Know your Audience: An Assessment of Preferred Learning Styles of Freshman Students at Red River High School in Grand Forks, North Dakota

Kelly D. Peters

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KNOW YOUR AUDIENCE: AN ASSESSMENT OF PREFERRED LEARNING STYLES OF FRESHMAN STUDENTS AT RED RIVER HIGH SCHOOL IN GRAND FORKS, NORTH DAKOTA

by

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Bachelor of Science, Mayville State University, 1992
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A Dissertation
Submitted to the Graduate Faculty
of the
University of North Dakota
in partial fulfillment of the requirements
for the degree of
Doctor of Education

Grand Forks, North Dakota
December
2008
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# TABLE OF CONTENTS

LIST OF FIGURES ......................................................................................................... ix  
LIST OF TABLES ........................................................................................................ x  
ACKNOWLEDGEMENTS ............................................................................................. xi  
ABSTRACT ................................................................................................................... xiii  

<table>
<thead>
<tr>
<th>CHAPTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>II.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Terms</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Models</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Dunn and Dunn Learning-Style Model</td>
</tr>
<tr>
<td>Kolb’s Experiential Learning Theory (ELT) and Learning Style Inventory (LSI)</td>
</tr>
<tr>
<td>Allinson and Hayes’ Intuition-Analysis Style</td>
</tr>
<tr>
<td>Curry’s Onion Model</td>
</tr>
<tr>
<td>Convergent-Divergent Styles</td>
</tr>
<tr>
<td>Grasha-Riechmann Learning Styles Questionnaire</td>
</tr>
<tr>
<td>Gregorc’s Learning Style Delineator</td>
</tr>
<tr>
<td>Holzman and Klein’s Leveller-Sharpener Styles</td>
</tr>
<tr>
<td>Honey and Mumford’s Four Learning Styles</td>
</tr>
<tr>
<td>Kaufmann’s Assimilator-Explorer Style</td>
</tr>
<tr>
<td>Kirton’s Adaption-Innovation Style</td>
</tr>
<tr>
<td>Park’s Holist-Serialist Style</td>
</tr>
<tr>
<td>Paivios Verbalizer-Visualizer Cognitive Style</td>
</tr>
<tr>
<td>Witkin’s Field-Dependence/Field-Independence</td>
</tr>
<tr>
<td>Characteristics</td>
</tr>
<tr>
<td>Auditory Learning Style</td>
</tr>
<tr>
<td>Visual Learning Style</td>
</tr>
<tr>
<td>Kinesthetic Learning Style</td>
</tr>
<tr>
<td>Learning Styles of Gifted Students</td>
</tr>
<tr>
<td>Learning Styles of Low Achievers</td>
</tr>
</tbody>
</table>
### Instructional Strategies

- Strategies for Teaching Auditory Learners: 32
- Strategies for Teaching Visual Learners: 32
- Strategies for Teaching Kinesthetic Learners: 32
- Strategies for Teaching Cooperative Learning Groups: 33
- Strategies for Teaching All Learners: 34

### Instructional Design

- Learning Responsibility: 38

### III. PROCEDURES

- Wendy's Story—End of Semester One: 43
- Methods: 43
- Subjects: 44
- CAPSOL Style of Learning Assessment—Form B: 45
- Reliability of the CAPSOL Instrument: 45
- Collection of Data: 46
- Data Analysis: 47

### IV. RESULTS

- Wendy's Story—End of Freshman Year: 48
- Purpose of the Study: 48
- Description of Sample: 49
- Research Question 1: 49
- Research Question 2: 50
- Research Question 3: 51
**LIST OF FIGURES**

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dunn and Dunn Learning-Styles Model (Dunn &amp; Dunn, 1967)</td>
<td>16</td>
</tr>
<tr>
<td>2.</td>
<td>Kolb’s Two-Dimensional Learning Model and Four Learning Styles (Loo, 2004)</td>
<td>19</td>
</tr>
<tr>
<td>3.</td>
<td>Kolb’s Perceiving/Processing Dimensions and Four Learning Styles (Loo, 2004)</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>Curry’s Onion Model (Anderson, 1988)</td>
<td>21</td>
</tr>
<tr>
<td>5.</td>
<td>Honey and Mumford’s Four Learning Styles Model (Artess, 2003)</td>
<td>24</td>
</tr>
</tbody>
</table>
LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Means and Standard Deviations for the Nine Learning Style Scale Scores</td>
<td>50</td>
</tr>
<tr>
<td>2.</td>
<td>Means, Standard Deviations, and Percentages One Standard Deviation Above and Below the Mean for Each of the Nine Learning Style Scale Scores</td>
<td>51</td>
</tr>
<tr>
<td>3.</td>
<td>One-way ANOVA Results with Means and Standard Deviations for the Nine Learning Style Scale Scores Comparing Boys and Girls</td>
<td>52</td>
</tr>
<tr>
<td>4.</td>
<td>One-way ANOVA Results with Means and Standard Deviations for the Nine Learning Style Scale Scores Comparing Students on Free-Reduced Lunch (Yes) or Not (No)</td>
<td>53</td>
</tr>
<tr>
<td>5.</td>
<td>Means and Standard Deviations for GPA and RIT Reading, Language Usage, and Math Scores</td>
<td>54</td>
</tr>
<tr>
<td>6.</td>
<td>Correlations and Significance Levels for GPA and the Nine Learning Style Scale Scores</td>
<td>55</td>
</tr>
<tr>
<td>7.</td>
<td>Correlations and Significance Levels for RIT Reading and the Nine Learning Style Scale Scores</td>
<td>56</td>
</tr>
<tr>
<td>8.</td>
<td>Correlations and Significance Levels for RIT Language Usage and the Nine Learning Style Scale Scores</td>
<td>58</td>
</tr>
<tr>
<td>9.</td>
<td>Correlations and Significance Levels for RIT Math and the Nine Learning Style Scale Scores</td>
<td>59</td>
</tr>
</tbody>
</table>
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ABSTRACT

The goal of this research was to identify theories and describe characteristics of learning styles, assess characteristics of freshman students at Red River High School using data from the CAPSOL (Computerized Assessment and Prescription Styles of Learning) Style of Learning Assessment, MAP (Measures of Academic Progress) Scores, GPA (Grade Point Average), and North Dakota STARS (State Automated Reporting System), and justify a pedagogical and philosophical change in instruction to adapt instructional strategies to match and strengthen students' learning styles.

The research investigated the relationships between learning style scale scores, GPA, gender, RIT (Rasch Unit) Scores, and socioeconomic factors. This study focused on the 307 freshman students enrolled in the required Physical Science I class during the 2007 fall semester. Of the 307 freshman, 273 (88.93%) were accessible as subjects. The raw data from the completed CAPSOL instruments were entered into SPSS (Statistical Package for Social Sciences). A frequency summary was calculated of the percentages scores of each sub scale.

Results: From the CAPSOL data, this researcher found a normal bell-curve distribution of the nine learning style scale scores. Gender and Learning Styles: No significant differences were found in: visual, auditory, kinesthetic, individual, or group learning styles. Boys scored higher than girls on oral learning styles, while girls scored higher than boys on written, sequential, and global learning styles. Socioeconomic
Factor of Free/Reduced Lunch or Not: No significant differences were found. GPA &
RIT Scores: The mean score for GPA was 3.07/4.00 scale. This group scored above the
national average on RIT Reading, Language Usage, and Math. GPA & Learning Styles
Relationship: A significant positive relationship was identified between: visual,
individual, written expressive, and sequential. A significant negative relationship was
identified between: group, auditory, kinesthetic, and global. Relationship between
Learning Styles & RIT Reading: Students with high visual scores had higher RIT
Reading scores. Relationship between Learning Styles & RIT Language Usage:
Students with high visual scores had higher RIT Language Usage scores. Relationship
between Learning Styles & RIT Math: Students with high visual scores had higher RIT
Math scores, and students with high global scores had lower RIT Math scores.
CHAPTER I

INTRODUCTION

Wendy's Story—First Day of School

Wendy enters her first class of her freshman year in high school with excitement and apprehension. She is not quite sure what to expect from her new instructors and from her new school. This is her first "first day of school" without her dad, as he passed away last September. Wendy earns average grades, but struggles a little bit in the really "hard" classes that require a lot of reading and theory. "If I can just do the assignment without listening to the instructor, I do just fine" she thought. Wendy is a very social student that loves to work in groups, but she does not like to read in class. When working individually or in groups, Wendy pays close attention to details and likes to have everything planned out one step at a time. When studying for tests, Wendy says she has to review and re-write notes to fully understand the material. Outside of school, Wendy's mother has to work two jobs to make ends meet. Wendy and her mother are trying to keep her focused on school, but they both know that Wendy may have to obtain a part-time job this year to help make ends meet.

If Wendy's instructors knew this valuable information about her, would they be better able meet her educational needs and assist in her academic success? Would her instructors be surprised to know that most of this information is already on file within the school? More importantly, if they knew more about Wendy and how she
learns, would her instructors be able to adapt their instructional styles to meet her learning style?

The fictional student Wendy has been used throughout this dissertation to put a name and a character to the problem many students feel when instructional styles do not meet students’ learning styles. Wendy was made from various characteristics taken from several students, teachers, and personal stories told to this researcher over the past seventeen years as he served as a classroom instructor, counselor, and administrator.

Learning Styles Information

Learning style (also known as cognitive style) is “the preferred or habitual patterns of mental functioning: information processing and the formation of ideas and judgments” such that within a learner’s style the “patterns of attitudes and interests influence what a person will attend to in a potential learning situation” (Burris, Kitchel, Molina, Vincent, & Warner, 2008, p. 44). Much like there are different ways to tie a shoe, change oil on a car, or wash the dishes, there are different ways (or styles) to learning. There is a general acceptance that the manner in which individuals choose to or are inclined to approach a learning situation has an impact on performance and achievement of learning outcomes (Cassidy, 2004). If there are different learning styles, different approaches to learning, and different ways to instruct, it led this researcher to believe that the more we know about our students and how they learn, the better able we will be to meet their educational needs and facilitate their success.

By identifying learning styles and knowing more about our students, we can understand the common learning needs within individual students and/or groups of
students. Once we know how students learn, we can become cognizant of their needs and interests, and we (educators) can create curriculum that addresses the learning style needs of all learners (Johnson, 2006). Example: If an instructor has a class of 20 students, and 15 of those students demonstrate a visual learning style, wouldn’t it benefit the students to adjust instructional strategies to meet the students’ learning styles? Student learning styles can impact a variety of areas in the classroom such as environment, student praise or reinforcement, class structure, and teaching methods (Burris et al., 2008). Using a “one size fits all” instructional style will not meet the educational needs of the students, and it will not assist the students in identifying their best method of learning. When teachers recognize their own styles of learning and teaching, they are better prepared to seek alternative approaches to make sure all students “get it” (Dresden, 2007). If we can provide the students and instructors with the knowledge, skills, and abilities to identify, understand, and use learning styles, won’t they be more successful in school and in future education and/or training?

Problem Statement

The truth of the matter is that we all have different learning styles, and the way most educators teach does not match the way most students learn. Most teachers persist in presenting information in a “chalk and talk” format. This works for students who have logical/mathematical and linguistic forms of intelligence. It does not work so well, for instance, for those students who prefer to learn in kinesthetic (physical) or interactive modes. It’s also time for schools to teach students how to learn, before they start teaching individual subjects. (Nicholl, 2003, p. 11a)

This researcher surmises that instructors at every level (elementary, secondary, and post-secondary) instruct the way they learn. If your instructor is a visual learner, he/she may provide a lot of visual examples and does activities on the board. If your
instructor is an auditory learner, he/she may provide a lot of lecture and storytelling of the material. If the instructor is teaching the best way he/she learns, is he/she meeting the educational needs of the students? By instructing to his/her strength and not the strength of the students, isn’t the instructor hindering the students’ ability to understand and retain information presented in the classroom? We do not all learn in the exact same way, so if the course structures were to acknowledge only one learning style, many of us would struggle (Patrick, 2004). In order to better meet the educational needs of our students, instructors need to be able to identify and understand learning styles, identify characteristics that align with students’ learning styles, and modify instructional strategies to align with students’ learning styles.

Through analysis of learning styles as identified by the CAPSOL Style of Learning Assessment and identification of student characteristics derived from the North Dakota State Automated Reporting System (STARS) and PowerSchool, this researcher attempted to answer the research question: Are there identifiable student characteristics (CAPSOL scores, gender, GPA, MAP Scores, etc.) that align with student learning styles?

Significance of Problem

Secondary school instructors who teach in the core and elective courses encounter every learning style and preference currently researched and published. By identifying common characteristics and describing the preferred learning styles, instructors can examine their students’ learning styles, their own instructional styles, and develop instructional strategies accordingly to better meet the students’ educational needs.
needs. When our clients change, we must change with them so that heuristic goals can be met (Stevenson & Dunn, 2001). Although many K-12 teachers and college professors “teach like they have been taught,” our current times call for new strategies and instructional delivery methods.

Research Questions

1. What were the means and standard deviations for the learning style scale scores (visual, auditory, kinesthetic, individual learning, group learner, oral expressive, written expressive, sequential, and global learning) of freshman students enrolled during the fall semester of 2007 at Red River High School?

2. What percentage of the various learning style scores were one standard deviation over the mean learning style scale score?

3. Were there differences in boys and girls on the learning style scores?

4. Were there differences by socioeconomic status (free-reduced lunch or not) on the learning style scale scores?

5. What were the means and standard deviations for GPA and Rasch Unit scores (RIT scores) at the end of the first year and the learning style scale scores?

6. Was there a relationship between GPA and the nine learning style scale scores?

7a. Was there a relationship between learning styles and the RIT Reading score?
7b. Was there a relationship between learning styles and the RIT Language Usage score?

7c. Was there a relationship between learning styles and the RIT Math score?

Definition of Terms

*Auditory language learner.* The learner’s preference for listening, understanding spoken directions, following logic that is explained verbally, and addressing background sounds—whether supportive or disruptive (Styles of Learning, n.d.)

*Bodily-kinesthetic learner.* The learner’s preference for understanding by actively touching, manipulating, arranging, acting, showing and experimenting with various physical approaches by experiencing first-hand (Styles of Learning, n.d.).

*CAPSOL (Computerized Assessment and Prescription Styles of Learning).* A comprehensive instrument that will identify a student’s style of learning. The CAPSOL assesses nine modes of learning (auditory language, visual, bodily-kinesthetic, individual learner, group learner, oral expressive, written expressive, sequential, and global) (Styles of Learning, n.d.).

*Global learner.* The learner’s preference for “big picture” understanding and addressing information whole to part, internalizing the “why,” wanting to know what will this become, and if I learn this information, where can I apply it in the real world (Styles of Learning, n.d.).
Group learner. The learner’s preference for collaboration with one or more other students in planning, discussing, sharing responsibility, organizing, listening, and supporting a point of view leading to a product (Styles of Learning, n.d.).

Individual learner. The learner’s preference for addressing acquisition of knowledge from an individual perspective, comparing new information with previous experience and reflecting understanding through their own opinions and models of perception (Styles of Learning, n.d.).

MAP (Measures of Academic Progress). A state-aligned computerized adaptive assessment program developed by the Northwest Evaluation Association (NWEA) that provides educators with the information they need to improve teaching and learning. MAP has also been called NWEA in various school districts. Educators use the growth and achievement data from MAP to develop targeted instructional strategies and to plan school improvement. With the ability to test students up to four times a year, MAP test results help educators make student-focused, data-driven decisions (Northwest Evaluation Association, n.d.a).

Oral expressive learner. The learner’s preference for expressing their understanding and insight through spoken description or through questioning of ideas, concepts or facts (Styles of Learning, n.d.).

RRHS (Red River High School). A Class “A” high school located in Grand Forks, North Dakota, with a current enrollment of 1,156 students in Grades 9-12 (State Automated Reporting System, n.d.).
**Sequential learner.** The learner’s preference for information and procedures that are based on logic, timeliness, ordering, prioritizing, and the use of inferences, including timelines, flow-charts, diagrams, etc (Styles of Learning, n.d.).

**STARS (North Dakota State Automated Reporting System).** Online reporting system that was developed for the North Dakota Department of Public Instruction (DPI) to report education-related statistics.

**Visual learner.** The learner’s preference for visually gathering and comprehending information through reading, observing models, maps, graphic organizers, charts, and demonstrations, and to internalize their own perspective (Styles of Learning, n.d.).

**Written expressive.** The learner’s preference for expressing their understanding and insight through written descriptions, questioning, and word processing emphasizing cut/paste approaches, and drawing conclusions (Styles of Learning, n.d.).

Acronym and Abbreviation List

1. CAPSOL—Computerized Assessment and Prescription Styles of Learning
2. GPA—Grade Point Average
3. MAP—Measures of Academic Progress
4. NWEA—Northwest Evaluation Association
5. RIT Score—Rasch Unit
6. RIT Range—Rasch Unit Range of RIT Scores
7. RRHS—Red River High School
8. STARS—North Dakota State Automated Reporting System
Assumptions of the Study

Students were candid and impartial with their responses on the CAPSOL learning style preference questionnaire.

Researcher Bias: At the time of the study, this researcher was an associate principal at Red River High School, where the research was conducted.

Limitations

The responses were limited to enrolled ninth-grade students in the general education Physical Science I classes at RRHS beginning in the fall semester of 2007.

Summary

In Chapter II, this researcher has outlined current research on learning style models, characteristics of learning styles, instructional strategies, learning responsibility, and instructional design. In Chapter III, this researcher has outlined methods used for data collect and analysis, subject demographics, and CAPSOL data. In Chapter IV, this researcher has outlined the research questions complete with tables and data. In Chapter V, this researcher stated the conclusions from the research questions, recommendations for educators (instructors and administrators), and recommendations for school board members (budgetary line-item consideration).
CHAPTER II
REVIEW OF LITERATURE
Wendy's Story—Mid-Term of First Quarter

As the first quarter moves along, Wendy has been able to stay focused and attentive in most of her classes. Fall is a busy time of year for Wendy as she is playing volleyball and working a part-time job some nights and on weekends. At mid-term of the first quarter, Wendy has earned pretty good grades, but she has to put a lot of extra time into re-writing her notes, reviewing the material, and trying to stay ahead of the homework in her “hard” classes like Algebra I and Physical Science I. These required classes are pretty full, and the instructors spend most of their time “teaching to the masses,” and little time with individual instruction. Wendy is doing okay for now, but she wishes she could understand the material better the first time it is presented in class.

In late October, one of the career counselors from the school visited Wendy’s Physical Science I class to talk about careers, success in high school, and to conduct a study on learning styles. Wendy took the CAPSOL Style of Learning Assessment during one class that showed that her dominate learning style was bodily-kinesthetic, she liked to work in groups, she had a high preference for written expression, and she was a step-by-step or sequential learner. This information made sense to Wendy, and she felt she knew herself better and was better able to meet her own learning needs based on what she learned from the CAPSOL. However, she wondered if this
information was ever given to her instructors? If it was, she believed the instructors
would be able to understand her better, and they could better meet her educational
needs.

Review of Literature

While not all students learn in the same manner or at the same speed, the more
we know about learning styles and student characteristics, the more prepared we will be
to understand how our students learn, identify student characteristics associated with
learning styles, and adapt instructional styles to meet students’ learning styles. It has
been demonstrated through research that there is significant improvement in academic
achievement, student attitudes, and student behavior when individual learning styles are
accommodated through complementary teaching styles, teaching techniques, or
resources (Griggs, 1985). One instructor wrote, “I found that if I could offer
educational alternatives and individualize the learning experience, the end result
improved and the course evaluation increased” (Heffler, 2001, p. 307). Students learn in
a variety of ways, and their ability to attain this information also varies. A student’s
capacity to learn is impacted by a teacher’s style of conveying information (Al-Balhan,
2007). In the coming paragraphs, this researcher outlined current research on learning
style terms, models of learning styles, learning style characteristics, strategies, learner
responsibility, and instructional design. This list was not intended to be fully inclusive.

Terms

Learning style is the way in which each learner begins to concentrate on,
process, internalize, and retain new and difficult information (Dunn & Dunn, 1993b;
Gremli, 1996). A learning style has also been described as a biologically and
developmentally imposed set of personal characteristics that make the same teaching (and learning) methods more effective for some and less effective for others (Davis & Franklin, 2004). R. Dunn defined learning styles in the following manner at the 16th Annual Leadership Institute in New York City: “Learning style is the missing link to individualizing or personalizing learning for each student. If students don’t learn the way we teach them, then we must teach them in the way they learn best” (Dunn & Dunn, 1993a, p. 53). Learning style is what it says. It is the style in which the student learns the material presented to him/her. Personal, physical, emotional, psychological, and developmental traits all have an influence on how a student learns.

For educators, learning styles can be determined through direct student observation. What we discover is that learning styles function as teaching blueprints in some respects. Vincent and Ross (2001) indicated a student’s preferred method of learning and guide the development of instructional strategies that incorporate the appropriate content and context. Yerxa commented: “Simply being aware that there can be different ways to approach teaching and learning can make a difference” (cited in Cassidy, 2004, p. 420). While being aware of learning styles is the first step, it is the first step of a never-ending journey to meet the changing needs of our students. Instructors may develop an understanding of learning styles and even develop tools and instructional strategies to adapt their instruction to the students’ learning styles, but instructors must realize that this process is on-going and ever changing. Each day the diversity of students grows within the confinement of our classrooms, so teachers have to tirelessly keep abreast with their research of diverse teaching strategies to reach all students (Furner, Noorchaya, & Duffy, 2005). As new students enter the classroom,
instructors must evaluate, identify, and adapt to meet the needs of their students. Instructors have to know more than the material. They must know how their students, their "audience" learns, and what they can do to meet their needs. Simply being the expert in the room is not enough. Instructors must know their students.

This statement goes back to an old marketing theory this researcher (and former business education instructor) remembered from undergraduate school, "Know your audience." For educators, we have to know the best way to reach our students to maximize their learning. Most children have a number of different intelligences and learning styles and can be engaged in a variety of ways (Hoerr, 2002). If not all students learn the same or at the same speed, we need to find out how they learn best and develop techniques for meeting their needs. A better understanding of learning styles can benefit not only educators through better development of lesson plans and dissemination of information across the spectrum of learning styles, but also their students as they all are taught in ways that promote their individual opportunities to learn (Alder, 2000; Vincent & Ross, 2001). Students benefit by using knowledge about their particular learning style to better manage their learning. Students whose learning styles are compatible with the teaching styles of an instructor tend to retain information longer, apply it more effectively, learn more, and have a more positive attitude toward school in general (Al-Balhan, 2007). The more we know about our audience, the better prepared we will be to meet their educational needs, the students will retain the information longer, and their attitudes will improve. "Know your audience."

How do we identify and understand a person's learning style? Dunn and Dunn (1993b) suggested the following:
To identify a person's learning style pattern, it is necessary to examine each individual's multidimensional characteristics to determine what is most likely to trigger each student's concentration, maintain it, respond to his/her natural processing style, and cause long-term memory. To reveal that, it is necessary to use a comprehensive model of learning style because individuals are affected by different elements of style and so many of the elements are capable of increasing academic achievement for those to whom they are important within a short period of time—often within 6 weeks. (p. 2)

**Models**

In the next section, this researcher outlined current research regarding models of learning styles. Two of the most popular, widely published, and widely used are listed first: Dunn and Dunn Learning-Style Model and Kolb’s Learning Styles Inventory. This list was not intended to be fully inclusive of all the published learning styles.

**Dunn and Dunn Learning-Style Model**

"Many people can learn things that are easy for them without using their learning styles, but all people can learn new and difficult information better when they capitalize on their styles" (Dunn & Dunn, 1998, p. 3). This model was focused on identifying individuals' preferences for specific instructional environments, strategies and resources, and the extent to which each approach either fosters or inhibits academic achievement (Dunn, Denig, & Lovelace, 2001). The Dunn and Dunn Learning-Style Model is based on the following theoretical cornerstones:

1. Most individuals can learn.
2. Instructional environments, resources, and approaches respond to diversified learning style strengths.
3. Everyone has strengths, but different people have very different strengths.
4. Individual instructional preferences exist and can be measured reliably.
5. Given responsive environments, resources, and approaches, students attain statistically higher achievement and attitude-test scores in matched, rather than mismatched treatments.
6. Most teachers can learn to use learning styles as a cornerstone of their instruction.

7. Many students can learn to capitalize on their learning style strengths when concentrating on new or difficult academic material. (Dunn & Dunn, 1993a, p. 6)

Dunn and Dunn (2006) stated that each student’s learning style is based on a complex set of reactions to various stimuli, biologically-inherited traits, and previously established behavior patterns. There is a tendency for those behavior patterns to repeat when students concentrate on new and difficult material. Addressed by this model were 21 unique elements classified into five stimulus strands that describe how students learn most efficiently based on their personal strengths (Honigsfeld & Dunn, 2006).

Although no one is influenced by all 21 elements, most students are affected by between 6 and 14. Those 21 elements are classified into environmental, emotional, sociological, physiological, and psychological variables:

**Environmental:** Students respond differently to the amount of light and sound and the temperature in their environment as they learn new and difficult academic content. In addition, some prefer more formal seating (e.g., hard chairs) whereas others prefer casual, informal seating (e.g., sofa).

**Emotional:** Some students are consistently highly motivated to begin and remain focused on an academic task until it has been completed; these students are called persistent. They often, but not always, provide their own structure for completing a task. Others rely on directives of teachers or peers to initiate a task, remain focused, and provide structure. Some do as they are required; others do the opposite of what they are supposed to do (conformists versus non-conformists).

**Sociological:** Some students learn best when studying alone; others when studying with peers or in pairs, and still others when studying with an authority figures. Some function in varied ways, whereas others learn best in a single pattern.

**Physiological:** Time of day, snacking while concentrating, and the ability to literally move from place to place also affect how well a student is able to learn new and difficult information.
Psychological: Students may process challenging academic information analytically, globally, or as an integrated learner who can learn through a combination of styles. Students may therefore master new and difficult content quite differently from each other. Analytics learn facts in a step-by-step sequence, gradually building to increased understandings by first examining the individual parts of a concept—the facts. Global processors learn best through an initial overview of the content or concept to develop an understanding of how the content relates to them before they can focus on the facts related to it. Integrated processors can learn almost anything if they are interested in the topic.

Processing Style: Some students learn best by hearing (auditory) complex material, others by reading or seeing it (visual), others when able to manipulate items with their hands (tactual, as when “doodling” or taking notes), and still others learn most effectively when moving while they are concentrating (kinesthetically—as when tapping their feet or walking). (Dunn et al., 2001, p. 10-11)

Figure 1. Dunn and Dunn Learning-Styles Model (Dunn & Dunn, 1967).
Kolb's Experiential Learning Theory (ELT) and Learning Style Inventory (LSI)

The LSI was first developed in 1976, and revised in 1985 (LSI-II), and was designed to measure the degree to which individuals display one of the four learning styles (divergent, assimilator, accommodator, and converger) derived from experiential learning theory (Klein, McCall, Austin, & Piterman, 2007; Manochehri & Youg, 2006). The focus of this model was on how individuals perceive and process information.

According to the ELT, the learning process was divided into four learning modes in terms of information perception and processing by learners: concrete experience (CE; experiencing) which favors experiential learning and real situations that are personally and immediately relevant to the individual, and emphasizes feeling as opposed to thinking; reflective observation (RO; reflecting) where extensive consideration is given to the task and potential solutions before there is any attempt at action, learning by watching and listening, and carefully observing before making judgments; abstract conceptualization (AC; thinking) where there is a preference for conceptual and analytical thinking in order to achieve understanding, focusing on using logic, ideas, and concepts; and active experimentation (AE; doing) which favors experiential learning involving active trial-and-error learning, learn by doing, ability to get things done, risk-taking, influencing people and events through action (Cassidy, 2004; Mestre, 2006; Wang, Wang, Wang, & Huang, 2006). A proposal of the ELT was that individual learning styles can be characterized on the basis of individual preference using his four principal learning theories (Engleberg, Schwenk, & Gruppen, 2001).

Concrete Experience (CE): Promotes the act of learning through experience. Students, who prefer to learn through CE value relationships with other people,
make decisions based on intuition, and tend to be more concerned with feelings as opposed to thinking.

**Reflective Observation (RO):** Promotes the act of learning through reflection. Students who prefer to learn through RO have the ability to consider and appreciate a variety of different viewpoints and perspectives and conduct thorough observations when making judgments.

**Abstract Conceptualization (AC):** Promotes the act of learning through careful thought. Students who prefer to learn through AC appreciate the use of logic and systematic planning when analyzing ideas and utilize a scientific approach when trying to solve a problem or make a decision.

**Active Experimentation (AE):** Promotes the act of learning by doing. Students who prefer AE are willing to take risks, strive to accomplish tasks, and desire to exert an influence on others through action. (Burris et al., 2008, p. 45)

Kolb based his theory of experiential learning on peoples' different approaches to perceiving and processing information, information integration, and non-dominant modes of expression while resolving the tension between the abstract-concrete and active-reflective orientations (Jones, Reichard, & Mokhtari, 2003; Manochehri & Young, 2006). In developmental terms, Kolb outlined three orders of learning styles. Included in the first were the specialized or basic learning styles (diverging, assimilating, converging, and accommodating). Represented by the second-order learning styles, were learning orientations and a combination of dialectics of the learning process. The third-order learning styles have three balanced learning profiles (De Jesus, Almeida, Teixeira-Dias, & Watts, 2007). An individual's developmental stage, experience he/she has while learning and the learning environment, all play a significant role in the learner's ability to learn.
To illustrate the theory, Kolb combined a horizontal axis of perceiving with a vertical axis of processing, and placing the axes within a circle. The axes also created four quadrants of learners with different learning style types (Loo, 2004).

![Kolb's Two-Dimensional Learning Model and Four Learning Styles](image)

**Figure 2.** Kolb's Two-Dimensional Learning Model and Four Learning Styles (Loo, 2004).

*Divergers* learn by combining concrete experience with reflective observation to create a learning style that can view concrete situations from many points of view. *Assimilators* thrive by reflecting on abstract concepts, are best at understanding a wide range of information, and putting the information in concise-logical form. Assimilators show a preference for attending lectures and writing papers. *Convergers* take abstract ideas and actively experiment to find practical uses for the ideas and theories by finding solutions to problems. *Accommodators* take concrete experiences mixed with active experimentation in a hands-on experience and learn through “gut feelings” rather than from logical analysis. Accommodators show a preference for group work and prefer
active participation over passive or reflective situations (Johnston, 1997; Jones et al., 2004; Loo, 2004).

Figure 3. Kolb’s Perceiving/Processing Dimensions and Four Learning Styles (Loo, 2004).

*Allinson and Hayes’ Intuition-Analysis Style*

Developed in 1996 in an effort to operationalise cognitive style for use in the area of management, the Allinson and Hayes’ Intuition-Analysis Style is focused on the dimension of intuition versus analysis which, Allinson and Hayes argued, represents a super-ordinate dimension of cognitive style. Right-brain orientation characterized by intuition with a tendency for rapid decision making based on feeling and the adoption of global perspective. Left-brain orientation is characterized by analysis where decisions are a result of logical reasoning focusing on detail (Cassidy, 2004).
Curry's Onion Model

Using the way in which learning/cognitive style is measured to propose a layer-like model of learning behavior; Curry utilized a four-layer onion metaphor to illustrate inner and outer layers of the construct (Cassidy, 2004). The layers are:

Preferred Environment: The individual’s preferred choice of learning environment. It is described as the outermost layer, the most observable layer and the layer most susceptible to influence, making it the least stable level of measurement.

Social Interaction: Provides the next layer and relates to the individual’s preference for social interaction during learning.

Intellectual Approach: The third and most stable layer is described as the individual’s intellectual approach to the processing of information.

Cognitive Personality Style: This appears the most robust component, described as a relatively permanent personality dimension . . . apparent only when an individual’s behavior is observed across many different learning situations. (Cassidy, 2004, p. 423)

Figure 4. Curry’s Onion Model (Anderson, 1988).

Convergent-Divergent Styles

Convergent style is characterized by the generation of the one accepted correct answer from the available information and divergent style as a propensity to produce a number of potentially acceptable solutions to the problem (Cassidy, 2004).
Grasha-Riechmann Learning Styles Questionnaire

Described in the Grasha-Riechmann Learning Styles Questionnaire are the six types of learning styles—competitive (students who learn to out-perform others), collaborative (students who share ideas with others), avoidant (students who are not enthusiastic about attending class), participant (the “good citizens” of the class), dependent (students who show little intellectual curiosity), and independent (confident in learning abilities). Dependent learners generally prefer a teacher-directed, highly structured course with explicit reading and class assignments, and a predetermined number of tests. Collaborative learners generally prefer discussion, as much student interaction as possible, group projects, collective assignments, and case studies. Independent learners like to have some influence on the content and structure of the course, have a say on the number of tests given, and have the instructor serve as a resource person rather than a formal lecturer (Butler & Pinto-Zipp, 2006; Charkins, O’Toole, & Wetzel, 1985).

Gregorc’s Learning Style Delineator

Gregorc required the subject to complete a matrix consisting of ten sets of four words and rank the words based on the first reaction to the words. Gregorc described four distinctive and observable behaviors: abstract, concrete, random, and sequential tendencies. A combination of these tendencies is indicative of individual style. These tendencies are reflective of in-born predispositions but individuals need to be capable of functioning outside their natural style (Butler & Pinto-Zipp, 2006; Cassidy, 2004).
Holzmann and Klein’s Leveller-Sharpener Styles

An examination of the complexity with which the individual perceives the task was introduced in 1954 by the Holzmann and Klein Leveller-Sharpener Styles model. The leveler has a tendency to oversimplify their perceptions of the task, assimilating detail and reducing complexity. The sharpener fails to assimilate effectively but instead introduces complexity, treating each piece of detail or event as novel. Assimilation is the dimension defining this particular cognitive style, with levelers and sharpeners being positioned at the extremes of the continuum (Cassidy, 2004).

Honey and Mumford’s Four Learning Styles

Activists are open to, enjoying learning from and actively participating in new experiences, liking a wide range of different activities, and immersing themselves fully and without bias in new activities, gregarious people, constantly involving themselves with others, dominated by immediate experiences and primarily interested in the hear and now, liking to initiate new challenges and to be the center of attention. Reflectors learn best when there are opportunities to sit back and review activities from many different perspectives, they like to observe and ponder experiences from many different perspectives, they collect data and think deeply about these before coming to any conclusions, they are good listeners, cautious and tend to adopt a low profile. Theorists fit experiences into theories and learn best when there is time to methodically explore the associations between ideas and situations, they think problems through in a vertical, step-by-step and logical way, they like to analyze and synthesize, they like to adopt a logical and rational approach to problem-solving but need structure with a clear purpose or goal, they tend to be perfectionists who will not rest easy until things are tidy and fit.

23

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into their rational scheme. Pragmatists are keen on trying out ideas, theories, and techniques to see if they work in practice; are eager to try out new ideas to see if they work; like to experiment, act quickly and confidently, practical and down to earth (Burdett, 2001; Downing & Chim, 2004; Rawaf, 2007).

Figure 5. Honey and Mumford’s Four Learning Styles Model (Ar tess, 2003).

Kaufmann’s Assimilator-Explorer Style

Kaufmann defined style in terms of an individual’s propensity to solve problems through either novel or familiar strategies. The style was developed around problem-solving behavior and has a close association with the use of creativity (Cassidy, 2004).

Kirton’s Adaption-Innovation Style

Kirton introduced an adaption-innovation dimension along which cognitive style could be measured with adaptors characterized by the desire to do things better and innovators by the desire to do things differently. Grounded in an assumption that
cognitive style is related to creativity, problem solving and decision-making strategies as well as aspects of personality, Kirton argued that style develops early in life and remains stable over both time and situation (Cassidy, 2004).

**Pask's Holist-Serialist Style**

The Pask Holist-Serialist learning style is related to the left and right brain function and the tendency of individuals to favor one side of the brain or the other when processing information (Smith, 2002). Serialists operate a step-by-step approach to learning, choosing to deal only with small amounts of information or material at any one time before going on to link these steps and achieve understanding. Holists utilize significant amounts of information from the start, looking to achieve understanding by identifying and focusing on major patterns or trends in the data. While both groups use different processes for learning, both groups achieve a similar level of understanding in the end (Cassidy, 2004).

**Paivios Verbalizer-Visualizer Cognitive Style**

The verbalizer-visualizer cognitive dimension is assessed through tests examining individual’s ability to generate information not present but dependent upon the presence of a spontaneous image. Individuals capable of responding quickly are considered visualizers and those with slower response rates, verbalizers. The fact that individuals have preferences for either visual or verbal thought has implication for learning (Cassidy, 2004).

**Witkin's Field-Dependence/Field-Independence**

Field-dependence/field-independence is essentially an individual’s ability to identify embedded figures in perceptual tasks—likened to spatial intelligence—and is
associated with the ability to take out embedded figures in non-perceptual problem solving tasks (Cassidy, 2004).

**Field-Independent Learners:** Characterized as operating with an internal frame of reference, intrinsically motivated with self-directed goals, structuring their own learning, and defining their own study strategies.

**Field-Dependent Learners:** Characterized as relying more on an external frame of reference, are extrinsically motivated, respond better to clearly defined performance goals, have a need for structuring and guidance from the instructor, and a desire to interact with other learners.

**Kagan's Impulsivity-Reflexivity:** This is measured using the Matching Familiar Figures Test (MFFT) which requires familiar line drawing of objects to be matched against several possibilities. Individuals who make quick responses after briefly scanning the alternatives are labeled "cognitive impulsives" while those who scrutinize each alternative before making a final decision are labeled 'cognitive reflectives.' (Cassidy, 2004, p. 425-426)

Characteristics

In the next section, this researcher examined the most common classifications of learning styles: auditory, visual, and kinesthetic. Once educators know and understand the basic types of learners described in this research, they can plan instruction that accommodates the needs of each student. By addressing learning styles, educators will help students develop their weaker learning modalities as well as their stronger, more natural ones (Mixon, 2004). Learning style is evaluated in terms of selected elements, including the immediate environment (sound, light, temperature, design), emotionality (motivation, personality, responsibility, structure), sociological preferences (learning alone, with a colleague or adult, and/or in a variety of other ways), physiological characteristics (auditory, visual, tactual, an/or kinesthetic, time-of-day energy levels, intake, and mobility needs), and global versus analytic (determined through correlations among sound, light, design, persistence) (Dunn & Dunn, 1993a).
When identifying the learning styles, the instructor must know which characteristics can be mapped and identified and which cannot. By being aware of the characteristics and their relevance for the learning style, the instructor is better able to estimate the results of the instructional change and make more meaningful applications during the teaching process (Graf, Viola, Leo, & Kinshuk, 2007). The instructor will be able to identify what he/she can change to make meaningful differences within the classroom. Instructors look for evidence beyond chance and ask, “How can I better serve my students?” (Ojure & Sherman, 2001, p. 33). The instructor will be able to answer the question, “What can I control and change to meet the needs of my students?”

*Auditory Learning Style*

Auditory learners enjoy listening and talking and having outgoing personalities and difficulty with written instructions, they learn best by listening to an explanation (Kanar, 1998; Vincent & Ross, 2001). Auditory learners approach education experiences effectively through listening. These learners process verbal instruction easily and this type of learning has traditionally been rewarded in educational settings (Mixon, 2004). These learners are most likely to listen attentively to people talk and can catch important points in lectures. Auditory learners also seem to be able to catch lyrics of songs and specific sounds, and remember them quickly (Burdett, 2001).

Although education is continually evolving, there are a large number of “old school” instructors who still practice the “sit and get” style of teaching. The students “sit” in the desks and “get” what the instructor verbally throws at them. If the student is an auditory learner, his/her learning style is being rewarded. In the classroom, small group activities or group discussions may be the most effective teaching-learning
strategies for auditory learners (Sayles, 2005). If the student is not an auditory learner, he/she may not receive the full benefit from the educational environment.

*Visual Learning Style*

Visual learners have vivid imaginations, learn by seeing images, they benefit from seeing graphic representations, visual models, and demonstrations of skills and concepts, must see to understand and they learn best by reading and watching (demonstrations, videos, television, readings, etc.), are quiet by nature, and find verbal instructions difficult (Burdett, 2001; Kanar, 1998; Vincent & Ross, 2001). Writing words or drawing figures will help these students learn new content along with the use of notes on bright colored paper, index cards or flash cards may stimulate knowledge retention for visual learners (Mixon, 2004; Sayles, 2005). During classroom activities, it is necessary to use visual materials frequently such as graphics, pictures, posters and photographs (Cirkinoglu & Demirci, 2007). If the visual student is stuck in/with an auditory classroom with an instructor who practices the “sit & get,” the student may struggle and not feel comfortable in the learning environment.

*Kinesthetic Learning Style*

Kinesthetic students acquire their knowledge through movement, touch, feeling an object, and tactile images (Burdett, 2001; Sayles, 2005). They are poor listeners, learn by doing, express emotions physically, and have an outgoing personality, they must touch or feel to understand, they learn best by engaging in hands-on activity (Kanar, 1998; Vincent & Ross, 2001). Traditionally, this type of learner has been the most neglected in education settings, and they may require faculty guidance in defining his/her learning style; identifying effective strategies of their secondary learning style;
appropriate techniques to manage the classroom activities/stimulus; these students can use their body in very expressive skilled ways for a distinct purpose, they have fine motor skills, and they can manipulate objects rather easily (Mixon, 2004; Nolen, 2003; Sayles, 2005). When you think about the traditional classroom (instructor in front of the class, students in desks, desks in nice-neat rows, students awaiting the knowledge to be spouted by the instructor), how is a tactile student going to learn in this environment? With the "old school" instructors still practicing "sit & get," the tactile/kinesthetic student is left out in the cold.

In the next section, this researcher outlined the learning styles of students at opposite ends of the learning spectrum: gifted and low achievers. To examine the students at the polar opposite ends of the learning spectrum, this researcher believed instructors would be able to compare and contrast the two learning styles and develop instructional strategies to meet both groups' learning style needs.

Learning Styles of Gifted Students

While not all students (gifted or otherwise) have the same learning style, gifted students and their peers have learning styles that vary from those of underachievers. Gifted students prefer kinesthetic (experiential and active) and tactile (hands-on) instruction, many are able to learn through auditory and visual methods. Gifted students preferred to learn by themselves or with an authoritative teacher, and although some gifted students learn well early in the morning, many more prefer late morning, afternoon, or evening for concentrating on challenging academic studies (Dunn, 1996).
Learning Styles of Low Achievers

While not all students (low, underachievers, high risk for dropout, or otherwise) have the same learning style, underachieving students and their peers have learning styles that vary from those of gifted students. Underachievers tend to have poor auditory memory. If they learn visually, it is usually through pictures, symbols, graphs, comics, and cartoons rather than by reading text. Although these students want to do well in school, their inability to remember facts through lecture, discussion, or reading contributes to their low performance in traditional schools (Dunn, 1996).

High-risk students and dropouts, and students who perform well in school are discriminated by seven learning style traits. Most low achievers and dropouts need:

1. Frequent opportunities for mobility.
2. Reasonable choices of how, with which resources, and with whom to learn.
3. A variety of instructional environments, materials, and sociological groupings rather than routines and patterns.
4. To learn during later morning, afternoon, or evening hours.
5. Informal seating (beanbag chairs, cushions, etc.).
6. Soft illumination—bright or fluorescent light may contribute to hyperactivity.
7. Introduction to materials with tactile or visual resources, reinforced with visual or kinesthetic resources; or an introduction to materials with kinesthetic or visual resources, reinforced with visual or tactile resources. (Dunn, 1996, p. 5)

In the next section, this researcher outlined instructional strategies for auditory, visual, and kinesthetic learning styles, along with strategies for cooperative learning groups and strategies for all learners. To examine the various strategies, this researcher believed instructors would be able to develop instructional strategies and classroom activities that would meet existing learning styles and strengthen the learning styles that are not as well developed.
Instructional Strategies

The art of teaching means tailoring instruction to learning styles to offer a more pervasive and precise way of defining and meeting individual differences, thereby personalizing the relationship between the student and the teacher (McCarthy, 1990; Stewart, 1990). In the classroom, effective teaching and learning is a two-way process. The instructor has to “know the audience” and be able to adapt his/her instructional strategies to the students’ learning styles. Recognizing and responding to the students’ needs would be the mark of the ‘professional teacher,’ described by Darling-Hammond (1998) as “one who learns from teaching rather than one who has finished learning how to teach” (p. 7). The students who know and understand their learning style are able to focus their time and energy into learning the material in a way that is best suited for them, they are able to develop their weaknesses in their non-dominate learning styles, and they are able to take responsibility for their learning and become a self-advocate to inform instructors how he/she learns best. The argument here is that a greater awareness and deliberateness in this approach will yield improved performance in learning and teaching (Rayner, 2007).

When working with learning styles, the instructor has to be able to identify learning styles and instruct using techniques that will address a student’s strengths and weaknesses. “Once the learning styles have been identified, instructors can estimate the approach(es), method(s), and sequence(s) that are likely to make learning relatively comfortable for each person” (Dunn & Griggs, 2000, p. 19). A teacher will attempt to work with the learning styles but, from time to time, he/she will flex preferred approaches to learning, stimulate the growth of new strategies, and challenge the
learner(s) to adapt to new knowledge in a different way. A teacher should teach to all learning styles to prevent students from becoming too reliant on one approach to learning recognizing that they may all be present within the same class of students (Cho & Fored, 2002; Muse, 2001; Rayner, 2007). The instructor and the students are responsible for identifying, understanding, and developing dominate and non-dominant learning styles in the student. The instructor cannot just teach to the students’ strengths, and the students have to be able to develop their areas of learning-style weakness.

Strategies for Teaching Auditory Learners

Teachers of auditory learners need to provide as much auditory/verbal stimuli/reinforcement as possible. Examples of stimuli/reinforcement include verbal reinforcement, group activities, class discussion, reading aloud, arranging information in rhythmic patterns such as poems or songs, making tapes of class notes, stressing the importance of class discussion participation, reading assignments out loud, and reading written assignments out loud (Bell, 1998; Vincent & Ross, 2001).

Strategies for Teaching Visual Learners

Teachers of visual learners need to provide multiple visual clues such as using video equipment (films, projection viewers, PowerPoint); providing assignments in writing; using charts and pictures; using overlays, charts, and pictures; using bright colors for bulletin boards and displays; providing handouts, visualizing new ideas or information presented; and reading all of the assignment directions (Bell, 1998; Vincent & Ross, 2001).
Strategies for Teaching Kinesthetic Learners

Teachers of kinesthetic learners need to provide multiple activities to allow students to move and participate in the learning activity; hands-on activities; encourage note taking; learn by doing, touching, or practicing; take notes during lectures and discussions; underline important information in the textbooks; take breaks to stand and stretch; build projects to help explain ideas; optimize the use of manipulative objects and physical movement; provide lab activities; and provide classroom activities that promote participatory learning (Bell, 1998; Nolen, 2003; Vincent & Ross, 2001). When the students are active and involved, they are more productive.

Nolen (2003) had the following to say about working with kinesthetic learners (students and adults) in the boardroom and in the classroom:

These children like to touch things in order to learn, they usually cannot sit still for long. These students seem fidgety during much of the class. Simply giving them something to keep in their hands might solve this problem. Corporations have seen this in their meetings, so they have brought “executive toys” into their meetings. Each member is given some sort of gizmo to keep his/her hands busy. It has been found to increase creativity and productivity significantly. The same effect could take place with bodily-kinesthetic students, and it may just be that they needed something in their hands to satisfy this urge and calm their brains so that thinking and learning can take place. (p. 118)

Strategies for Teaching Cooperative Learning Groups

When working with students in a cooperative learning setting, it is not necessary to create homogeneous groups based on learning styles. Working in groups is crucial and helps students to recognize their own learning styles, learning style strengths and weaknesses, and to take advantage of the synergy that comes from working with people from a diverse range of backgrounds (Halstead & Martin, 2002). Training students in learning styles and constructive ways in which they can draw on each other’s strengths...
and involved each other in the group’s collaborative work may have a greater effect on both group atmosphere and learning outcomes (Hendry et al., 2005). Students are going to be asked to work with students of the same and different learning styles at school and when they enter the world of work. To assist them in developing effective working relationships, heterogeneous grouping of learning styles during group work is an effective first step in understanding how others work and developing cooperative skills with individuals who possess learning styles different from theirs.

Members of effective learning teams adopt specific roles based on aptitude, circumstance, and learning styles. The most-effective learning teams have members who are supportive of each other’s roles (coach, reviewer, recorder, and specialist) even if those roles sometimes interrupt the focus on immediate success. Team members also take responsibility for gathering information and ideas from outside the team and for sharing learning both with the team and others (Clutterbuck, 2002).

**Strategies for Teaching All Learning Styles**

Everyone has a learning style, and everyone has learning-style strengths (Dunn & Dunn, 1993a). Classroom instructors need to keep this basic philosophy in mind when preparing activities and lessons and provide multiple methods to help students master each new subject or problem (Cho & Forde, 2002). It is up to the instructor to identify the strengths and weaknesses and instruct in a manner that will enhance the strengths and improve the weaknesses. Vincent and Ross (1998) provided the following guidelines for good teaching of all styles of learning:

1. Know the material well before beginning to teach.
2. Write objectives and keep objectives in focus from planning to evaluation.
3. Let the students know what the objectives are.
4. Determine the learning styles of students before teaching.
5. Educate students on their own learning style and how to cope.
6. Match teaching style to the learning style of a majority of the students, giving attention to students with other learning styles.
8. Motivate learners by introducing the subject in view of its future relevance.
9. Provide an outline or concept map to organize learning.
10. Review previous learning, teach the current lesson, summarize information, and relate it to future learning.
11. Use audiovisual aids and activities that allow student participation wherever possible (make the instruction vivid).
12. Divide a complex task into smaller, achievable learning units.
13. Vary activities to sustain the learner's attention.
14. Use questions and answers to assess learning.
15. Watch nonverbal clues to determine status of learning.
16. Give students time to think.
17. Provide immediate feedback.
18. Assign tasks that allow for self-learning; for example, library readings, case problems, group projects.
19. Incorporate hands-on activities into the lesson wherever possible.
20. Always remember that learning is best when accompanied by a pleasant feeling; for example suitable environment, non-threatening atmosphere.

In the next section, this researcher outlined the importance of effective instructional design to meet the students' learning styles. This researcher promoted open communication of learner expectations between students and instructors, active observation of student learning behavior, and the willingness to change instructional methods and pedagogy outside of the instructors' comfort zone to meet the changing learning style needs of our students.

Instructional Design

To better meet the educational needs of our students, we have to know how our students learn best. When prior learning is valued and when preferred learning styles are recognized—students flourish (Chickering, 2006). For students to maximize their
own learning, they need to have an appreciation of what is expected of them by their teacher, and the teacher has to be able to match the learning style to the method of teaching to enhance material recall (Black, 2004; Kinchin, 2004). We have to know our students, and the students have to know what is expected from the instructor. Therefore, it is beneficial to assess the students’ preferred learning styles.

The information gained from such analyses enables the design of learning resources to be tailored to the needs of the learners. Once the analysis is done, an instructor can use a variety of strategies to create an intriguing learning environment on a consistent basis to address the auditory, visual, and kinesthetic learning styles of the students (Woeste & Barham, 2007). These teaching strategies should include formal lectures as well as informal class discussion, individual and group activities/project/presentation, active experimentation such as physical and experimental applied learning, personal feedback and encouragement, and formal structured observations and reflections to stimulate the brain on all levels including emotional, physical, and environmental levels (Cho & Forde, 2002; Rose, 2004; Weiss, 2000). Instructors need to learn how to recognize, respect, and respond to the wide-ranging individual differences among our diverse learners. If we do this—and it is a big if—then many more of our students will achieve learning that lasts (Chickering, 2006).

This may sound like a lofty goal, but it is a goal that is worth striving for if we can make meaningful change in how our students learn and how they succeed.

In a study of eight teachers working at a K-12 school in the United States, Haar, Hall, Schoepp, and Smith (2002) posed the question, “How do teachers instruct students with different learning style?” This question spawned the following sub-questions:
1. What kind of training or exposure have teachers had to learning styles?
2. Why do teachers utilize learning styles in their teaching?
3. How do teachers describe the framework they use to talk about learning styles?
4. How do teachers' own learning styles influence their teaching students with different learning styles?
5. How do teachers identify learning styles?
6. How do teachers adjust their teaching to account for different learning styles?
7. How do teachers know that they have achieved their desired outcome—student learning? (p. 142)

Based on the study and observation, Haar et al. (2002) found that teachers' approaches and methods often changed when informal assessments showed some students were having difficulty grasping concepts. The changes and adjustments made are typical with learning-style teachers. Learning-style teachers teach different children differently. The teachers were able to identify problem areas with their students' learning and adjust their teaching styles to meet the learning styles of the students.

In another study done by Rosenfeld and Rosenfeld (2004), teachers reported that after implementing changes outlined in a learning-styles program, the teachers were able to gain fluency in the language of individual learning differences; they gained interventionist beliefs about students, increased legitimizing and addressing of individual learning differences; and positive outcomes as a result of their changes, that is, awareness of self-development and increased learner success. The teachers found success in their ability to identify, interpret, and adjust their teaching styles to meet the learning styles of their students.

In the last section of this chapter, this researcher explained the importance of learning responsibility, or the responsibility of the students to become actively involved in their own educational process. This researcher explained the importance of students
actively analyzing how they learn, evaluate how they are being instructed, and become self advocates to express these discrepancies with instructors so they are able to make informed decisions and change instructional style to meet the students’ learning styles.

Learning Responsibility

The responsibility for learning is not completely placed on the instructors. The individual learner has to take an active role and some level of responsibility to ensure he/she learns the material presented. The most successful learners are those who can adapt to whatever mode of instruction are in use and who use a combination of learning methods (Kanar, 1998). Individual learning style has both strengths and weaknesses. From an educator’s perspective, you can take this into consideration when planning different learning activities. But as there is an interaction between the teacher and student in the teaching and learning process, the individual learner has a responsibility of his/her own to become an active learner. In the long run, students learn more effectively when they are encouraged to develop learning skills in their area of weakness (Gadt-Johnson & Price, 2000; Heffler, 2001). As stated earlier, education is a two-way street.

Students and teachers have to be actively and cooperatively involved if the process is going to be successful. If the teacher is adapting to learning styles, but the student(s) is not doing his/her part or feels that whatever he/she does will not impact learning, the learning process will suffer. Students may believe that learning is a predisposed process; what comes natural to them is all that they can do well, and they are doomed to failure in all other areas. Unless teachers support students to strengthen
undeveloped and under-developed characteristics of their learning styles, they are unlikely to have life-long success.

An important task of learning how to learn is to develop an awareness of oneself as a learner. Students need to reflect on their experience of learning in order to take charge of the full development of their abilities (McClanaghan, 2000). Students' active participation in their studies generally leads to better and deeper learning, recognizing their ability to learn, and becoming aware of a sense of learning, was a key factor in raising the self esteem of many pupils, particularly those who regarded themselves as failures (Hopper & Hurry, 2000; Romanov & Nevgi, 2007). Students need to know how they learn best (visual, auditory, tactile, etc.), when they learn best (early in the morning, late in the afternoon, etc.), and what they can do to improve their learning weaknesses (develop a quiet study area, re-write notes, schedule classes when learning is best, etc.).

For some students, teachers, parents, administrators, and school board members, this philosophical change to active and cooperative educational involvement will be a drastic departure from the teacher being the expert and doing all of the work to insure that students learn. In the past, there has been a great amount of responsibility and pressure put on teachers and course designers to pay closer attention to students' learning styles. From diagnoses, to encouraging students to reflect on their learning styles, to designing and teaching learning interventions around them, the majority of the work has been placed on the teacher. The shift to a focus on the learner, rather than on the subject matter or teacher, may have a considerable motivational effect both on students, who feel valued, and on teachers, who feel that they are engaging directly with
learners' needs rather than delivering a prescribed curriculum (Hall & Moseley, 2005). Students and teachers need to communicate and share ideas and observations. When students inform their teachers how they feel they learn best, and teachers give students a choice of activities to utilize in the classroom, this (hopefully) will motivate students to take more interest in their learning and contribute to their academic success (Johnson, 2006). Once the students realize they are the most important person in the room and that we (educators) are here for them, they may take a more active role in their education and work on the development of their dominate and non-dominate learning styles.

McClanaghan (2000) had the following to say about helping students learn how to learn:

Research has suggested that knowing one's preferred learning style enhances a student's ability to achieve academic success. The knowledge that there are different styles for achieving success is in itself an eye opening experience for many students.

Some studies have indicated that academically successful students have fewer strong learning style preferences than do low achievers. The challenge is to assist students in perfecting their natural learning style while providing the incentive to develop less dominant styles they will need in the workforce and other areas of their lives. Engaging in the process of learning how to learn must include awareness of how one perceives and processes material to be learned.

Helping students learn how to learn may be the most important lesson faculty can teach students. Life-long learners, capable of learning and working in diverse settings, are vital to the 21st century society. (pp. 484-485)

The instructor must know his/her students, set goals for the class/lesson, and prepare lessons keeping all learning styles in mind when developing lesson activities that cultivate a spirit of inquiry and a sense of delight in discovery that will become part of the individual's learning style (Lambert, 2006; Speaker, 2001). The lesson activities
should engage students by offering course materials in multiple formats that address different learning styles (Armstrong, 2005). Once instructors know the students and create lesson activities to engage and involve the students related to their learning styles, students should be more active, involved, and successful in their education.

Some skeptics might say that teachers do not have the time or resources to teach to each individual student’s learning style. One researcher suggested the strategy of teaching to what she called the middle ground. This teaching technique is presented as a challenge for the students to recognize and become aware of their learning preferences/styles and to stretch their own learning preferences to include other types of learning styles; while teachers are being challenged to vary the presentation of information, and provide many different choices for students on how they can show the teacher they understand (Hill, 2005; Silverman, 2006). The teacher can identify the various learning styles of his/her students, develop instructional strategies to meet the learning style of his/her students, and to challenge students to develop their non-dominant learning styles.

While it may take time, energy, training, and work to develop instructional strategies to meet students’ learning styles, research has demonstrated and overwhelmingly supported the position that matching students’ learning-style preferences with complementary instruction improved academic achievement and student attitudes toward learning (Lovelace, 2005).

The potential benefits of modifying instruction to student learning differences are too valuable to ignore. Future research will need to continue to evaluate the validity of existing learning and cognitive style constructs and the reliability and validity of the instruments used to assess those constructs. There is a
tremendous need for theoretical clarity and empirical verification. (Genovese, 2004, p. 173)

If instructors practice the mantra of "know your audience," learn how their students learn, become consciously aware of the learning style needs of their students, and adapt instructional strategies to meet, challenge, and strengthen these learning styles, students will be more active, involved, motivated, and successful in their education. Presented in Chapter III is the description of the instrument and methodology utilized in the data collection process for this study.
CHAPTER III
PROCEDURES

Wendy’s Story—End of Semester One

By the end of the first semester, Wendy was doing “OK” in her classes. She felt that her instructors were getting to know her better, they knew what kind of questions she felt comfortable answering in class, and she felt the instructors were teaching more to the students, instead of just teaching the material. She was thankful that she had some of the instructors for the entire year, but she was a little unsure about the new instructors she would have in her semester classes. She had “heard” that her Foods I instructor, Mrs. Jones, was pretty tough and that she liked to give essay tests. She had also “heard” that Mr. Smith in Computer Applications I was a dynamic instructor that really motivated the students and kept them involved in the class. Wendy hoped her new instructors knew more about her than just her name and student identification number. She hoped she would not struggle to get started in the new classes with the new instructors.

Methods

On a consistent daily basis in their regular education classroom, secondary instructors encounter students who may possess a wide-range of learning styles. Each student possesses preferred styles in which he/she finds it easier to learn information
(Sayer & Studd, 2006). Students who enroll in secondary courses comprised of students from a variety of academic backgrounds may present a variety of learning styles. With such variance in learning styles, the academic success of a student may be hindered because instructors may not teach to the learning strength of that student. The purpose of this study was to determine the learning style modes of freshman students who enrolled in a core curriculum Physical Science I course at Red River High School.

Approval for the use of human subject data was obtained by this researcher from the Superintendent’s Office of the Grand Forks Public School District No. 1 (see Appendix A: please see attached request letter). When approval was requested on July 17, 2008, the new superintendent at Grand Fork Public School District No. 1, Dr. Larry P. Nybladh, had just started his employment contract. After conferring with the assistant superintendent, Mr. Jody Thompson, Dr. Nybladh and Mr. Thompson granted permission for the use of existing school data. As outlined in his portfolio duty assignments, Mr. Thompson was the district administrator who signed the permission form for this researcher (see Appendix B: please see attached permission form).

Subjects

Of the 307 students enrolled in freshman Physical Science I class during the 2007 fall semester at RRHS, 273 (88.93%) students were accessible as subjects for this study. This difference in student participation was attributed to students that were not in attendance the day(s) the CAPSOL instrument was administered. In the fall of 2007, there was not a process in place for students to make-up the CAPSOL if they were absent on the day(s) it was administered. Grade 9 demographics: 307 students—140 white males, 138 white females, 6 black males, 7 black females, 5 American
Indian/Alaskan Native males, 2 American Indian/Alaskan Native females, 2 Asian males, 3 Asian females, 3 Hispanic males, and 1 Hispanic female (State Automated Reporting System, n.d.). One case was also deleted due to extreme values.

Ethnicity factors were not calculated due to the limited ethnic population of the sample. To maintain confidentiality and student anonymity, this researcher chose not to disaggregate the data for each ethnic population at Red River High School.

CAPSOL Style of Learning Assessment—Form B

The CAPSOL is a two-page carbon assessment form consisting of 45 questions and is administered by the counselors at RRHS. The questions are divided into nine modes (visual, auditory, bodily-kinesthetic, individual, group, oral expressive, written expressive, sequential, and global). Each mode has five statements for the students to score. The students circled their responses to the statements that are “Always like me,” “Generally like me,” “Sometimes like me,” or “Never like me.” “Always like me” has a numeric value of 4. “Sometimes like me” has a numeric value of 3. “Sometimes like me” has a numeric value of 2. “Never like me” has a numeric value of 1. Once the answers to the statements are recorded, the students score the CAPSOL by adding up the point value assigned to each statement. Each mode is scored on a continuum from Low Preference (5 to 9 points) to High Preference (16 to 20 points).

Reliability of the CAPSOL Instrument

Reliability of the CAPSOL was determined by administering the student version to 960 fifth-grade through tenth-grade students in a test/retest situation. A Pearson’s r was calculated for each of the 45 items to determine the correlation between responses to the items from the first to second administration of the CAPSOL. A mean correlation
Coefficient was also calculated to estimate test-retest reliability of the instrument. Correlation coefficients for the 45 items ranged from 0.52 to 0.93. The mean correlation coefficient for the items was 0.74 (www.stylesoflearning.com, March 18, 2008).

Construct validity of the CAPSOL was established through factor analysis. Responses to the 45 items of the CAPSOL Form A by 524 students and the CAPSOL Form B by 580 students were validated by Dr. John Conrath at Ohio State University over an 8-month comprehensive study period using a test/re-test research method. The arbitrary criterion for an item to represent a factor was a factor loading of .40. Any item below .40 was modified or replaced until all of the items met the criteria (H. Henderson, personal communication, July 15, 2008).

Content validity of the CAPSOL was established through experts in learning style research. The experts were comprised of five school administrators with terminal degrees well versed in learning style research, five classroom teachers who have at least 10 years of experience with learning style research, and five post-doctorate students researching learning styles. The experts agreed that all of the items were valid measurements of the nine learning style modes (H. Henderson, personal communication, July 15, 2008).

Collection of Data

The career counselors at RRHS scheduled the administration of the CAPSOL with the Physical Science I course instructors during the 2007 fall academic semester. The testing is usually done during 1 of the 2 days in which the career counselors work with students in the classroom on career-related material. RRHS has given the
CAPSOL to freshman students for the past 10 years (P. Peterson, personal communication, June 27, 2008).

The students were told their participation was completely voluntary and would not affect their course grade if they chose not to participate. Subjects were shown an illustration of how to mark their answers on the CAPSOL instrument. Students were instructed to answer each question honestly and to mark the first answer that came to mind. Each CAPSOL instrument was examined by the career counselor for completion as the students turned in their CAPSOL instrument.

Data Analysis

Following the data collection, the raw data from the completed CAPSOL instruments were entered into the SPSS (Statistical Package for Social Sciences) database statistical program. The statistical objective was to determine the largest sampling of “high preference and low preference” percentages scores of learning styles of the overall sample and the largest sampling of “high preference” percentage score of learning styles by GPA, gender, RIT Scores, and RIT Ranges. A frequency summary was calculated of the percentage scores of each sub-scale (visual, auditory, bodily-kinesthetic, individual learner, group learner, oral expressive, written expressive, and sequential and global learner) of students enrolled in the Physical Science I course on the CAPSOL. This study and data analysis was limited to high school freshman students only at Red River High School.

Described in Chapter IV was the purpose of the study, description of the sample, states the research questions, and presentation of the results of the data analyses.
CHAPTER IV

RESULTS

Wendy's Story—End of Freshman Year

In May, Wendy was scheduled to meet with her counselor to pick her classes for the next school year. Wendy's grades were "good" in her mind, but she still longed to earn better grades and hopefully earn an academic scholarship to college. Wendy's grades dipped slightly at the start of the second semester as she and her new instructors were getting to know each other and figure each other out. Once the "introductory period" was over, about three weeks into class, Wendy was able to bring up her grades and finish strong in her semester classes (Foods I and Computer Applications I). As she looked at the course description guide and visited with her counselor about her classes for next year, she knew she wanted to take another computer class from Mr. Smith. She liked the way he taught, she felt he took the time to get to know the students, and Wendy felt comfortable taking a class from an instructor who she already knew and one knew her and how she learned.

Purpose of the Study

The purpose of this study was to investigate the relationships between learning style scale scores, GPA, boys and girls, and socioeconomic factors. The following sections are described in this chapter: a description of the sample, research questions, analysis of data, and graphical representation of the data.
Description of Sample

Of the 307 students enrolled in freshman Physical Science I class during the 2007 fall semester at RRHS, 273 (88.93%) students were accessible as subjects for this study. This difference in student participation was attributed to students that were not in attendance the day(s) the CAPSOL instrument was administered. Grade 9 demographics included 307 students with 140 white males and 138 white females, 6 black males and 7 black females, 5 American Indian/Alaskan Native males and 2 American Indian/Alaskan Native females, 2 Asian males, 3 Asian females, 3 Hispanic males, and 1 Hispanic female. Fifty-one of the 273 students qualified for free/reduced lunch and, thus, created the sample for the socio-economic disadvantaged (State Automated Reporting System, n.d.).

Research Question 1

What were the means and standard deviations for the learning style scale scores (visual, auditory, kinesthetic, individual learning, group learner, oral expressive, written expressive, sequential, and global learning) of freshman students enrolled during the fall semester of 2007 at Red River High School? Descriptive statistics were run to identify the mean and standard deviation of each of the nine learning styles. The lowest possible score would have been 5, with the highest being 20. A middle score within this range would have been a 12.5. The lowest mean score was identified in the group learning style (11.6), while the highest score was recorded in the kinesthetic learning style (14.2) (Table 1). All of these scores were consistent with the scale score for the group approximating the middle value in almost every case (one case was deleted for extreme values).
Table 1. Means and Standard Deviations for the Nine Learning Style Scale Scores (N=273).

<table>
<thead>
<tr>
<th>Scales</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>13.3</td>
<td>3.25</td>
</tr>
<tr>
<td>Auditory</td>
<td>13.4</td>
<td>2.76</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>14.2</td>
<td>3.27</td>
</tr>
<tr>
<td>Individual</td>
<td>14.1</td>
<td>3.47</td>
</tr>
<tr>
<td>Group</td>
<td>11.6</td>
<td>3.44</td>
</tr>
<tr>
<td>Oral</td>
<td>13.9</td>
<td>3.52</td>
</tr>
<tr>
<td>Written</td>
<td>12.3</td>
<td>3.26</td>
</tr>
<tr>
<td>Sequential</td>
<td>13.4</td>
<td>3.18</td>
</tr>
<tr>
<td>Global</td>
<td>12.2</td>
<td>2.80</td>
</tr>
</tbody>
</table>

Research Question 2

*What percentage of the various learning style scores were one standard deviation above or below the mean learning style scale score?* Descriptive statistics were run to identify the mean and standard deviation of each of the nine learning styles. A score over 16 or approximately one standard deviation above the mean was considered to be a high score, indicating a high preference for that learning style. A score of less than 9 was considered to be a low score, indicating a low preference for that learning style. The lowest standard deviation was in the auditory learning style (2.76), while the highest was in the oral learning style (3.52). The results were presented in Table 2.
Table 2. Means, Standard Deviations, and Percentages One Standard Deviation Above and Below the Mean for Each of the Nine Learning Style Scale Scores (N=273).

<table>
<thead>
<tr>
<th>Scales</th>
<th>Mean</th>
<th>SD</th>
<th>% Above SD</th>
<th>% Below SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>13.3</td>
<td>3.25</td>
<td>16.5</td>
<td>18.7</td>
</tr>
<tr>
<td>Auditory</td>
<td>13.4</td>
<td>2.76</td>
<td>16.1</td>
<td>14.3</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>14.2</td>
<td>3.27</td>
<td>16.1</td>
<td>20.5</td>
</tr>
<tr>
<td>Individual</td>
<td>14.1</td>
<td>3.47</td>
<td>19.8</td>
<td>15.4</td>
</tr>
<tr>
<td>Group</td>
<td>11.6</td>
<td>3.44</td>
<td>20.9</td>
<td>11.7</td>
</tr>
<tr>
<td>Oral</td>
<td>13.9</td>
<td>3.52</td>
<td>17.6</td>
<td>16.1</td>
</tr>
<tr>
<td>Written</td>
<td>12.3</td>
<td>3.26</td>
<td>15.4</td>
<td>16.5</td>
</tr>
<tr>
<td>Sequential</td>
<td>13.4</td>
<td>3.18</td>
<td>19.0</td>
<td>19.4</td>
</tr>
<tr>
<td>Global</td>
<td>12.2</td>
<td>2.80</td>
<td>22.7</td>
<td>17.2</td>
</tr>
</tbody>
</table>

Typically in a relatively normal distribution, about 16% are above or below one standard deviation from the mean. All of these percentages were indicative of relatively normal distributions for these scale scores.

Research Question 3

Were there differences in boys and girls on the learning style scores?

MANOVA was conducted to test for differences between boys and girls on the nine learning style scale scores with results indicating an overall significant difference (Wilks’ Lambda = .781 with 9 and 263 degrees of freedom, $p < .001$). One-way ANOVAs were conducted for the individual scale scores. The results were presented in Table 3.
Table 3. One-way ANOVA Results with Means and Standard Deviations for the Nine Learning Style Scale Scores Comparing Boys and Girls (N=273).

<table>
<thead>
<tr>
<th>Scales</th>
<th>Boys’ Mean</th>
<th>Girls’ Mean</th>
<th>F Value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>12.9</td>
<td>13.7</td>
<td>3.50</td>
<td>.064</td>
</tr>
<tr>
<td>Auditory</td>
<td>13.5</td>
<td>13.4</td>
<td>.07</td>
<td>.798</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>14.4</td>
<td>14.0</td>
<td>1.51</td>
<td>.220</td>
</tr>
<tr>
<td>Individual</td>
<td>14.2</td>
<td>14.0</td>
<td>.10</td>
<td>.758</td>
</tr>
<tr>
<td>Group</td>
<td>11.5</td>
<td>11.6</td>
<td>.06</td>
<td>.809</td>
</tr>
<tr>
<td>Oral</td>
<td>14.5</td>
<td>13.3</td>
<td>8.72</td>
<td>.003</td>
</tr>
<tr>
<td>Written</td>
<td>11.5</td>
<td>13.1</td>
<td>18.75</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Sequential</td>
<td>12.3</td>
<td>14.6</td>
<td>42.84</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Global</td>
<td>11.8</td>
<td>12.7</td>
<td>6.50</td>
<td>.011</td>
</tr>
</tbody>
</table>

No significant differences were found between boys and girls on five of the learning styles: visual, auditory, kinesthetic, individual, and group. However, significant differences were identified between boys and girls on the oral, written, sequential, and global learning styles. Boys scored higher than girls on oral learning style scale and girls scored higher than boys on the written, sequential, and global learning style scales.

Research Question 4

*Were there differences by socioeconomic status (free-reduced lunch or not) on the learning style scale scores?* MANOVA was conducted to test for difference between students on free/reduced lunch to students not on free/reduced lunch with
results indicating no overall significant differences between the two groups (Wilks’ Lambda = .964 with 9 and 263 degrees of freedom, \( p = .367 \)). The means, standard deviations, and ANOVA results were presented in Table 4.

Table 4. One-way ANOVA Results with Means and Standard Deviations for the Nine Learning Style Scale Scores Comparing Students on Free-Reduced Lunch (Yes) (N=51) or Not (No) (N=222).

<table>
<thead>
<tr>
<th>Scales</th>
<th>Yes (N=51)</th>
<th>No (N=222)</th>
<th>F Value</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>13.2</td>
<td>13.3</td>
<td>.17</td>
<td>.734</td>
</tr>
<tr>
<td>Auditory</td>
<td>14.1</td>
<td>13.3</td>
<td>4.03</td>
<td>.046</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>14.3</td>
<td>14.2</td>
<td>.03</td>
<td>.860</td>
</tr>
<tr>
<td>Individual</td>
<td>13.5</td>
<td>14.2</td>
<td>1.65</td>
<td>.201</td>
</tr>
<tr>
<td>Group</td>
<td>11.8</td>
<td>11.5</td>
<td>.25</td>
<td>.617</td>
</tr>
<tr>
<td>Oral</td>
<td>13.9</td>
<td>13.9</td>
<td>.002</td>
<td>.962</td>
</tr>
<tr>
<td>Written</td>
<td>12.1</td>
<td>12.4</td>
<td>.37</td>
<td>.535</td>
</tr>
<tr>
<td>Sequential</td>
<td>12.9</td>
<td>13.5</td>
<td>1.63</td>
<td>.203</td>
</tr>
<tr>
<td>Global</td>
<td>12.5</td>
<td>12.2</td>
<td>.42</td>
<td>.518</td>
</tr>
</tbody>
</table>

Overall, the conclusion was that there were no significant differences by this socioeconomic indicator on the nine learning style scale scores.

Research Question 5

What were the means and standard deviations for GPA and Rasch Unit Scores (RIT Scores) at the end of the first year and the learning style scale scores? Descriptive statistics were run to identify the mean and standard deviation of GPA and RIT Scores.

The mean score for GPA was 3.07, which is about a B average on the standard 4-point-
The mean RIT score for Reading was 225.3, Language Usage 225.0, and Math was 236.8. The 50th percentile score for Reading is 224, Language Usage is 222, and Math is 236 (Northwest Evaluation Association, n.d.a). The results were presented in Table 5.

Table 5. Means and Standard Deviations for GPA and RIT Reading, Language Usage, and Math Scores (N=273).

<table>
<thead>
<tr>
<th>GPA and RIT Scales</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA</td>
<td>3.07</td>
<td>.91</td>
</tr>
<tr>
<td>Reading</td>
<td>225.30</td>
<td>11.80</td>
</tr>
<tr>
<td>Language Usage</td>
<td>225.00</td>
<td>9.48</td>
</tr>
<tr>
<td>Math</td>
<td>236.80</td>
<td>14.46</td>
</tr>
</tbody>
</table>

This group scored slightly above average on the test scores with Reading 225.3 locally compared to 222.6 nationally, Language Usage 225.0 locally compared to 220.8 nationally, and Math 236.8 locally compared to 234.0 nationally, based on the 2008 status norms (Northwest Evaluation Association, n.d.a).

Research Question 6

Was there a relationship between GPA and the nine learning style scale scores?

Multiple correlation and regression were calculated to determine the relationships between GPA and the nine learning style scale scores. The overall multiple correlation was .355 with 12.6% of the variance accounted for on GPA (R=.355, F = 4.22, with 9 and 263 degrees of freedom, p < .001). Stepwise forward multiple regression was also conducted to identify the significant predictors for this relationship. The four
significant variables indicated by this analysis were in order of priority: group, sequential, global, and visual. The correlation coefficients for the nine learning style scale scores with GPA were provided in Table 6.

Table 6. Correlations and Significance Levels for GPA and the Nine Learning Style Scale Scores (N=273).

<table>
<thead>
<tr>
<th>Scales</th>
<th>Correlation</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>.208</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Auditory</td>
<td>-.177</td>
<td>.002</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>-.166</td>
<td>.003</td>
</tr>
<tr>
<td>Individual</td>
<td>.225</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Group</td>
<td>-.226</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Oral</td>
<td>-.093</td>
<td>.062</td>
</tr>
<tr>
<td>Written</td>
<td>.116</td>
<td>.029</td>
</tr>
<tr>
<td>Sequential</td>
<td>.223</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Global</td>
<td>-.161</td>
<td>.004</td>
</tr>
</tbody>
</table>

Significant positive relationships were indicated by the results between visual, individual, written, and sequential with GPA. Significant negative relationships were indicated between group, auditory, kinesthetic, and global with GPA. Comparing these results with the stepwise analysis, the most significant positive relationship variables were sequential and visual, whereas the most significant negative relationship variables were group and global. It was shown in the research that students with high visual and high sequential scale scores tended to have high GPAs, while students with high group and high global scale scores tended to have low GPAs.
Research Question 7a

*Was there a relationship between Learning Styles and the RIT Reading score?*

Multiple correlation and regression were calculated to determine the relationships between RIT Reading score and the nine learning style scale scores. The overall multiple correlation was .345 with 11.9% of the variance accounted for on RIT Reading (R=.345, F=3.94, 9 and 263 degrees of freedom, p < .001). Stepwise forward multiple regression was also conducted to identify the significant variables in this relationship. Only one variable was significant for this analysis: visual. The simple correlation coefficients were indicated in Table 7 for the nine learning style scale scores with RIT Reading score.

Table 7. Correlations and Significance Levels for RIT Reading and the Nine Learning Style Scale Scores (N=273).

<table>
<thead>
<tr>
<th>Scales</th>
<th>RIT Reading</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>.311</td>
<td>&lt;.011</td>
</tr>
<tr>
<td>Auditory</td>
<td>-.184</td>
<td>.002</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>-.096</td>
<td>.112</td>
</tr>
<tr>
<td>Individual</td>
<td>.241</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Group</td>
<td>-.192</td>
<td>.001</td>
</tr>
<tr>
<td>Oral</td>
<td>-.041</td>
<td>.498</td>
</tr>
<tr>
<td>Written</td>
<td>.130</td>
<td>.032</td>
</tr>
<tr>
<td>Sequential</td>
<td>.059</td>
<td>.333</td>
</tr>
<tr>
<td>Global</td>
<td>-.032</td>
<td>.594</td>
</tr>
</tbody>
</table>
Significant positive relationships were found between visual, individual, and written with RIT Reading. Significant negative relationships were indicated between auditory and group with RIT Reading. Comparing these results with the stepwise analysis, the most significant positive relationship variable was only with visual. Students with high visual scores tended to have higher RIT Reading scores.

Research Question 7b

*Was there a relationship between learning styles and the RIT Language Usage score?* Multiple correlation and regression were calculated to determine the relationships between RIT Language Usage score and the nine learning style scale scores. The overall multiple correlation was .362 with 13.1% of the variance accounted for on RIT Language Usage ($R = .362$, $F = 5.35$, 9 and 263 degrees of freedom, $p < .001$). Stepwise forward multiple regression was also conducted to identify the significant variable in this relationship. Only one variable was significant for this analysis: visual. Displayed in Table 8 were the simple correlation coefficients for the nine learning style scale scores with RIT Language Usage score.

Significant positive relationships were indicated between visual, individual, and written with RIT Language Usage. Significant negative relationships were indicated between auditory, kinesthetic, and group with RIT Language Usage. Comparing these results with the stepwise analysis, the most significant positive relationship variable was only visual. Students with high visual scores tended to have higher RIT Language Usage scores.
Table 8. Correlations and Significance Levels for RIT Language Usage and the Nine Learning Style Scale Scores (N=273).

<table>
<thead>
<tr>
<th>Scales</th>
<th>RIT Reading</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>.362</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Auditory</td>
<td>-.257</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>-.126</td>
<td>.037</td>
</tr>
<tr>
<td>Individual</td>
<td>.241</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Group</td>
<td>-.176</td>
<td>.004</td>
</tr>
<tr>
<td>Oral</td>
<td>-.081</td>
<td>.181</td>
</tr>
<tr>
<td>Written</td>
<td>.178</td>
<td>.003</td>
</tr>
<tr>
<td>Sequential</td>
<td>.099</td>
<td>.104</td>
</tr>
<tr>
<td>Global</td>
<td>-.035</td>
<td>.561</td>
</tr>
</tbody>
</table>

Research Question 7c

*Was there a relationship between learning styles and the RIT Math Score?*

Multiple correlation and regression were calculated to determine the relationships between RIT Math score and the nine learning style scale scores. The overall multiple correlation was .310 with 9.6% of the variance accounted for on RIT Math ($R=.310$, $F=3.10$, 9 and 263 degrees of freedom, $p = <.001$). Stepwise forward multiple regression was also conducted to identify the significant variable in this relationship. Two variables were significant for this analysis: visual and global. Indicated in Table 9 was the simple correlation coefficient for the nine learning style scale scores with RIT Math score.
Table 9. Correlations and Significance Levels for RIT Math and the Nine Learning Style Scale Scores (N=273).

<table>
<thead>
<tr>
<th>Scales</th>
<th>RIT Math</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual</td>
<td>.219</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Auditory</td>
<td>-.101</td>
<td>.097</td>
</tr>
<tr>
<td>Kinesthetic</td>
<td>-.116</td>
<td>.055</td>
</tr>
<tr>
<td>Individual</td>
<td>-.193</td>
<td>.001</td>
</tr>
<tr>
<td>Group</td>
<td>-.123</td>
<td>.042</td>
</tr>
<tr>
<td>Oral</td>
<td>.044</td>
<td>.472</td>
</tr>
<tr>
<td>Written</td>
<td>.064</td>
<td>.292</td>
</tr>
<tr>
<td>Sequential</td>
<td>-.004</td>
<td>.943</td>
</tr>
<tr>
<td>Global</td>
<td>-.119</td>
<td>.049</td>
</tr>
</tbody>
</table>

Significant positive relationships were indicated between visual and individual with RIT Math. Significant negative relationships were indicated between group and global RIT Math. Comparing these results with the stepwise analysis, the most significant positive relationship variable was visual, whereas the most significant correlation was global. Students with high visual scores tended to have higher RIT Math scores, and students with high global scores tended to have lower RIT Math scores.

Summary

The analyses are now concluded, and it is indicated by the results that there were some significant differences and some significant relationships. Presented in Chapter V were a summary of the study, conclusions drawn from the results, discussion points for
the reader, and recommendations for educators, administrators, and school board members.
CHAPTER V
SUMMARY, CONCLUSIONS AND DISCUSSION, AND RECOMMENDATIONS

Presented in Chapter V were a summary of the present study within the context of previous related research and the findings and conclusions drawn from the results. In addition, recommendations for educators, administrators, school board members were provided.

Summary

Learning style is “the preferred or habitual patterns of mental functioning: information processing and the formation of ideas and judgments” (Burris et al., 2008, p. 44). If there are different learning styles, different approaches to learning, and different ways to instruct, this researcher believes the more we know about our students and how they learn, the better equipped we are to meet their educational needs and facilitate academic success.

By identifying the way our students learn, we can become cognizant of their needs and interests and we (educators) can create curriculum that addresses the learning style needs of all learners (Johnson, 2006). In order to accomplish this task, instructors must: (a) recognize their own styles of teaching and learning, (b) identify and understand learning styles, (c) identify and understand their students’ various learning styles, (d) identify characteristics that align with students’ learning styles, (e) modify instructional strategies to align with students’ learning styles through differentiated
instruction, and (f) develop instructional strategies that will meet the students’ learning styles while providing opportunities to strengthen non-dominant learning styles. When instructors reflect on their teaching styles, they develop a deeper understanding of their own actions, a firmer grasp on the processes that take place in their classrooms, and stronger problem-solving skills (Honigsfeld & Schiering, 2004). The more we know about our own instructional strengths and weaknesses, and the more we know about our audience; the better able we will be to identify learning styles and adapt our instructional strategies to meet the learning style needs of our students.

Conclusions and Discussion

Research Question 1: What were the means and standard deviations for the learning style scale scores (visual, auditory, kinesthetic, individual learning, group learner, oral expressive, written expressive, sequential, and global learning) of freshman students enrolled during the fall semester of 2007 at Red River High School? Descriptive statistics were run to identify the means and standard deviations of the nine learning styles. All of these scores were consistent with the scale score for the group approximating the middle value in almost every case. The group learning style scored the lowest with 11.6, while the kinesthetic learning style scored the highest with 14.2. It was indicated by the data that this group of freshman students preferred to work independently or as individuals, and they preferred kinesthetic learning activities over visual or auditory learning activities.

Research Question 2: What percentage of the various learning style scores were one standard deviation over the mean learning style scale score? In a normal bell-curve distribution, 16% of the items measured are above or below one standard deviation from
the mean. In this study, relatively normal distributions were indicated by all of the percentages for these scale scores.

Research Question 3: Were there differences in boys and girls on the learning style scores? No significant differences were found between boys and girls in: visual, auditory, kinesthetic, individual, or group learning styles. Boys scored higher than girls on oral learning styles, while girls scored higher than boys on written, sequential, and global learning styles.

The traditional school system where students come into the classroom, sit down, listen, read, and write in a strand-driven, project-driven type of learning does not fit today’s classroom, especially when half of the students are boys (Cook, 2006). Why?

Over the past two decades, scientists have said that brain chemistry and male sex hormones play a role in boys’ physical and mental abilities. Girls develop language skills more quickly and typically are more patient, while boys tend to have better hand-eye coordination and less developed fine-motor skills. (Cook, 2006, p. 5)

The physical and mental developmental difference between boys and girls helps to explain the differences in learning styles. Research has shown boys are more impatient than girls. In the classroom, if the boy is having trouble completing an activity and/or lesson, he may be more likely to verbally explain his ideas or answers to overcome the frustration of not being able to complete the activity and/or lesson. With girls being more patient, they are physically and mentally able to stay focused on time-consuming tasks associated with written, sequential, and global learning activities. They have the ability to “stick with it” to write out the answer, complete multi-step processes, or look at “the big picture” and internalize how they will use this information.
Research Question 4: Were there differences by socioeconomic status (free-reduced lunch or not) on the learning style scale scores? No significant differences were found with this socioeconomic indicator on the nine learning style scale scores.

Research Question 5: What were the means and standard deviations for GPA and Rasch Unit scores (RIT scores) at the end of the first year and the learning style scale scores? Descriptive statistics were run to identify the mean and standard deviation for GPA and RIT scores. The mean score for GPA was 3.07, which is about a B average on the standard letter-grade scale. This group scored slightly above the national average on RIT Reading (225.3 locally compared to 222.6 nationally), RIT Language Usage (225.0 locally compared to 220.8 nationally), and RIT Math (236.8 locally compared to 224.0 nationally). The well-published statistics and academic history of North Dakota students performing above national averages on standardized tests such as the ACT and SAT were supported by collected data.

Research Question 6: Was there a relationship between GPA and the nine learning style scale scores? Multiple correlation and regression were calculated to determine the relationships between GPA and the nine learning style scale scores. A significant positive relationship was identified between the following learning styles: visual, individual, written expressive, and sequential. A significant negative relationship was identified between the following learning styles: group, auditory, kinesthetic, and global.

Research Question 7a: Was there a relationship between learning styles and the RIT Reading score? Multiple correlation and regression were calculated to determine
the relationships between RIT Reading score and the nine learning style scale scores. Only one variable was significant for this analysis: visual. Students with high visual score tended to higher RIT Reading scores.

Research Question 7b: Was there a relationship between learning styles and the RIT Language Usage score? Multiple correlation and regression were calculated to determine the relationships between RIT Language Usage score and the nine learning style scale scores. Only one variable was significant for this analysis: visual. Students with high visual scores tended to have higher RIT Language Usage scores.

Research Question 7c: Was there a relationship between learning styles and the RIT Math score? Multiple correlation and regression were calculated to determine the relationships between RIT Math score and the nine learning style scale scores. Two variables were significant for this analysis: visual and global. Students with high visual scores tended to have higher RIT Math scores, and students with high global scores tended to have lower RIT Math scores.

Conclusions and Explanations

Research Question 1: What were the means and standard deviations for the learning style scale scores (visual, auditory, kinesthetic, individual learning, group learner, oral expressive, written expressive, sequential, and global learning) of freshman students enrolled during the fall semester of 2007 at Red River High School?

This researcher can only speculate why this group preferred individual and kinesthetic learning activities. The freshman students might have experienced numerous and/or negative group learning opportunities in their educational careers. In the past at Red River, students from all grades have expressed their displeasure with
group activities if the group receives the same grade for the activity, even though some participants do not “carry their weight.” If they work alone, they cannot blame anyone else for not doing his/her part in the activity. To address kinesthetic learning style, this researcher examined the differences in the academic day between middle school and high school in our area. Middle schools have more breaks, more opportunity for social interaction, a larger variety of academic activities within the same classroom, and more contact time with a primary classroom instructor, such as in a home-room instructional period. This constant movement and change may lead to the students’ preference for kinesthetic or movement-based learning activities.

Research Question 4: Were there differences by socioeconomic status (free-reduced lunch or not) on the learning style scale scores?

This finding came as a surprise to this researcher. Historic research has asserted that socioeconomic status is the single best predictor of academic achievement; low socioeconomic status predicts low achievement (Caldwell & Ginther, 1996). But, the research question is not asking about academic achievement. The research question is asking about preferred learning styles. Once the question was analyzed and clarified, the distinction between the two criteria (academic achievement and preferred learning style) was clear. Based on the data supplied by this sample, there was no significant difference found with socioeconomic factors (free-reduced lunch or not) and the nine learning style scale scores.

Research Question 6: Was there a relationship between GPA and the nine learning style scale scores?
To draw conclusions between the positive relationship between visual, individual, written expressive and sequential learning styles and GPA, this researcher believed there to be a direct relationship between the learning styles and higher order/critical thinking skills. The students possess and/or have developed the higher order/critical thinking skills that assist them in their academic success. The visual, individual, written expressive and sequential learning styles utilize identifiable higher order/critical thinking skills that involve analysis, synthesis, and evaluation.

To examine the relationships between GPA and the nine learning style scale scores, we need to briefly review each learning style and analyze the positive or negative relationship each has with higher order/critical thinking skills utilized by each learning style.

**Positive relationship:** *Visual learner:* The learner’s preference for visually gathering and comprehending information through reading, observing, and to internalize their own perspective. *Individual learner:* The learner’s preference for addressing acquisition of knowledge from an individual perspective, comparing new information with previous experience and reflecting on their own opinions and models of perception. *Written expressive:* The learner’s preference for expressing understanding and insight through written descriptions, questioning, and drawing conclusions about the subject matter. *Sequential:* The learner’s preference for information and procedures that are based on logic, timeliness, ordering, prioritizing, and the use of inferences (Styles of Learning, n.d.).

Within each of these learning styles are identifiable higher order/critical thinking skills that appear high on Bloom’s Taxonomy scale. Critical thinking involves logical
thinking and reasoning including skills such as comparison, classification, sequencing, cause/effect, patterning, webbing, analogies, deductive and inductive reasoning, forecasting, planning, hypothesizing, and critiquing (Eduscapes, n.d.). When we examine higher order thinking skills, we focus on the top three levels of Bloom's Taxonomy: analysis, synthesis, and evaluation (Coun.uvic.ca, n.d.).

**Negative Relationship:** *Auditory Language:* Learner's preference for listening, understanding spoken directions, and following logic that is explained verbally. *Kinesthetic:* Learner's preference for understanding by actively touching, manipulating, arranging, acting, and experimenting with various physical approaches. *Global:* Learner's preference for "big picture" understanding and addressing information whole to part (Styles of Learning, n.d.).

Within each of these learning styles are identifiable higher order/critical thinking skills that appear low on the Bloom's Taxonomy scale.

Auditory—observe and recall, list, define, tell.

Kinesthetic—demonstrate, complete, illustrate.

Global—order, group, infer causes (Coun.uvic.ca, n.d.).

To draw conclusions between the negative relationship between auditory language, kinesthetic, and global learning styles and GPA, this researcher believed there to be a direct relationship between the learning styles and higher order/critical thinking skills. The students possess and/or have developed the higher order/critical thinking skills that assist them in their academic challenges. The auditory language, kinesthetic, and global learning styles utilized identifiable higher order/critical thinking skills that do not involve analysis, synthesis, and evaluation.
Why do students with high visual and high sequential scale scores tend to have high GPAs? Visual learners prefer visually gathering and comprehending information through reading, observing, and internalizing information into their own perspective. Sequential learners prefer information and procedures that are based on logic, timeliness, ordering, prioritizing, and the use of inferences (Styles of Learning, n.d.). These students are able to gather and comprehend information through reading and observation which are common tasks used within the classroom. Once the information is obtained by the students, they are able to internalize the data, compare and discriminate between ideas, relate knowledge from several sources, and make choices based on the supplied data. Again, all of these intellectual tasks are high on Bloom’s Taxonomy (analysis, synthesis, and evaluation) of higher order/critical thinking skills.

Why do students with high group and high global scale scores tend to have low GPAs? Group learners prefer collaboration with one or more other students in planning, discussing, and sharing responsibility. Global learners prefer understanding and addressing information whole to part and how to apply acquired knowledge (Styles of Learning, n.d.). These students are able to work collaboratively, group problem-solve using required skills or knowledge, and infer cause and affect relationships. Again, all of these intellectual tasks are low on Bloom’s Taxonomy (knowledge, comprehension, application) of higher order/critical thinking skills. Although cooperative and group learning activities are promoted and used in many classes and subjects, a majority of assignments, projects, and virtually all tests are individual in nature. If the student relies on others (cooperative learning) to overcome his/her...
academic weaknesses, he/she will ultimately experience a lower GPA once he/she has
to complete an assignment, project, or test independently.

Why do students with high visual scores tend to score high on RIT Reading
scores? This learner’s preference is for visually gathering and comprehending
information through reading, observing models, maps, graphic organizers, charts, and
demonstrations, and to internalize their own perspective (Styles of Learning, n.d.). The
act of reading is a visually-dependent activity. The characters on the page or screen are
visually gathered, the visual graphics are internalized and interpreted, and the reader is
forced to make sense of the information presented. If the visual learner possesses the
well-developed reading skills and abilities (able to recognize the words, derive meaning
from charts/graphs, comprehend the messages being printed/displayed) characteristic of
a visual learner, it is natural to conclude a visual learner will score higher on a visually-
dependent assessment (such as the MAP Reading test) than a non-visual learner or a
learner with poor reading skills and abilities.

Why do students with high visual scores tend to score high on RIT Language
Usage scores? Visual learners have vivid imaginations, learn by seeing images, they
benefit from seeing graphic representations, visual models, and they learn best by
reading and watching (Burdett, 2001; Kanar, 1998; Vincent & Ross, 2001). During
classroom activities it is necessary to use visual materials frequently such as graphics,
pictures, posters and photographs (Cirkinoglu & Demirei, 2007). The act of reading
and engagement in the writing process are both visually-dependent activities. The
Language Usage portion of the MAP test evaluates: descriptive, narrative, and personal
composition writing, persuasive writing, writing expository text, the proper use of
nouns, pronouns, verbs, adjectives, adverbs, conjunctions, and interjections, use of sentence structures, use of figurative language and sound patterns, and proper use of spelling, punctuation, and grammar (Northwest Evaluation Association, n.d.a). If the visual learner possesses the well-developed language usage skills and abilities (able to write in various methods, use proper sentence structure, and use proper spelling, punctuation, grammar) characteristic of a visual learner, it is natural to conclude a visual learner will score higher on a visually-dependent assessment (such as the MAP Language Usage test) than a non-visual learner or a learner with poor language usage skills and abilities.

Why do students with high visual scores tend to score higher on RIT Math scores? Visual learners thrive with visual clues (films, projection viewers, PowerPoint), they enjoy assignments in writing, provide handouts, visualize new ideas or information presented, and read all of the assignment directions (Bell, 1998; Vincent & Ross, 2001). The act of analyzing a math problem and completing the multiple steps and calculations to solve the equation is a visually-dependent activity. The characters, symbols, letters, numbers, and mathematical calculations on the page are visually gathered, and the reader is forced to make sense of and logically process the information presented. If the visual learner possesses the well-developed reading skills and abilities (able to recognize numbers, mathematical symbols, derive meaning from charts/graphs, comprehend multiple steps needed for calculation) characteristic of a visual learner, it is natural to conclude a visual learner will score higher on a visually-dependent assessment (such as the MAP Math test) than a non-visual learner.
Why do students with high global scores tend to score lower on RIT Math scores? Global learners tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly “getting it.” Global learners may be able to solve complex problems quickly or put things together in novel ways once they have grasped the big picture, but they may have difficulty explaining how they did it (Science Education Resource Center, n.d.). Math is a very sequential process. The student has to solve steps a, then b, then c, then d, and so on in a specific order. If a step is missed or skipped, it can negatively affect the answer to the equation. If the global learner “jumps around” the equation, not fully understanding or answering each step in the process, it is natural to conclude a global learner (who tends to learn in large jumps, absorbing material randomly without seeing connections) will score lower on a sequential assessment (such as the MAP Math test) than a non-global learner.

Recommendations

To effectively adapt instructional strategies to meet the learning styles of students, there must be a systematic philosophical and pedagogical change with administrative and school board support and training for the entire instructional and support services faculty/staff. While this training will be on-going and repeated as new instructors come and go within the district, the following is an outline of the Learning Styles Program:

1. Establish budgetary line-item financial support and dedicated professional development time, training, and support to the Learning Styles Program by the school board, superintendent, directors, and building administrators.

72
2. Educate and train instructional and support services faculty/staff on the Learning Styles outlined within the CAPSOL Style of Learning Assessment.

3. Require the entire instructional and support services faculty/staff to take the CAPSOL during summer in-service training.

4. Survey the instructional and support services faculty/staff at the beginning of the first year to identify their perceptions of learning styles and compare their perceptions to the actual CAPSOL data. This will assist the instructional and support services faculty/staff to compare what they “think” about their students’ learning styles, and what the data can “prove” about their students’ learning styles.

5. In-service the instructional and support services faculty/staff on Differentiated Instruction. Again, this will need constant monitoring, review, and updating as instructional and support services faculty/staff change.

6. Monitor progress reports, academic referrals, and student/parent academic concerns to identify if the academic needs of the students are being met.

7. Examine the possibility and feasibility of scheduling students according to learning styles and instructors’ learning/teaching styles.

8. Use the following data from eighth grade for incoming freshman students: End-of-year GPA, Spring MAP scores, and scores from the North Dakota State Assessment.

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9. Administer the CAPSOL early in Fall Quarter (within the first 2 weeks of class) of the freshman year.

10. Upload the CAPSOL data into PowerSchool by mid-term of Fall Quarter of the freshman year so instructors have access to the Learning Styles data through the Class Roster Files.

The Learning Styles Program outlined above is not meant to be a static program, but a fluid and evolving program. The program must be supported by commitment (financial, training, and time for implementation and planning) from the district administration, cooperation and implementation from the instructional and support services faculty/staff, constant monitoring for effectiveness, and constant adapting as the needs of the students change. We have to be able to identify the way our students learn and adapt our instructional strategies to meet their learning styles if we want to maximize their learning opportunities and success. "Know your audience."

Wendy’s Story—Rewind

In May of her eighth-grade year, Wendy’s course grades, GPA, North Dakota State Assessment scores, and fall and spring MAP scores were sent to the high school for the counselors to examine. In August, during teacher in-service training, the high school instructors were required to attend workshops on Differentiated Instruction and Learning Styles and take the CAPSOL to identify their own learning styles. New instructors would attend the full-course workshop, while instructors already in the system would attend refresher classes to jog their memories on the importance of identification of learning styles, strategies, and skills to meet various learning styles,
and they were given planning time to develop their skills in adapting instructional styles to student learning styles.

During the first week of class, Wendy’s required science class took the CAPSOL Style of Learning Assessment, and her scores (along with all other freshmen) were entered into PowerSchool for teachers to access in their Class Roster Files. By mid-term of the first quarter, all of the students were given the CAPSOL, their scores were entered into PowerSchool, and the counselors were busy working with the classroom instructors to monitor and address any academic concerns that were creeping into the classroom.

The counselors, classroom instructors, and principals worked together to address any concerns or problem areas matching instructional styles to learning styles. The classroom instructors were asked to review their notes on Differentiated Instruction, adapt lessons and activities to match their audience, and to challenge their students with lessons and activities that would strengthen their weaker learning styles. If needed, student schedules were adjusted to match learning styles with instructor teaching styles at that time. Scores on the North Dakota State Assessment and MAP Tests were also being examined and tracked to monitor progress and to identify areas of strength and/or weaknesses. All of this data would be used to check progress at the end of each quarter, at the beginning of the second semester, and when students began to select classes and instructors in the future.
Appendix A

Letter of Request to Use Existing School Data

Red River High School

July 17, 2008

Dr. Larry P. Nybladh
Superintendent
Grand Forks Public School
District No. 1
2400 47th Avenue South
Grand Forks, ND 58201

Dear Dr. Nybladh:

My name is Kelly D. Peters, and I am an Associate Principal at Red River High School in Grand Forks, North Dakota. I am also a doctoral student at the University of North Dakota in the Educational Leadership Department. I am formally writing this letter to request permission to use existing school data for my dissertation.

Below is an abstract of my dissertation topic and related information.

TITLE: Know Your Audience: An Assessment of the Preferred Learning Styles and Student Characteristics of Freshman Students at Red River High School in Grand Forks, North Dakota

DESCRIPTION: This research is an assessment of the freshman students enrolled in the general education Physical Science class at Red River High School during the Fall semester of the 2007-2008 school year. Learning style is the preferred or habitual patterns of mental functioning: information processing and the formation of ideas and judgments such that within a learner’s style the “patterns of attitudes and interests influence what a person will attend to in a potential learning situation” (Burris, Kitchel, Molina, Vincent, and Warner, 2008, p. 44). There is a general acceptance that the manner in which individuals choose to or are inclined to approach a learning situation has an impact on performance and achievement of learning outcomes (Cassidy, 2004, p. 420). If there are different learning styles, different approaches to learning, and different ways to instruct; it leads this researcher to believe that the more we know about our students and how they learn, the better able we will be to meet their educational needs and facilitate their success. By identifying common characteristics and learning more about our students we can understand the common learning needs within individual students and/or groups of students. Once we know how students learn, we can become cognizant of their needs and interests, and we (educators) can create curriculum that addresses the diversity of all learners (Johnson, 2006, p. 38).

METHODOLOGY: Research will be done using existing data obtained by this researcher within his job function as associate principal at the Red River High School. Data will be attained from the CAPSOL (Computerized Assessment and Prescription Styles of Learning) Style of Learning Assessment, PowerSchool (on-line grading and attendance program), STARS (North Dakota State Automated Reporting System), and MAP (Measures of Academic Progress). This data is currently stored on a computer server at the Grand Forks School District. Working in
conjunction with the Education Foundations Department at UND, the data will be uploaded into
the SPSS program for computation and analysis.

ANTICIPATED RESULTS: This researcher believes there will be identifiable characteristics
in the freshman student population that will answer the following research questions: 1. What
are the overall percentage scores of “high and low preference” of learning style (visual, auditory,
bodily, kinesthetic, individual learning, group learner, oral expressive, written expressive,
sequential, and global learning) of freshman students enrolled during the fall semester of 2007 at
Red River High School? 2. What gender exhibited the largest sampling of “high preference”
percentage score of learning styles (visual, auditory, bodily, kinesthetic, individual learning,
group learner, oral expressive, written expressive, sequential, and global learning) of freshman
students enrolled during the fall semester of 2007 at Red River High School? 3. What academic
grade point average (GPA) standing exhibited the largest sampling of “high preference”
percentage score of learning styles (visual, auditory, bodily, kinesthetic, individual learning,
group learner, oral expressive, written expressive, sequential, and global learning) of freshman
students enrolled during the fall semester of 2007 at Red River High School? 4. What Rasch
Unit Score (RIT Score) and Rasch Unit Range (RIT Range) exhibited the largest sampling of
“high preference” percentage score of learning styles (visual, auditory, bodily, kinesthetic,
individual learning, group learner, oral expressive, written expressive, sequential, and global
learning) of freshman students enrolled during the fall semester of 2007 at Red River High
School? 5. What identifiable characteristics does the largest sampling of “high preference”
percentage score of learning styles (visual, auditory, bodily, kinesthetic, individual learning,
group learner, oral expressive, written expressive, sequential, and global learning) have in
common of freshman students enrolled during the fall semester of 2007 at Red River High
School?

I am asking for permission to use existing data currently on file and accessible to me as an
Associate Principal. Confidential student information (names) will not be identifiable as each
student entry will be coded by his/her PowerSchool student identification number. The data will
be stored on the secure Grand Forks Public School District computer network server.

If you have any questions, comments, or concerns, please feel free to contact me at my office
(701) 746-2407, ext 810, at home (701) 757-0165, on my cell phone (701) 740-9583, or by
e-mail: Kelly.Peters@GFSchools.org. Thank you.

Sincerely yours,

Mr. Kelly D. Peters
Associate Principal
Appendix B

Permission Form to Use Existing School Data

RESEARCH

Our school system considers it contrary to the best interests of the pupils, the schools, and the public to allow solicitation or accessing of pupils by outside organizations within or through the public schools. Accordingly, no activities of this nature will be permitted except through specific sanction of the board. In whatever exceptions are granted, there must be an avoidance of pressure on the children and school staff in carrying out such projects.

We are reluctant to permit the pupils and school organizations to serve as a device for collecting information not pertinent to the conduct of the school program. Any request of this nature demands the close scrutiny of the administration both as to the purpose of collecting the information and the manner in which the data are gathered. In rare instances when such a request is granted, no pressure should be placed upon either children or parents to furnish information unless matters of public health or safety are directly involved.

Applications to conduct research in the schools must be made to the appropriate Assistant Superintendent prior to the commencement of the study. Approval may be granted if the project has useful implications for school improvement planning.

Experimental programs and "pilot studies" must have the approval of the superintendent's office. Experimental programs will be designed in such a manner that appropriate evaluative techniques may be applied and that such evaluations will determine the feasibility of implementing such programs on a broader base.

Request to Conduct Research in the Grand Forks Public Schools

<table>
<thead>
<tr>
<th>Date: July 22, 2008</th>
<th>Name: Kelly Don Peters</th>
<th>Phone: (701) 757-0165</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fax or Email: <a href="mailto:Kelly.Peters@GFSchools.org">Kelly.Peters@GFSchools.org</a></td>
<td>Research Advisor: Dr. Gary Schnellert</td>
<td></td>
</tr>
<tr>
<td>Address: 506 40th Avenue South, Grand Forks, ND 58201</td>
<td>College or Dept.: Educational Leadership</td>
<td></td>
</tr>
</tbody>
</table>

Research Title: Know Your Audience: An Assessment of the Preferred Learning Styles and Student Characteristics of Freshman Students at Red River High School

Give a brief description of your research. Attach additional papers if necessary. Please attach sample copies of assessment instrument, tests, or communications to be used:

Please see attached letter.

Number of students needed for research: Class of 2011 (300)  Number of teachers needed for research: None  Grade Level or Dept.: Class of 2011

What schools are you interested in conducting the research in?
Red River High School in Grand Forks, North Dakota

Will confidential records be required? [If yes, indicate type]: Yes, GPA, MAP Scores, Demographic Information, CAPSOL Data

Length of time required to complete the research: 1 School Year

To be completed by School District Official:

Approved: [Signature]  Date: 7-22-08

Assistant Superintendent Signature: [Signature]  Date: 7-22-08

To be conducted research in the following schools:
Red River High School in Grand Forks, North Dakota

Page 26

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### CAPSOL Style of Learning Assessment-Form B


<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
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</table>

| 1. I remember what I read better than what I hear. | 4 3 2 1 |
| 2. I learn better if someone lectures to me rather than reading silently to myself. | 4 3 2 1 |
| 3. When I make or create learning tools for my studies it helps me to remember. | 4 3 2 1 |
| 4. I complete more work when I work alone. | 4 3 2 1 |
| 5. When I really have a lot of work to do I like to work with 3 or 4 colleagues. | 4 3 2 1 |
| 6. I can say the answer to a question better than I can write it. | 4 3 2 1 |
| 7. Assignments which I write are easy for me to do. | 4 3 2 1 |
| 8. I like to follow step by step directions. | 4 3 2 1 |
| 9. I like to draw pictures. | 4 3 2 1 |
| 10. I understand a problem which is written down better than one I hear. | 4 3 2 1 |
| 11. When I do math problems, I say the numbers to myself. | 4 3 2 1 |
| 12. I learn best by building, baking or doing things. | 4 3 2 1 |
| 13. I like to work by myself. | 4 3 2 1 |
| 14. I like to learn in a group because I learn from others in my group. | 4 3 2 1 |
| 15. I would rather tell how something works than write how it works. | 4 3 2 1 |
| 16. I like doing written assignments. | 4 3 2 1 |
| 17. I like to organize my work. | 4 3 2 1 |
| 18. I like to daydream. | 4 3 2 1 |
| 19. I would rather read a story than listen to a story. | 4 3 2 1 |
| 20. I remember information I hear better than information I read. | 4 3 2 1 |
| 21. I like to accomplish tasks with my hands, like repairing objects, etc. | 4 3 2 1 |

#### DIRECTIONS: Read each question. Circle the four (4) if the statement always describes you. Circle the one (1) if it is never like you. Circle the two (2) if it is sometimes like you, and circle the three (3) if it is generally like you. Please respond with the first answer that comes to mind. Please do not look back and review previous answers. To score, tear off this sheet when finished.
INSTRUCTIONS FOR SCORING

There are 5 rows of scores for each mode. For example, notice that the 5 rows of visual (V) are shaded. The number circled in each row is the score for that row. Total the scores in the five rows for each mode. The highest possible score is 20 and the lowest possible score is 5. Mark the score for each mode on the CAPSOL Style of Learning Profile.

A high score (16 through 20) indicates a high preference for that particular mode.

A low score (5 through 9) indicates a low preference for that particular mode. It is likely the student will not function well in this mode. There are suggestions on the back of this sheet to enhance a student's preference to operate in this mode.

<table>
<thead>
<tr>
<th>MODE</th>
<th>LOW PREFERENCE</th>
<th>HIGH PREFERENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V) Visual</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(A) Auditory</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(BK) Bodily-Kinesthetic</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(I) Individual</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(GR) Group</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(OE) Oral Expressive</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(WE) Written Expressive</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(S) Sequential</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
<tr>
<td>(GL) Global</td>
<td>5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20</td>
<td></td>
</tr>
</tbody>
</table>

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HIGH PREFERENCES

VISUAL — PERCEIVING THE WRITTEN NUMBER AND WORD
1. Use walls, videos, and other visual media to learn.
2. Take notes during presentations.
3. Work puzzles or chart outlines.
4. Use workbooks and notebooks.
5. Use imagination and think in pictures.

AUDITORY — PERCEIVING THE SPOKEN NUMBER AND WORD
1. Use cassette or CD recordings to listen to recorded lessons.
2. Be involved in classroom lectures and discussions.
3. Practice or review out loud.
4. Participate in oral reports, debates, and discussions.
5. Talk about things—look for similarities.

BODILY-KINESISThem — INVOLVING ALL SENSES IN THE LEARNING PROCESS
1. Use props, charts, and demonstrations.
2. Draw a visual to work and learn from.
3. Use simulations or hands-on examples that demonstrate the same principles.
4. Use rhythm when learning lists.

INDIVIDUAL LEARNER — PREFERENCE TO STUDY AND WORK ALONE
1. Use computers, tape recorders, and VCRs.
2. Have a quiet place to work and learn.
3. Use learning approaches that allow you to work alone, such as computers or programmed instructions.
4. Use programmed learning and instructional packages.
5. Keep a log to chart your progress, chart your progress.

GROUP LEARNER — PREFERENCE TO STUDY AND WORK IN A GROUP
1. Use group study techniques such as discussion, group-organized, cooperative, or task teams to address problems.
2. Use project teams.
3. Be involved in discussions about what is being learned.
4. Use group responsibility activities.
5. Build team vision, mission and beliefs.

ORAL EXPRESSIVE — DESIRE TO SPEAK TO INDIVIDUALS OR A GROUP
1. Present oral reports.
2. Use panel discussions and debates.
3. Put thoughts on paper, oral reports.
4. Participate in class discussions and lectures.
5. Participate in panel discussions for a better understanding.

WRITTEN EXPRESSIVE — DESIRE TO DO WRITTEN WORK
1. Use written reports, essays, journals, log books.
2. Investigate writing programs, word processing, and chat on the web.
3. Use lecture taking.
4. Write 10-15 seconds after a question is asked, to provide time to think.
5. Provide for creative writing experiences.

SEQUENTIAL — PROCESSING STEP BY STEP
1. Provide and develop outlines.
3. Use phonetic symbols for language.
4. Outline descriptions into small parts and analyze the parts.
5. Use experimental puzzle, skill exercises and worksheets.

GLOBAL — PROCESSING BY UNDERSTANDING THE WHOLE
1. Provide a general overview prior to discussion. Add notes of the presentations.
2. Involve faculty, humor, and appeal to understand.
3. Experience concepts then reflect, then discuss the whole picture.
4. Use identifying techniques.
5. Drawings, graphics, pictures, and imaginative words in stories or descriptions.
6. Provide opportunities to think about thinking.

LOW PREFERENCES

VISUAL — PERCEIVING THE WRITTEN NUMBER AND WORD
1. Read materials that are enjoyable.
2. Write out all math computations.
3. Pay close attention to colors and shapes.
4. Practice using computer games, reading graphs, charts, maps, and other visual devices.
5. Often chooses to focal familiar objects such as trees, plants, and flowers.

AUDITORY — PERCEIVING THE SPOKEN NUMBER AND WORD
1. Talk about familiar things.
2. Repeat to others after it has been heard.
3. Repeat things under your breath.
4. Practice listening skills involving funny or important quotes.
5. Become familiar with audio cassette tapes and CDs.

BODILY-KINESISThem — INVOLVING ALL SENSES IN THE LEARNING PROCESS
1. Handle tomato items and describe the color and texture.
2. Become involved in arts, singing, dancing, sports, or other such sensory activities.
3. Use activities which involve body movements.
4. Become involved in art, coloring, drawing, or other such activities.
5. Make mobiles, use tape, and fold models.

INDIVIDUAL LEARNER — PREFERENCE TO STUDY AND WORK ALONE
1. Read and tell jokes that have been compiled alone.
2. See how something is done and then practice doing it alone.
3. Work alone on ventures such as drawing, writing, making a collection, etc.
4. Participate in study skills programs.
5. Imagine doing something alone.

GROUP LEARNER — PREFERENCE TO STUDY AND WORK IN A GROUP
1. Share ideas with others.
2. Encourage open group for all to participate.
3. Provide activities that encourage interaction among participants.
4. Provide an open mind to ideas of others.
5. Revise social skills.

ORAL EXPRESSIVE — DESIRE TO SPEAK TO INDIVIDUALS OR A GROUP
1. Discuss topics which are familiar.
2. Relax others verbally to participate by talking.
3. Ask in understanding of self and expose self concept.
4. Look for opportunities for peer interaction.
5. Read written reports aloud.

WRITTEN EXPRESSIVE — DESIRE TO DO WRITTEN WORK
1. Be involved in writing about things which are familiar.
2. Review basics of writing.
3. Compose short, concise, quality reports.
4. Use composition papers.
5. Use writing(autograph) for related fields.

SEQUENTIAL — PROCESSING STEP BY STEP
1. Practice beginning objects.
2. Develop writing skills.
3. Practice writing step by step directions. For example, how to make a peanut butter and jelly sandwich.
4. Take things apart and then put them back together.
5. Classify objects according to size, shape and color, compare and contrast, prioritizes.

GLOBAL — PROCESSING BY UNDERSTANDING THE WHOLE
1. Use initial to encourage integration.
2. Develop skills in clustering (WEB/NO).
3. Practice identifying when reading materials.
4. Practice identifying familiar objects.
5. Foretaste what the project will look like when completed.
REFERENCES


Armstrong, L. (2005, December). Learning style considerations are important to teaching critical thinking. *Online Classroom*, p. 3.

Artess, J. (2003). How adults really learn—or what we think we know about how they learn! *MMU Learning and Teaching in Action, 2*(2), 7.


