consistently with those styles, and examine outcomes, there is not persuasive evidence that the learning style analysis produces more effective outcomes than a â€œone size fits all approach.â€ Of course, the learning style analysis might have been inadequate. Or even if it is on the mark, the fact that one intervention did not work does not mean that the concept of learning styles is fatally flawed; another intervention might have proved effective.Â All of us exhibit jagged profiles of intelligences. There are common sense ways of assessing our own intelligences, and if it seems appropriate, we can take a more formal test battery.