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A study of the relationship between learning styles and academic achievement

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A STUDY
OF THE RELATIONSHIP
BETWEEN LEARNING STYLES
AND ACADEMIC ACHIEVEMENT

Thesis

Submitted to

The School of Education and Allied Professions

UNIVERSITY OF DAYTON

In Partial Fulfillment of
the Requirements for the Degree

Master of Science in Education

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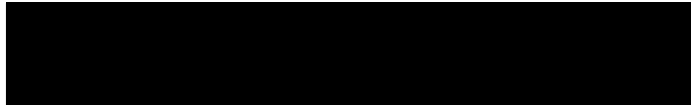
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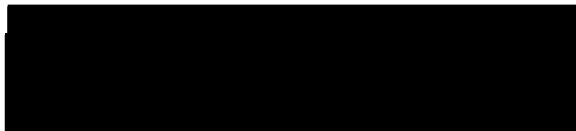
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ABSTRACT

A STUDY OF THE RELATIONSHIP BETWEEN LEARNING STYLES AND ACADEMIC ACHIEVEMENT

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University of Dayton, 1999

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This study investigated the relationship between student learning style and academic achievement in Language Arts, Math, Science, and Social Studies. The subjects of this study were 74 students from a rural mid-western school district, 43 males and 31 females. Students were given the LSI-II, and the results of that test yielded a categorization of one of four learning styles; diverger, converger, accommodator, and assimilator. Grade point averages for each student at the end of the first quarter were also determined. Data were analyzed through a crosstabs procedure. Many of the categories were found to have a higher than expected frequency of students per cell. These results indicate that there may be some factors common to learning styles and academic achievement.

ACKNOWLEDGMENTS

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I want to express my deepest gratitude and love to my husband, Andy. His willingness to put his dreams aside for mine are inspiring. To my children Allison and Ian, I wish to express my gratitude for their patience and understanding, but mostly for their unconditional love. To my mother, Kathy, thank you for your undying willingness to help. Without the love and support of my family, this degree would never have come to fruition.

TABLE OF CONTENTS

APPROVAL	ii
ABSTRACT.....	iii
ACKNOWLEDGMENTS	iv
TABLE OF CONTENTS.....	v
LIST OF TABLES.....	vi
CHAPTER	
I. INTRODUCTION	1
Purpose of Study	
II. REVIEW OF LITERATURE.....	5
Learning Style Inventories	
Relationship between Learning Style and Personality	
Relationship between Learning Style and Achievement	
Adapting Instruction to Accommodate Learning Style	
Summary of Review of Literature	
Hypothesis	
III. METHODOLOGY.....	19
Subjects and Setting	
Instrumentation and Procedure	
IV. RESULTS	24
V. DISCUSSION, IMPLICATIONS, AND CONCLUSIONS	29
Discussion of Results	
Limitations	
Conclusions and Recommendations	
REFERENCES	33

LIST OF TABLES

1. Learning Style Preferences	24
2. Observed Over Expected Numbers in Each Cell of Learning Style by Grade for Language Arts	25
3. Observed Over Expected Numbers in Each Cell of Learning Style by Grade for Math	26
4. Observed Over Expected Numbers in Each Cell of Learning Style by Grade for Science	26
5. Observed Over Expected Numbers in Each Cell of Learning Style by Grade for Social Studies	27

CHAPTER I

INTRODUCTION

For many years, educators have known that some children learn better while “doing”, while others understand by listening, and yet others can comprehend what they see. It has been noted that in 334 B. C. Aristotle stated that, “each child possessed specific talents and skills” (Reiff, 1992, p. 7), and discussed the concepts of individual differences in young children. Only within the last twenty years has the education community studied the significance of learning styles in relationship to classroom achievement. Learning style researchers believe that each person can learn, and that their learning style should be acknowledged and respected (Dunn, Given, Thomson & Brunner, 1998). According to Dunn et al., (1998) “teaching individuals through their learning-style strengths improves their achievement, self-esteem, and attitude toward learning” (p. 25). As a community of educators, these outcomes are what we strive for with our students.

In today’s society, education focuses on testing and finding the most proficient students. However, the search for proficiency is taught in a teacher-centered instead of a student-centered manner where students are eager and willing to learn.

As educators, parents, and society as a whole, we do not want the children of today to grow up being able to only memorize factual knowledge. They should be able to utilize their natural abilities in order to analyze, apply, and synthesize information. When students understand how they learn best, they will be able to handle any learning challenge that they face. Dunn et al., (1998) states, "learners are empowered by a knowledge of their own and others' learning styles"(p. 25).

A learning style is a multi-faceted construct developed through genetics and environment which considers personality, study strategies, developmental age, and learning process skills which must be addressed when determining a child's learning modality (Dunn, 1988; Dunn, 1995; Silver, Strong, & Perini, 1997).

Numerous studies concerning learning styles have been completed, with varying results. Still, the one commonality is that research has found a positive relationship between accommodation of learning styles and academic achievement. For example, Dunn, Griggs, Olson, Beasley, and Gormon (1995) state that those "students whose learning styles are accommodated would be expected to achieve 75% of a standard deviation higher than students who have not had their learning styles accommodated" (p. 353).

In relation to study skills, Geiser (1999) found that the utilization of “learning-style-responsive study/homework strategies offer a significant positive influence on students’ mathematics achievement over that offered by a traditional approach to study-skills instruction” (p.32). Moreover, the use of learning style preferences in the classroom encourages positive and self-directed behavior. Students are eager and most importantly, able to learn in a learning styles classroom.

Several studies have shown that a relationship exists between learning styles and academic achievement. For example, O’Brien (1994) found that students with the concrete sequential learning style as described by Gregorc tended to have higher levels of academic achievement. Also, the concrete sequential students earned a better GPA than those students found to be Abstract Random (AR) or Bi-modal (BI) (O’Brien, 1994). O’Brien explains his findings with the idea that the school environment may be designed around or encourages the behaviors of the concrete sequential students. Busato, Prins, Elshout, and Hamaker (1999) also found a relationship between learning styles and achievement. Their study asserts that students who utilize a meaning directed learning style tend to experience a positive level of achievement. Each of these studies produces support for more research with learning styles and achievement.

While many experimental studies have been conducted concerning a specific learning style, not many studies show the relationship between a specific learning style and a specific academic area of concentration. Therefore, the need to compare students' learning style preference and area of high academic achievement still exists. A description of students' learning style preference and first quarter grades in the four core classes of Math, Language Arts, Science, and Social Studies will clearly examine the relationship between learning styles and achievement. Furthermore, this study will show justification for adapting teaching styles to affect the majority of learning style preferences within an academic area of concentration. For example, are the majority of high achieving math students clustered in a particular learning style? If so, it would make sense to adjust one's teaching style to accommodate that particular style. The same would hold true when considering Language Arts, Science, and Social Studies.

Purpose of Study

The purpose of this study was to investigate the relationship between eighth grade students' learning style preferences and their first quarter grades in Math, Language Arts, Science, and Social Studies.

CHAPTER II

REVIEW OF THE LITERATURE

The amount of research concerning learning styles and their impact on student personality and achievement is vast. However, all of the recent research concerning learning styles points to the relationship between learning style and student achievement, attitude, and behavior. Students who are able and encouraged to learn in their own cognitive, affective, and physical domain perform better in school. Currently, the psychoanalytic theory of learning styles attempts to interpret human differences and create educational systems to complement these differences. Silver, Strong, and Perini (1997) suggest that a learning style influences the way people react when they accomplish any cognitive task. Additionally, many researchers have attempted to create inventories to assess students' learning styles and suggest methods for adapting instruction to suit students' learning styles. However, there are several learning style definitions and methods that are touted as being the best. For educators, the difficulty lies in choosing a learning style assessment and method that best suits the prevailing theories and philosophies, while considering what is best for the students' learning experience.

A learning style is a multi-faceted construct which considers personality, study strategies, developmental age, and learning process skills which must be addressed when determining a child's learning modality (Dunn, 1988; Dunn, 1995; Silver, Strong, & Perini, 1997). Rita Dunn's commentary on learning styles suggests that students recognize the manner in which they learn best, and this is defined as a style preference (Dunn, 1988). Moreover, their preferences change and develop as they encounter new developmental stages. For example, Dunn (1988) states, "with time, youngsters' preferences evolve from psychomotor (learning through touching and experiencing) to visual and then to auditory, as the learner matures" (p. 305).

Learning Style Inventories

Several learning style inventories have been created based upon much research. For example, the Kolb Learning Style Inventory is based on how a learner perceives and processes information. It is designed to categorize learners as one of the following; diverger, assimilator, converger, or accommodator (Sharp, 1997). A diverger is characterized by learning in a concrete manner. They tend to be visual and feeling oriented. Divergers excel at brainstorming and sharing ideas in a group context. Conversely, assimilators process information abstractly. They

tend to value order and accuracy, and they prefer to work alone. Similarly, convergers are characterized by their desire to work alone. Also, they value efficiency and prefer a "hands on" approach to learning. On the other hand, accomodators prefer an unstructured setting where they can teach themselves and other students. Additionally, they prefer to process information through problem-solving and experience (Sharp, 1997). Most students fall predominately into one of these categories. Some students may be categorized into two of these styles, however, they will be dominate in only one category.

John Jenkins authored an article in support of Learning Style implementation into the middle school level. He describes and supports the NASSP Learning Style Profile (LSP) which assesses cognitive skills, perceptual response, and study and instructional preference (Jenkins, 1991). Jenkins quotes a study in which Letteri (1982) utilized 30 hours of cognitive skills techniques and succeeded in raising middle school students' math achievement by 3.75 grade levels (Jenkins, 1991). Jenkins asserts that even minute changes in cognitive lesson plans, introduction of new material, and classroom physical environment will have a positive effect on student achievement. Jenkins (1991) states, "For those middle schools that have introduced and persisted with learning styles, the results are clear and impressive. Student achievement increases; student attitudes toward school improve; and school discipline problems decrease" (p. 6).

Moreover, Berry and Sahlberg sponsored a study that based its framework on the research of DeCorte (1993). De Corte outlined his six characteristics of learning. He stated that learners are categorized as one of the following; Constructive, Cumulative, Co-operative, Self-regulated, Goal -oriented, or Contextual (Berry & Sahlberg, 1996). The authors created a study that assessed students' perceptions of the question, "what is learning?" Also, they created a written tool to help researchers assess students' method of learning. Their findings indicate that middle school students can not verbalize their own learning style. However, through their survey questionnaire, the authors were able to determine that most middle school students' learning styles were categorized as "A-Constructive, B-Cumulative, or C- Contextual" (Berry & Sahlberg, 1996, p. 33), according to DeCorte's framework. The authors make a valuable point, "if pupils know how to learn, then they will be better prepared for the life-long activity of learning" (Berry & Sahlberg, 1996, p. 34).

Relationship between Learning Style and Personality

A study conducted by Busato, Elshout, Hamaker, and Prins categorized learning styles into four distinct categories based on J. D. Vermunt's Inventory of Learning Styles. These include: meaning directed, reproduction directed,

application directed, and undirected learning styles (Busato et al., 1999). The authors found several correlations between personality and learning styles. For example, they noted, "agreeableness was associated positively with the reproduction directed and application directed learning styles" (Busato et al., 1999, p. 129). This suggests that personality, interests, and ability function together to direct a person's learning and studying strategy.

Another personality-related study by Riding and Wigley found a relationship between cognitive style and personality. They defined cognitive style as Wholistic-Analytic and Verbal-Imagery, and personality as Extraversion, Neuroticism, Psychoticism, Impulsiveness, Venturesome, Empathy, and State and Trait anxiety (Riding & Wigley, 1997). The authors assert that "extraversion, neuroticism, and psychoticism are likely to influence social behavior and group work" (p. 382), and are thus relevant to education. The authors found that there are significant interactions between learning style and their effects on neuroticism and impulsiveness. This raised a question concerning how personality sources and style combine to effect behavior. A student's behavior could affect his or her ability to utilize his/her natural learning style tendencies for processing and studying.

Relationship between Learning Styles and Achievement

Academic success partially depends upon acquiring the necessary skills for learning. Proper study skills and strategies are paramount in learning. Research has shown a link between learning styles and academic achievement through study strategies and skills. For example, a study conducted by Riding and Al-Sanabani considers the ideas of the wholistic-analytic learning style which refers to an individual's tendency to organize in wholes or parts, and the verbal-imagery style which determines how a person processes information, verbally or with pictures. They deduce that as a whole, a summary passage, along with a reading passage, increases the recall performance of both learning styles. Moreover, verbalizers are superior with verbal presentations while imagers excel with a pictorial mode of learning. Interestingly, Riding and Al-Sanabani conclude that the older a student becomes, the more often he or she creates new learning strategies to cope with unfamiliar or difficult learning experiences (Riding & Al-Sanabani, 1998).

Focusing on study strategies, Beishuizen and Stoutjesdijk (1999) conducted an experimental study to determine the effects of deep or surface level study strategies on essay or multiple choice tests. They found that students with a deep processing learning style scored higher on both tests than those with a

surface level style. These differences were attributed to the deep processors increased factual knowledge which occurs because of the difference in the way that they orient and plan their studying strategies. More importantly, they found that the difference in deep or surface level processing as a learning style is only applicable to studying before and after the initial reading or processing of material (Beishuizen & Stoutjesdijk, 1999). As they stated, "deep and surface learning styles do not necessarily lead to different approaches to actual learning, but cause different ways of orienting, planning, and organizing information which has been collected by studying" (p. 296). This statement suggests that deep and surface level learning styles are related to study habits more so than actual learning styles. However, as educators, knowing a student's study strategy could assist a teacher in preparing a student for a testing situation. Just knowing the type of test, essay or multiple choice, could help a student utilize his or her study strategy to best prepare for a test.

Likewise, Ertmer and Dillon's (1998) study of case-based instruction notes that all students do not learn or function properly with one specific learning strategy. Their interviews with study participants reflect the idea that students' perception of class value, class goals, and reflective monitoring strategies are not

always comparative to the learning method. Ertmer and Dillon assert that educators must be aware of students' attitude and aptitude toward a specific learning strategy (Ertmer & Dillon, 1998). Subsequently, before teaching with one specific style or strategy, an educator must assess his or her classroom for weakness or readiness in regards to the style.

Geiser's experimental study concerning achievement and study strategies in mathematics at the middle school level shows that achievement levels increase with learning-style-responsive strategies (Geiser, 1999). Also, he hypothesized that the achievement of the control group may have increased because those students had been directly taught the necessary learning strategies to increase their ability to self-regulate their study time. Moreover, the control group experienced an increase in attitude toward school and homework. The author's conclusion states, "these findings support the conclusion that learning-style-responsive study/homework strategies offer significant positive influence on students' mathematics achievement over that offered by a traditional approach to study-skills instruction" (Geiser, 1999, p. 32).

Additionally, O'Brien's discussion of cognitive learning styles and academic achievement found that the Kolb concrete sequential learning style led to increased academic achievement, where as, the abstract random style had the lowest level of achievement. A concrete sequential learner utilizes the physical

world of reality, and they think sequentially and methodically (O'Brien, 1994). Conversely, the abstract random style focuses on emotions and feelings, and they tend to be exuberant and intense. O'Brien (1994) asserts, "that counseling programs and curriculum which are currently designed toward the concrete sequential student be modified to include the abstract random learning style as well" (p. 32).

Finally, a recent study of approximately 1,000 California community college freshman studied the relationship between learning style and academic success across the curriculum. The students took the Kolb LSI, and these results were compared with high school GPA, age, race, gender, and the student's college class schedule (Sims, 1995). All of the college courses were broken down into six categories based upon their general area of inquiry. The Learning Style results showed an almost even 50.5 percent of the students were concrete experiential while 49.5 percent fell into the abstract conceptual learning style (Sims, 1995).

However, the study results showed that after one quarter of college the abstract conceptual learning style dominated in academic success throughout the curriculum by almost one full grade point. This statistic becomes more important when one considers the following points:

At entry into college, the concrete experiential students were equal to, or slightly above, the high academic record of the abstract conceptual

student. At the end of only one quarter's worth of college work, the abstract conceptual students were a full grade point above the concrete oriented ones. Most significantly, the abstract conceptual dominance held across all control variables including age, race, and gender. (Sims, p.93, 1995)

These findings are significant when discussing the manner in which material is presented to students. Those students who are more abstract "thinkers" instead of concrete "doers" had more success at the collegiate level. However, the high school grade point average of each group was similar. Therefore, one must conclude that the manner of presentation must change when one reaches the college level. Significant arguments could be made to adjust the manner of presentation of material at the collegiate level. Each student deserves an equal chance to succeed. If learning styles are considered at all levels of education, more students may experience academic success.

Adapting Instruction to Accommodate Learning Style

Rita Dunn's research concerning learning styles has elicited much new and needed information concerning the manner in which people learn. Consideration of a child's learning style may make the difference between academic success and failure. Therefore, each students' style preference should be considered in all

lessons taught. For example, Dunn (1995) notes that learning styles are developed through a complex system of genetics and environment.

In every family: a) mothers and fathers tend to have styles that are diametrically opposite; b) siblings learn differently from each other; c) offspring do not necessarily reflect either of their parents' styles; and d) culturally diverse students have as many within-group as between-group differences (Dunn, 1995, p. 7-8). Moreover, Dunn revealed that only 13% of students learn best by themselves, while about 28% learn best with peers. Also, only about 28% of elementary students, 30% of middle school students, and 40% of high school students learn best in the morning. More than half of all students learn best in the late morning and early afternoon (Dunn, 1995). These important statistics indicate several discrepancies in the manner in which school systems function. Many schools are geared toward individual learning, and most systems begin school before 9:00 a.m. According to the statistics, neither of these concepts are conducive to student learning and achievement.

Dunn (1998) suggests that people's learning styles differ by ability, gender, age, and processing methods. With these concepts, she supports the utilization of learning style models within classrooms. First, Dunn notes that gifted children not only have different learning styles than underachieving

students, but also, they do not learn well with similar methods. Second, gender greatly affects a person's learning style. By nature, males are more visual, tactual, kinesthetic, and tend to be more mobile. On the other hand, females are more auditory, conforming, and prefer to work alone. Third, Dunn asserts that students' learning styles adjust as they mature and remain in school. Interestingly, very few young children are auditory or visual learners. Conversely, they tend to be more tactual and kinesthetic which would suggest the use of hands on material versus a lecture based lesson. Finally, a person's processing strategy greatly influences the ability to learn. Global or more right-processing individuals prefer soft lighting, sound, and informal seating while studying. On the other hand, analytic-left processing students prefer quiet, well-lit, and formal seating for studying. Dunn's assertions make a valid case for the utilization of learning styles adaptations in classrooms.

Moreover, Barbara Given (1998) focused her study on the effectiveness of the Dunn and Dunn learning styles model with relationship to psychological and neurobiological research. She found that the Dunn and Dunn model supports research concerning the "critical psychological needs of learners" (p. 11). The Dunn model concentrates on five domains: emotional, sociological, psychological, physiological, and environmental aspects of learning (Given, 1998). Each of these domains interacts positively with what researchers term as

basic human needs. For example, Leonard suggests that humans have “the need to be, to belong, to know, to do, and to get” (as cited in Given, 1998, p.11). The Dunn model supports these needs by allowing students to “be who they are” (Given, 1998, p. 11). Given also found that each of the five domains has a neurobiological basis. For example, the environmental domain has effects on vision, temperature, and body comfort. This suggests that when students are in their environmental comfort zone, they will learn better. All of Given’s findings lend support to the Dunn and Dunn model of learning styles.

Finally, Dunn, Griggs, Olson, Beasley, and Gormon conducted a meta-analytic study of the Dunn and Dunn model of Learning Style Preferences (Dunn et al., 1995). The authors specifically concentrated on previous studies that utilized the Dunn and Dunn model. They determined that by limiting the meta-analysis to one model they would increase the reliability and validity of their findings. Dunn and Dunn (1995) have based their model on “identifying individuals’ preferences for instructional environments, methods, and resources” (p. 354). The meta-analysis confirms the idea “that providing educational interventions that are compatible with students’ learning style preferences is beneficial” (Dunn et al., 1995, p. 357).

Summary of Review of Literature

Through the literature, the multi-faceted aspects of learning styles remains evident. Learning styles information is distributed in many different styles and for various uses within the educational framework. Different theorists have created many different learning style inventories with each inventory touting its own version of learning styles. However, all of the research indicates that regardless of the learning style inventory that is used, students tend to experience more success when they recognize their style. Students are able to capitalize on their learning style strengths and concentrate on improving their weaknesses. Moreover, the studies have shown that learning style recognition by a teacher who utilizes the information to the advantage of the student will help the student be more successful in the classroom. Therefore, using learning style inventories and teaching toward a student's learning style seems to be advantageous for all involved in the learning process.

Hypothesis

After a review of the literature, the researcher is operating under this hypothesis: There is a positive relationship between a student's learning style preference and grade in an academic core class (Math, Language Arts, Science, and Social Studies).

CHAPTER III

METHODOLOGY

This chapter will describe the methods utilized to conduct this study. First, the subjects and setting will be described. Second, the implementation of the study, and the data collection methods will be discussed. Third, the instrumentation that was used will be described. Finally, this chapter will address the following hypothesis: There is a positive relationship between a student's learning style and his or her grade in an academic core class (Math, Language Arts, Science, and Social Studies).

Subjects and Setting

This study was conducted in a rural, mid-western school district comprised of approximately 3,513 students in grades kindergarten through twelfth. The school district is located in the county seat, in a town of approximately 10,000 non-transient middle class citizens. Many of the workers are employed in local factories, area businesses, and a small percentage are farmers. Approximately 98 percent of the school population is white with the remaining percentage of students consisting of American Indian/Alaskan; .3%, Asian; .3%, Black; .2%,

Hispanic; 1.1%, and Multi-racial; .1%

The 74 subjects chosen for the study attend a seventh and eighth grade middle school where the 269 eighth grade students are split into three teams. Each team consists of four core teachers and a special education resource teacher. The ethnicity of the students is predominately Caucasian. There were 43 boys and 31 girls.

The sample consisted of all those students who took the LSI-II learning styles inventory during the first quarter of the 1999-2000 school year. Also, those same students must have first quarter grades from the studied middle school team. Those students who moved into the district after the learning styles inventory was given were exempt. Likewise, those who moved out of the district before the culmination of the first quarter were also omitted.

Instrumentation and Procedure

The two variables identified in this study are: learning style preference and academic achievement in Language Arts, Math, Science, and Social Studies.

Learning style preference was measured by the Kolb Learning Styles Inventory LSI-II (Hay/McBer, 1993). This test is designed to identify a learning style based upon a learners perception and processing of information.

Specifically, the test measures how people perceive information based on concrete experience or abstract conceptualization. Processing is evaluated based upon active experimentation and reflective observation (Sharp, 1997). The areas of perceiving and processing are added together in order to find a specific learning style.

The Kolb Inventory was chosen for several reasons. First, the random questioning of the inventory made it more reliable than other tests. The questions were placed randomly within the questionnaire so that the students were unable to recognize a pattern in the questioning. Also, the Kolb LSI-II categorized the learning style preferences into four easily understood and manageable categories. The four category distribution of the data made it easier to compile the statistics concerning the students' preferences. Moreover, the inventory was readily available and affordable to the researcher.

Specifically, the four styles contain different strengths of each learner.

Divergers are concrete and reflective learners. They utilize their senses and tend to be feeling oriented. They are best at looking at a situation or experience from many different perspectives (Sharp, 1997).

Assimilators are abstract and reflective. Watching and thinking are their strong points. They tend to be organized and logical. They are referred to as

assimilators because of their ability to integrate pieces of information into a whole (Sharp, 1997).

Convergers, are abstract and active experimenters who learn best by doing and thinking. These learners tend to be more “hands on”, and they prefer working with objects rather than people (Sharp, 1997).

Accommodates are concrete and active experimenters who learn best by utilizing their senses and by doing. These learners adapt will to new and challenging situations (Sharp, 1997).

The students grades were compiled at the end of the first nine weeks grading period which began on August 24, 1999 and terminated on October 30, 1999. The mathematics topics studied during the first nine weeks included: powers and exponents, variables, equations, expressions, inequalities, perimeter and area, and problem solving. The science concepts covered included: rocks and minerals, earth's surface, and latitude and longitude. The social studies topics studied included: geography of North America, climate, pre-historic history, and explorers. The language arts curriculum for the first nine weeks included: a review of the writing process with some short essay and creative writing, the reading and discussion of a fictional novel, grammar review, spelling and vocabulary, and proficiency review.

Data for both variables were entered into a 4x4 contingency table using crosstabs procedure (SPSS, 1995). The expected and observed frequencies of grades and the learning style category were observed. The following null hypothesis was tested: There is no relationship between a child's learning style category, and his or her achievement in the four core classes of Math, Language Arts, Science, and Social Studies.

RESULTS

CHAPTER IV

This study addressed the following hypothesis: There is a relationship between a student's learning style preference and his or her grade in an academic core class (Language Arts, Math, Science, and Social Studies). Results from the descriptive procedures will be presented.

Test results from the Kolb Learning Style Inventory (LSI-II) and the academic grades of 74 students were calculated. The LSI-II form of the learning style preference test categorized each child according to his or her strongest preference for learning. The styles include; Diverger, Converger, Accommodator, and Assimilator. The percentage of students in each category are presented in Table 1.

Table 1
Learning Style Preferences

<u>Percentage of students in each category</u>			
<u>Diverger</u>	<u>Converger</u>	<u>Accommodator</u>	<u>Assimilator</u>
28.4%	20.3%	33.8%	17.6%

The expected percentage for each learning style category was 25%. The results indicate that the diverger and accommodator categories contained higher than expected percentages of students who utilize those styles. These two categories are similar in that they both utilize the concrete experience as a learning strategy. Moreover, the converger and assimilator categories held noticeably less than 25% of the students. It is interesting to note that both of these styles lean toward abstract methods of learning.

The students' first nine weeks grades were categorized by a single letter; for example, 100%-90% =A, 89%-80% =B, 79%-70% =C, 69%-60% =D, and 59% or below =F. A 4x4 contingency table for each subject by style is displayed in Tables 2-5.

Table 2

Observed Over Expected Numbers in Each Cell of Learning Style by Grade for Language Arts

Grade	<u>Learning Styles</u>				Total
	Diverger	Converger	Accommodator	Assimilator	
A	8/3.7	7/3.7	5/3.7	7/3.7	27
B	4/3.7	1/3.7	6/3.7	3/3.7	14
C	4/3.7	5/3.7	2/3.7	0/3.7	11
D	4/3.7	1/3.7	7/3.7	3/3.7	15
F	1/3.7	1/3.7	5/3.7	0/3.7	7
Total	21/15	15/15	25/15	13/15	74/100

Table 3
Observed Over Expected Numbers in Each Cell of Learning Style by Grade for Math

Grade	<u>Learning Style</u>				Total
	Diverger	Converger	Accommodator	Assimilator	
A	10/3.7	8/3.7	7/3.7	7/3.7	32
B	6/3.7	4/3.7	5/3.7	3/3.7	18
C	1/3.7	2/3.7	6/3.7	2/3.7	1
D	4/3.7	0/3.7	4/3.7	1/3.7	9
F	0/3.7	1/3.7	3/3.7	0/3.7	4
Total	21/15	15/15	25/15	13/15	74/100

Table 4
Observed Over Expected Numbers in Each Cell of Learning Style by Grade for Science

Grade	<u>Learning Style</u>				Total
	Diverger	Converger	Accommodator	Assimilator	
A	9/3.7	7/3.7	4/3.7	6/3.7	26
B	5/3.7	7/3.7	8/3.7	5/3.7	25
C	2/3.7	0/3.7	5/3.7	1/3.7	8
D	4/3.7	0/3.7	7/3.7	1/3.7	12
F	1/3.7	1/3.7	1/3.7	0/3.7	3
Total	21/15	15/15	25/15	13/15	74/100

Table 5

Observed Over Expected Number in Each Cell of Learning Style by Grade for Social Studies

Grade	<u>Learning Style</u>				Total
	Diverger	Converger	Accommodator	Assimilator	
A	5/3.7	7/3.7	4/3.7	6/3.7	22
B	8/3.7	4/3.7	12/3.7	5/3.7	29
C	5/3.7	3/3.7	6/3.7	2/3.7	16
D	3/3.7	1/3.7	2/3.7	0/3.7	6
F	0/3.7	0/3.7	1/3.7	0/3.7	1
Total	21/15	15/15	25/15	13/15	74/100

A Crosstabs procedure was utilized to determine the numbers in each cell. The cells denote the number of observed over the number of expected students per cell in Language Arts, Math, Science, and Social Studies. The expected number of students for each cell to be evenly distributed should be 3.7 students per cell.

Some similarities are evident when looking at the students' grades and learning style preferences. First, for each core class, the A students are evenly distributed among the four learning styles. Also, many of the B students in each class were either evenly distributed among the four categories with slightly heavier influence among the diverger and accommodator categories.

Second, a majority of the C average and below grades in each class were found in the diverger and accommodator categories. Additionally, with the exception of the A students, the assimilator category rarely contained the expected number of students per letter grade or category. For the most part, the same holds true for the converger category. It is evident that the study participants were predominately divergers and accommodators.

CHAPTER V

DISCUSSION, IMPLICATIONS, AND CONCLUSIONS

The results of this study are interpreted in this chapter. Conclusions will be drawn. The limitations of this study will be addressed, and suggestions for further research will be offered.

Discussion of Results

The higher than expected numbers found in the contingency tables indicate that the predominant learning styles among the study population are diverger and accommodator. This is interesting considering that both of these styles rely heavily on concrete experience as a method for learning. Moreover, previous research supports the idea that the concrete learning style is related to academic achievement. However, this study shows that many of the A students fell evenly into all of the learning style categories. This idea supports the Dunn concept, that each student has a style preference. The results of this study seem to indicate that each student functions best when he or she recognizes and utilizes his or her style (Dunn, 1998).

Another interesting point is that in each core class, the majority of students receiving an F grade fell into the accommodator learning style. This may indicate that those students who utilize concrete experience and active experimentation combined as a learning style do not get their learning style preference met in that class. Moreover, of the cells that scored below the expected frequency, many were found in the assimilator category, or below the C average grade level. The assimilator category relies heavily on abstract thinking and reflective observation. These results may indicate that abstract conceptualization and reflective observation are constructs difficult to incorporate within the developmental age of the students. This supports Dunn's theory that as the developmental age of the student increases, their learning style may change (Dunn, 1998).

Neither of the styles that utilize abstract thinking were found as predominant learning styles for the subjects. These results correspond with earlier research that found that students who utilize the concrete experience learning style tend to have greater academic achievement, while those who process abstractly do not perform as well (O'Brien, 1994).

Limitations

The small number of students (74) may have contributed to the skewed number of diverger and accommodator learning styles. Perhaps a larger number of subjects may have shown a greater consistency among all learning styles. Also, another limiting factor of the study may have been the developmental age of the students. Since the learning styles were evenly distributed among two concrete experience styles, the researcher is inclined to believe that eighth grade subjects may still predominately rely on concrete experiences in order to learn.

Conclusions and Recommendations

The fact that the A students were evenly distributed among the four learning styles shows that they adapted well to each learning style. On the other hand, the clustering of the lower grades within two learning styles shows that their learning style did not meet the class demands, or it was not met by the type of instruction. The review of the literature supported the idea of a positive relationship between learning style and academic achievement. Further research needs to be conducted in this area, utilizing a variety of assessment techniques to measure all aspects of learning styles and academic achievement.

This researcher still supports the point of view suggested by Ertmer and Dillon (1998) asserting that educators must be aware of students' attitude and aptitude toward a specific learning style. This researcher recommends two specific courses of action be taken by each classroom teacher. First, each child's learning style should be assessed at the beginning of the school year. This would afford the teacher a more thorough understanding of each child's preferences. Second, after assessing the learning styles, the educator must adjust his or her teaching style to fit the learning styles of the students. For example, this researcher's students would benefit greatly if curriculum was presented with emphasis on concrete experiences. Using creativity and a variety of teaching techniques, an educator can target the learning styles of his or her students. As educators, we owe our students the best possible education they can have. By focusing on their learning style preferences, we will come closer to achieving this goal.

REFERENCES

- Beishuizen, J. J., & Stoutjesdijk, E. T. (1999). Study strategies in a computer assisted study environment. Learning and Instruction, 9, 281-301.
- Berry, J., & Sahlberg, P. (1996). Investigating pupils' ideas of learning. Learning and Instruction, 6, 19-36.
- Busato, V. V., Elshout, J. J., Hamaker, C., & Prins, F. J. (1999). The relation between learning styles, the Big Five personality traits and achievement motivation in higher education. Personality and Individual Differences, 26, 129-140.
- Dunn, R. (1988). Teaching students through their perceptual strengths or preferences. Journal Of Reading, 31, 304-309.
- Dunn, R. (1995). Fastback: Strategies for educating diverse learners. Bloomington, IN: Phi Delta Kappa Educational Foundation.
- Dunn, R. (1998). How children learn: the impact of learning style responsive instruction on student achievement, attitudes, and behavior. National Forum Of Applied Educational Research Journal, 11,(1) 4-9.

Dunn, R., Given, B., Thomson, B. K., & Brunner, C. (1998). The international learning-styles network: Who, when, what, where, why- and why not? National Forum of Applied Educational Research Journal, 11,(1) 24-27.

Dunn, R., Griggs, S., Olson, J., Beasley, M., & Gormon, B. S. (1995). A meta-analytic validation of the Dunn and Dunn model of learning-style preferences. The Journal of Educational Research, 88, 353-362.

Ertmer, P. A., & Dillon, D. R., (1998). "Shooting in the dark" versus "Breaking it down": understanding students' approaches to case-based instruction. Qualitative Studies In Education, 11, 605-622.

Geiser, W. (1999). Effects of learning-style-responsive versus traditional study strategies on achievement, study, and attitudes of suburban eighth-grade mathematics students. Research In The Middle Level Education Quarterly, 22,3, (3) 18-37.

Given, B., (1998). Psychological and nuerobiological support for learning-style instruction: why it works. National Forum of Applied Educational Research Journal, 11,(1) 10-15.

Hay/McBer Training Resources Group. (1993). Self-scoring inventory and interpretation booklet (Revised Scoring) [Brochure]. Boston, MA: David A. Kolb.

Jenkins, J. M. (1991). Learning styles: recognizing individuality. Schools in the Middle, 1,(12) 3-6.

O'Brien, T. P. (1994). Cognitive learning styles and academic achievement in secondary education. Journal of Research And Development In Education, 28, 11-21

Reiff, J. C. (1992). Learning styles. Washington, D. C.: National Education Association.

Riding, R. J., & Al-Sanabani, S. (1998). The effect of cognitive style, age, gender, and structure on the recall of prose passages. International Journal of Educational Research, 29, 173-185.

Riding, R. J., & Wigley, S. (1997). The relationship between cognitive style and personality in further education students. Personality and Individual Differences, 23, 379-389.

Sharp, J. (1997). Applying Kolb learning style theory in the communication classroom. Business Communication Quarterly, 60, (2) 129-134.

Sims, R. R. , & Sims, S. J. (Eds.). (1995). The importance of learning style: Understanding the implications for learning, course design and education. Westport, CT: Greenwood Press.

Silver, H., Strong, R., & Perini, M. (1997). Integrating learning styles and multiple intelligences. Educational Leadership, 55, (1) 22-27.

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