Purpose

This study was conducted for three purposes: 1) to determine what effect student awareness of cognitive style had on the performance of vocational community college students in Oregon, 2) to explore similarities and differences among four vocational areas and between males and females in these areas with regard to perceived cognitive learning styles, and 3) to discover and describe cognitive elements that each vocational area held in common. The study was designed to meet the following six specific objectives:

1. To determine the effectiveness of the mapping process by comparing the grades of the mapped and unmapped students of the study

2. To determine the effectiveness of the mapping process by comparing the course failures of the mapped and unmapped students of the study
3. To determine the effectiveness of the mapping process by comparing the dropout rates of the mapped and unmapped students in the study.

4. To determine if there is a difference among selected vocational areas with regard to the student cognitive maps.

5. To determine if differences exist between male and female maps in each of the identified vocational areas.

6. To determine if common composite maps occur in each of the identified vocational areas.

**Methods and Procedures**

A pilot survey was conducted to determine which Oregon community colleges could be included in the study, resulting in the selection of Lane, Linn-Benton, and Mt. Hood community colleges. The population consisted of the vocational education students in these schools. Cohen's (1969) power analysis tables were used to determine the appropriate sample sizes. Students were randomly selected from the population, and their cognitive style maps, course drop status, and course failure status were identified. The "t" test, Chi-square, two-way analysis of variance, and R-mode factor analysis techniques were used to generate data for interpretation.
Findings

The findings noted for each objective were as follows:

1. The results of the "t" test showed no significant difference in mean grade point averages between mapped and unmapped students.

2. The Chi-square analysis produced no significant difference between mapped and unmapped students with respect to number of course failures or number of courses dropped.

3. Two-way analysis of variance tests were conducted on each of the 28 elements of the cognitive preference inventory. Results across the four vocational areas produced a significant difference without interaction in the elements of T(VL), Q(CES), Q(CET), Q(CP), Q(CS), Q(CTM), F, K. Tukey's Honestly Significant Difference (Glass and Stanley, 1970) test was applied to determine where the differences existed and these results were reported.

4. Additional results of the two-way analysis of variance with regard to male/female scores yielded significant differences without interaction on the following nine elements:
Final results of the two-way analysis of variance noted that there was significant interaction between the levels of vocational area and sex on the six elements of $Q(A)$, $Q(T)$, $Q(P)$, $Q(CEM)$, $Q(CK)$, and $Q(CT)$. The interaction was plotted and described as ordinal or disordinal.

5. The R-mode factor analysis produced commonly held elements for each vocational area as follows:

<table>
<thead>
<tr>
<th>AGRICULTURE</th>
<th>BUSINESS</th>
<th>HEALTH</th>
<th>TRADE AND INDUSTRIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T(AL)$</td>
<td>$T(AL)$</td>
<td>$T(VL)$</td>
<td>$Q(T)$</td>
</tr>
<tr>
<td>$T(VL)$</td>
<td>$T(AQ)$</td>
<td>$T(VQ)$</td>
<td>$Q(V)$</td>
</tr>
<tr>
<td>$Q(CES)$</td>
<td>$Q(T)$</td>
<td>$Q(V)$</td>
<td>$Q(CES)$</td>
</tr>
<tr>
<td>$Q(CH)$</td>
<td>$Q(CK)$</td>
<td>$Q(P)$</td>
<td>$Q(CKH)$</td>
</tr>
<tr>
<td>$Q(CK)$</td>
<td>$Q(CKH)$</td>
<td>$Q(CE M)$</td>
<td>$Q(CT)$</td>
</tr>
<tr>
<td>$Q(CT M)$</td>
<td>$Q(CE M)$</td>
<td>$Q(CS)$</td>
<td>$K$</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>I</td>
<td>R</td>
</tr>
</tbody>
</table>

Conclusions and Recommendations

Based on the findings of objectives one, two and three, it was determined that the treatment of cognitive mapping did not cause
significant gains in the students' academic achievement. The differences among the four vocational areas, and the similarities within each area, suggest that certain accommodations in curriculum design and teaching methods could be beneficial. Male and female preferences in certain cognitive elements suggest some differences in learning style.
Cognitive Mapping and Vocational Students in Selected Oregon Community Colleges

by

Allan Dale Fisher

A THESIS

submitted to

Oregon State University

in partial fulfillment of the requirements for the degree of

Doctor of Education

Completed April 18, 1980
Commencement June 1980
APPROVED:

Redacted for privacy

Assistant Professor of Agricultural Education in charge of major

Redacted for privacy

Dean of School of Education

Redacted for privacy

Dean of Graduate School

Date thesis is presented April 18, 1980

Typed by Opal Grossnicklaus for Allan D. Fisher
ACKNOWLEDGEMENT

It is my belief that true gains in personal growth are accomplished in proportion to one's openness and others' willingness to share. Therefore sincere appreciation is given to the following:

.. The members of my doctoral committee—Dr. Pat Atteberry, Dr. Lee Cole, Dr. Wayne Courtney, Dr. Robert McCain, and Dr. Carvel Wood—for their interest and assistance in the graduate process

.. Dr. Lee Cole, my major professor, for his consistent willingness to support and share

.. Dr. Wayne Courtney for his special help and instruction in research procedures

.. Dr. Henry Ten Pas and Dr. Joel Galloway, former committee members, for their guidance at the beginning of this journey

.. My wife Donna and daughters, Amy and Diana, for their support and encouragement

.. The staff at Mt. Hood Community College for their efforts in providing data for the study.

In a special way I give all credit, honor, and glory to my God that never faileth.

A. D. F.
# TABLE OF CONTENTS

I. INTRODUCTION .................................................. 1
   - Purpose of the Study ......................................... 3
   - Objectives .................................................. 4
   - Rationale .................................................. 4
   - Assumptions ............................................... 10
   - Definitions ............................................... 11

II. BACKGROUND, RELATED LITERATURE AND RESEARCH ............. 17
   - Cognition .................................................. 18
   - Foundations from Piaget ................................... 19
   - The Educational Sciences .................................. 20
   - Related Research .......................................... 24
   - Oregon's Community College System ...................... 29
   - Vocational Education in Oregon ........................... 33

III. DESIGN OF THE STUDY .......................................... 37
   - Population ................................................ 37
   - Selection of Samples ..................................... 39
   - Instrument ............................................... 40
   - Dependent Variables ..................................... 47
   - Design Matrix and Method of Analysis .................... 48

IV. PRESENTATION OF FINDINGS ................................... 57
   - Treatment ................................................. 57
   - "t" Test Results .......................................... 58
   - Chi-Square Test Results ................................... 58
   - Two-Way Analysis of Variance Results .................... 60
   - Factor Analysis Results .................................. 65
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of Findings</td>
<td>68</td>
</tr>
<tr>
<td>Results of &quot;t&quot; Test</td>
<td>68</td>
</tr>
<tr>
<td>Results of Chi-Square Test</td>
<td>68</td>
</tr>
<tr>
<td>Results of Two-Way Analysis of Variance</td>
<td>68</td>
</tr>
<tr>
<td>Results of R-Mode Factor Analysis</td>
<td>69</td>
</tr>
<tr>
<td>Conclusions</td>
<td>70</td>
</tr>
<tr>
<td>Objectives One, Two and Three</td>
<td>70</td>
</tr>
<tr>
<td>Objective Four</td>
<td>70</td>
</tr>
<tr>
<td>Objective Five</td>
<td>72</td>
</tr>
<tr>
<td>Objective Six</td>
<td>74</td>
</tr>
<tr>
<td>Implications</td>
<td>75</td>
</tr>
<tr>
<td>Recommendations for Further Study</td>
<td>78</td>
</tr>
</tbody>
</table>

BIBLIOGRAPHY | 80 |

APPENDIX A. Pilot Survey and Results: Oregon Community College Involvement in Cognitive Mapping | 86 |

APPENDIX B. Cognitive Style Mapping Instrument and Explanation Booklet | 89 |

APPENDIX C. Cognitive Style Models | 112 |

APPENDIX D. Significant Interaction Plots: Two-Way Analysis of Variance | 119 |

APPENDIX E. Percentages of Common Variance and Cumulative Percentages for the R-Mode Factor Analysis | 126 |
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Percent of Enrollees Above Average (Median) in Academic Aptitude</td>
<td>9</td>
</tr>
<tr>
<td>1.2</td>
<td>Ability Measures of Male High School Graduates of Vocational Programs (In Percent)</td>
<td>9</td>
</tr>
<tr>
<td>3.1</td>
<td>&quot;t&quot; Test Design Matrix</td>
<td>48</td>
</tr>
<tr>
<td>3.2</td>
<td>Chi-Square Design Matrix</td>
<td>51</td>
</tr>
<tr>
<td>3.3</td>
<td>Two-Way Analysis of Variance Design Matrix</td>
<td>53</td>
</tr>
<tr>
<td>3.4</td>
<td>Two-Way Analysis of Variance Fixed Design Layout</td>
<td>55</td>
</tr>
<tr>
<td>4.1</td>
<td>Results of Course Failures</td>
<td>59</td>
</tr>
<tr>
<td>4.2</td>
<td>Results of Course Dropouts</td>
<td>60</td>
</tr>
<tr>
<td>4.3</td>
<td>Results of Two-Way Analysis of Variance</td>
<td>64</td>
</tr>
<tr>
<td>4.4</td>
<td>Results of Factor Analysis Clusters--Vocational Areas with Commonly Held Elements</td>
<td>66</td>
</tr>
</tbody>
</table>
COGNITIVE MAPPING AND VOCATIONAL STUDENTS
IN SELECTED OREGON COMMUNITY COLLEGES

CHAPTER I

INTRODUCTION

During the past decade educators have recognized a marked change in the characteristics of the postsecondary student population. This change, to a large extent, has been caused by an increasing population of non-traditional students.

Individuals traditionally denied access to higher education, especially those from low socioeconomic backgrounds and members of minority groups, have enrolled in ever-increasing numbers. ACTP (1977, p. 1)

As a result, differences in the student population have been evident not only in background and personality characteristics but in entering academic and occupational competencies as well.

In contrast to this marked change in student-body characteristics, the changes in instructional procedures at many postsecondary institutions have been slow to evolve. A report by the American College Testing Company (1977) describes a widely accepted view of education as a process in which the instructor is the dispenser of knowledge and the student is the receptor.

Even though some demographic differences have been identified and accounted for, there is a belief that other variables in the educational process should be examined. Kogan (1971, p. 242) stated:
Nevertheless, there are other kinds of individual differences to which educators should be alert, and we can expect such differences to exist even if demographic variables are held constant.

Educational psychologists, in assessing individual differences, have focused on verbal and numerical ability differences because they have been seen as being most closely associated with traditional educational goals. The counseling process has assessed personal and motivational differences. Mastery learning and competency-based education have focused on individual differences with respect to time or rate of learning. Extensive research has been completed on the measurement of abilities and interests of students while little attention has been given to psychological research on cognitive style. Witkin (1973, p. 16), one of the leading researchers on cognitive style, summarized the belief held by many about the potential of this concept:

While relatively little research has been done, compared to what is possible and needed, it is already clear that cognitive style is a potent variable in students' academic choices and vocational preferences; in students' academic development through their school career; in how students learn and teachers teach, and in how students and teachers interact in the classroom.

Many models for cognitive style have been proposed (Appendix C). The model developed and implemented to the greatest extent at
the community college level is that of the late Joseph E. Hill. In
Hill's (1976, p. 3) model, the concept of cognitive style is expressed
as a Cartesian product of the sets: symbols and meanings, cultural
determinants, and modalities of inference.

Symbols and Meanings \times Cultural Determinants \times Modalities of Inference

Each set in this model was composed of a series of elements which
interact with elements in the other sets to form the individual's cog-
nitive style. Through application of this process to specific educa-
tional settings, teachers identify the cognitive style of their students,
understand their own style, and prescribe personalized educational
approaches.

**Purpose of the Study**

The concept of cognitive style mapping has been accepted in
several Oregon community colleges and has been implemented in a
modified manner and on a limited basis. Therefore, the central
purpose of this study was to determine what effect student awareness
of cognitive style had on the performance of the vocational community
college student in Oregon.
Objectives

The study was designed to meet the following specific objectives:

1. To determine the effectiveness of the mapping process by comparing the grades of the mapped and unmapped students of the study
2. To determine the effectiveness of the mapping process by comparing the course failures of the mapped and unmapped students of the study
3. To determine the effectiveness of the mapping process by comparing the dropout rates of the mapped and unmapped students of the study
4. To determine if there is a difference among selected vocational areas with regard to the student cognitive maps
5. To determine if differences exist between male and female maps in each of the identified vocational areas
6. To determine if common composite maps occur in each of the identified vocational areas.

Rationale

A rationale for the determination and implementation of the concept of individually preferred learning styles has as its base
the principles of 1) humane learning environments, 2) administrative, teacher, and student accountability, and 3) individual options and responsibilities.

Speaking to the issue of humane practices in education, Hunter (1977, pp. 98-99) declared:

Humanism is an end. Humanism focuses on a goal in education. That goal is based on fundamental respect for the worth of the individual, the right to be in charge of his/her own fate; to be the decision maker; to be proactive rather than merely reactive to the environment. . . . There must be many means to achieve humanistic ends.

In a recent article Rogers (1977) summarized research done in the area of humanizing education. He noted that teachers who were highest in 1) attempting to understand the meaning of the school experience for each student, 2) respect for the student as an individual, and 3) establishing a genuine relationship with the student produced the following results:

1. Greatest gains in academic achievement
2. Highest positive self-concept in students
3. More initiating behavior in the classroom
4. Fewer discipline problems
5. Lower absence rate from school.

Lange (1972) discovered that when community college nursing students determined their own learning style and it was matched with
that of the instructor the matched students perceived their instructor more positively than did non-matched students. As might be expected from Roger's (1977) findings, the matched students also had a higher gain in academic achievement.

The call for accountability has begun and is continuing to be heard on the Federal, state and local level. The fact that a time of greater accountability will inevitably come is demonstrated by such developments as: minimum competency requirements on a state and local level (Fancher, 1979), course behavioral objectives stated in measurable terms, back-to-basics movements, educational malpractice suits (Doe vs. San Francisco School District), and taxpayer revolts.

Hentoff (1977, p. 46) believes that malpractice suits will not improve schooling. "Instead," she stated, "more energy should be devoted to providing students with alternative ways to learn."

Hentoff (1977, p. 45) asked:

In any given school why can't we have many different models for learning? Why shouldn't a parent be able to choose from, let's say, seven different approaches to learning in seven different third grades?

Alternatives mean choices that help students achieve their potential. Students may be oral learners, kinesthetic learners,
independent learners, or any combination of the diverse elements that make up personality and learning styles.

Addressing alternatives, Reckinger (1979) made the interesting observation that Thomas Edison must have been a kinesthetic learner. He grew up in a rural Midwestern area where stories circulated of how terrible he had been in school. Finally, he accidentally blew up the school and was kicked out. There was no way for him to continue his learning in school. Fortunately, he found alternative ways to develop his talents.

Taglianetti (1977, p. 1), executive director of California Youth Homes, claimed that 70 to 80 percent of the youths in juvenile detention facilities are auditory learners. He remarked:

What we do with these kids is to underscore their failings (to read) and by that convert them into failures. American schools take the attitude that failing a lot makes you a failure.

Bates and Keirsey (1975) reported that 62 percent of the student population does not function well in the traditional school. They believed this was because students do not possess traditional learning styles and personalities. Thirty-eight percent learned best through activity. That thirty-eight percent had the lowest correlation between academic ability and grade point average and were the ones who most often dropped out of school.
Reckinger (1979, p. 255) made an interesting and cogent analogy among people, azaleas and cabbages:

Respect for differences requires an 'agricultural' model that focuses on individual nurture and cultivation due to innate needs. We use differing methods for growing cabbages and azaleas. And, there is no problem over which way is better; one isn't right and the other wrong. Anyone would call a farmer a fool who planted them in the same place and gave them the same fertilizer, sun, and water. We value each and, knowing they will not thrive unless needs are met, we respect their different natures and accept their special requirements.

When we respect the differences we know exist in people, and when we value the contributions to be gained by those differences, we shall widely and effectively provide for their nurture and cultivation, encouraging them to become all they can be.

Project TALENT data as reported by Evans (1971, pp. 169-70) and given in Tables 1.1 and 1.2 showed that the general population of vocational education students possessed different characteristics than students in the college preparatory curriculum. The data in Tables 1.1 and 1.2 showed that while the students in the vocational programs exhibited a lower than average academic aptitude, their ability measured in visual reasoning was above average. One should also note the difference in male/female vocational students' academic aptitude, this will be examined by consideration of objective five in this study.
Table 1.1
Percent of Enrollees Above Average (Median) in Academic Aptitude

<table>
<thead>
<tr>
<th>Secondary School Curriculum</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Curriculum</td>
<td>31</td>
<td>35</td>
</tr>
<tr>
<td>College Preparatory</td>
<td>69</td>
<td>77</td>
</tr>
<tr>
<td>Vocational</td>
<td>23</td>
<td>43</td>
</tr>
</tbody>
</table>

Table 1.2
Ability Measures of Male High School Graduates of Vocational Programs (In Percent)

<table>
<thead>
<tr>
<th>Ability Measure</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Knowledge</td>
<td>47.6</td>
</tr>
<tr>
<td>Perceptual Speed and Accuracy</td>
<td>47.4</td>
</tr>
<tr>
<td>Mathematics</td>
<td>43.2</td>
</tr>
<tr>
<td>English</td>
<td>36.9</td>
</tr>
<tr>
<td>Visual Reasoning</td>
<td>59.2</td>
</tr>
</tbody>
</table>

It would seem, then, that vocational students may possess unique characteristics. Some specific questions addressing this apparent uniqueness in cognitive style are: Does the cognitive style of the individual student in a given classroom influence learning ability? Does cognitive style determine how a student might learn best? Does cognitive style determine what a student chooses to learn? Does cognitive style interact with teaching method to produce different optimum learning situations for students with differing cognitive styles? Does the type of teaching method to which
students are exposed effect any change in their cognitive style? Can teaching methods be designed to accommodate individual students' cognitive styles? Do different types of materials used in a presentation interact with the students' cognitive style to influence the learning outcome? These questions have drawn a tentatively affirmative answer in some Oregon community college programs. They have identified student and teacher cognitive styles and utilized this information by allowing students to match their cognitive styles with that of their teachers.

In a pilot study it was determined that three of the 13 community colleges in Oregon were involved with cognitive mapping for several different vocational areas. It would seem appropriate to determine what effect this activity was having on the vocational programs and the students involved.

Assumptions

1. Population for this study consisted of vocational students from Lane, Linn-Benton, and Mt. Hood community colleges. Therefore, any implications or applications to other institutions would be based on the assumption that they are similar in nature to the participants in this study.

2. Because there was a large number of subjects (over 3000) mapped by random instructor and student requests, it was
assumed that a bias-free sample of mapped and unmapped subjects could be obtained.

3. A major part of the treatment of this study included the application and interpretation of a self-reported, preference inventory type instrument. The following assumptions relate to that type of instrument:

1. Persons possess accurate knowledge about their interests and abilities
2. Persons will report honestly and accurately about themselves
3. Persons frequently choose to do what they do best
4. Persons avoid doing what they do poorly.

Definitions

Cognition, Cognitive Style, Learning Style

The definitions and explanations of the terms cognition, cognitive style, and learning style are many and varied. As the subject was examined by professionals in the field of psychology and by learning theorists, many strands of commonality were found.

Allport (1937) used the word "style" more than 40 years ago to describe consistencies and patterns demonstrated by individuals in their day-to-day activities.
Early definitions of cognition focused on "knowing," which Morris and Pai (1976) describe as the basis for the philosophical process or state of knowing--epistemology. Closely related to cognition was perception which came from the philosophical area of phenomenology.

Scheffler (1965) offered a clear and succinct statement about the problem of knowledge. His statement contains five questions about knowledge combined with criteria which must be met if these questions are to be answered. Briefly, these questions are summarized by Eliot (1971, p. 3):

1. What is knowledge? How can we describe or define it? How can we provide it with some logical status?
2. What knowledge is most reliable or important? By what reasonable standard can we classify and rank various types of knowledge?
3. How does knowledge arise? How do men and animals compare with respect to knowing and the acquisition of knowledge? What processes and mechanisms do we ascribe to man to account for intellectual growth over his life span?
4. How should the search for knowledge be conducted? To what extent is our knowledge of cognitive development restricted by our logic or constrained by our experimental procedures?
5. How is knowledge best taught? How can parents and teachers foster the growth of knowledge and help children use it more effectively?

This study primarily addressed the second question of the last item.

Researchers and theorists have offered various definitions of cognitive style and cognitive process as the terms began to be applied more frequently over the past three decades. One of the earlier
definitions of cognitive process comes from Bruner (1957, p. vii), who observed that cognitive process was "... the means whereby organisms achieve, retain and transform information." Ten years later Bruner et al. (1967, p. 1) suggested that the nature of "cognitive growth" was "... how human beings increase their mastery in achieving and using knowledge." Heider (1964, p. 201) noted that investigations into cognitive process raised the question:

'What are the conditions that bring it about that a person knows something, and what are the effects of this knowing?' An assessment of these conditions and effects guides us in our social actions.

Hill (1976) saw these conditions and effects as instrumental in understanding and improving student performance in the classroom. He observed (1976, p. 2), "Each student has a unique cognitive style or way of acquiring meaning of knowing." He developed his model of prescriptive educational programs from the above assumption.

Blumenthal (1977, p. 5) commented on the larger scope of cognition and the cognitive process:

The study of human cognition traditionally concerns questions of two types: (1) the content of human knowledge and (2) the nature of human mental processes that enable the learning and use of that knowledge. The study of the process of cognition, as in the present text, focuses on the latter question.

Process refers to actions of cognitive performance (perceiving remembering, thinking, desiring) that depend on the organism's biological performance capacities.

Content refers to systems of knowledge (languages, arithmetic, music, social codes, tools) that the human
biological capacities use to extend and enrich experience and behavior. Such systems and devices are learned and passed on from generation to generation. The study and analysis of any one of these systems is the concern of an associated discipline (linguistics, theoretical mathematics, musicology, jurisprudence, cultural anthropology).

Other recent research has explored the newer concept of "cognitive style." Brooks (1977, p. 1) wrote, "Cognitive styles are characteristic, spontaneous ways of gathering and processing information." In a broader scope, Kuchinskas (1979, p. 269) observed, "Cognitive style can be defined as the way an individual acts, reacts and adapts to the environment." Although some differences in the definitions of cognitive style and cognitive process can be found in the literature, the common elements of gaining and processing meaning are clearly identified.

Definitions of "learning style" began to surface in the 1960s, as noted by Fisher and Fisher (1968, p. 30):

A relatively recent concept which emerged out of the experience and discussions of knowledgeable teachers is the idea that there are different, identifiable ways in which students approach learning. 'Learning Style' is a useful term to explore this complicated phenomenon.

Later, Fisher and Fisher (1979, p. 245) wrote, "Our use of 'style' (learning) refers to a pervasive quality in the behavior of an individual, a quality that persists though contents may change." Spalding (1974, p. 10) observed that, "one determines 'coping' style by
categorizing all observable acts in the classroom and later equates this to learning style." De Cecco (1968, p. 75) saw learning styles as "personal ways in which individuals process information in the course of learning new concepts and principles." Somewhat more recent is Gregorc's definition (1979, p. 237):

Learning style consists of distinctive behaviors which serve as indicators of how a person learns from and adapts to his environment. It also gives clues as to how a person's mind operates.

Most definitions under the category "learning style" addressed only the process of acquiring meaning.

A final category used was that of "learner type" employed by Britt (1971, pp. 14-15) of Cambridge, England: "Individuals can be classified into learner types (LT) on the basis of their distinctive patterns of response in objective test batteries and instructional tasks."

For the purpose of this study, cognitive style and learning style are used synonymously. They describe both a product and a process. Cognitive style is a product in the sense that a quality or characteristic has been formed by one's physical and psychological substance and experience. It is a process in that it represents the procedures one uses to gather meaning, integrate and store information, and integrate the information through one's personality to arrive at conclusions and decisions.
Cognitive Map

A numerical or graphic representation of how a person gathers meaning, processes information, and arrives at decisions.

Community College

A community college is a two-year, postsecondary educational institution that offers primarily vocational-technical training and/or the first two years of a baccalaureate degree. Additionally, it may offer adult developmental skill programs in basic educational needs and community service.

Vocational Education

Vocational education is any form of education, training, or retraining designed to prepare persons to enter, continue in, or advance in gainful employment in any recognized occupation, excluding those designated as professional or requiring a baccalaureate or higher degree (Calhoun and Finch, 1976).
In a previous section, Rationale, it was demonstrated through a review of literature that individual differences may exist in the learning/teaching situation. The goal of this chapter was to review literature related to the study and to provide a background of research conducted in certain areas related to the present study.

Specifically Chapter II was designed and organized to:

1. Give a brief review of the complexities and foundations of cognition
2. Explain the development, current applications, and research involving The Educational Sciences, as they relate to cognitive style
3. Present a brief description of the Oregon Community College System
4. Define and briefly describe Vocational-Technical Education in Oregon with special emphasis on implementation in the community colleges.
Cognition

In the field of psychology one can note a "revival" or notable increase in interest and investigation of the cognitive process since the 1950s. This has occurred as rigid stimulus-response theories have begun to be replaced by mediation models. In addition, impetus has come from information theory. The nature of inputs and outputs was not explained solely by such interval characteristics as channel capacity. Those who applied information theory to psychological phenomena were faced with the problems of mediating cognition. Finally, as changes in personality are examined, theory from Freud to Skinner to Rogers, it is seen that the desire to investigate and understand cognition has rapidly increased.

In the late 1960s cognition became a recognized branch of psychology, and from 1970 to the present a quarterly journal entitled Cognitive Psychology has been published. A quote from the October 1979 issue gives an indication of the scope of the publication:

Cognitive Psychology publishes original empirical, theoretical, and tutorial papers, methodological articles, and critical reviews dealing with memory, language processing, perception, problem solving, and thinking. This journal emphasizes work on the organization and processing of human information.
Foundations from Piaget

One of the most influential foundations of developmental cognitive psychology came from the work by Piaget (Berlyne, 1964). The understanding of this development and of the growth patterns of intelligence is necessary as a basis for the application of cognitive style and Educational Sciences to community college age students. Berlyne described the intellectual growth patterns that Piaget obtained from the study of small groups of children at successive age levels. These patterns can be related to the three Educational Sciences of: theoretical and qualitative symbols, cultural determinants, and modalities of inference. These three Educational Sciences will be explained in more detail in the next section on Educational Sciences. The developmental periods as summarized by Berlyne (1964) include the following stages:

Sensori-Motor Intelligence (birth to two years). This period relates to some theoretical and many qualitative symbols.

Preconceptual Thought (two to four years). This period begins the formation of cultural determinants and modalities of inference.

Intuitive Thought (four to seven years). In this period implementation of theoretical and qualitative symbols continues. There is also a more complete selection of cultural determinants.
Concrete Operations (seven to eleven years). This period is where the cultural determinants and modalities of inference are more completely integrated in the information gathering and processing procedure.

Formal Operations (eleven to fifteen years). By the end of this period the person is able to perceive in abstract theoretical and qualitative symbols and to form hypotheses which can be explored by new forms of analysis, such as inverse and reciprocal relationships or proportional and combinational inferences.

The relating of the above periods of development to the Educational Sciences provides a starting point to discuss the Educational Sciences. It also demonstrates that the earliest implementation of these sciences in the educational process should begin no earlier than the senior high school level.

The Educational Sciences

The term Educational Sciences first appeared as a conceptual framework in the book The Education of American Teachers by Conant (1960). Conant (1960, p. 120) did not claim education as a science, but offered an alternative explanation for the field of human activity called education:

I prefer not to speak of the sciences of engineering but of the engineering sciences. I doubt that there is or ever
will be a science of medicine, yet I am sure enormous strides have been made in the medical sciences. Therefore, I think it would be better to discuss... what might be called the educational discipline rather than the science or discipline of education.

DeLoach (1969, p. 5) saw the Educational Sciences as being developed to explain phenomena and solve problems in education through four procedures:

1) Clarifying purposes, 2) providing consistent interpretations of issues and information, 3) employing means that better determine the reliability and validity of predictions and generalizations than those currently being used, and 4) establishing a universe of discourse (common language) by which education at all levels might communicate.

Hill, past president of Oakland Community College, Bloomfield Hills, Michigan, developed what he called the "Educational Sciences" as an underlying structure for the applied field of knowledge called education. In the development of this concept the following assumptions are made (Hill, 1976, p. 4):

1. Education is a process of searching for meaning
2. Thought is different from language
3. The human creature is social in nature and has a unique capacity for deriving meaning from its environment and personal experiences through the creation and use of symbols
4. Not content with biological satisfactions alone, mankind continually seeks meaning.

Hill, up to the time of his sudden death by heart attack in 1976, developed the following seven Educational Sciences (Ibid., p. 2).
1. Symbols and their meanings
2. Cultural determinants of the meanings of symbols
3. Modalities of inference
4. Educational memory
5. Cognitive styles of individuals
6. Teaching styles, administrative styles and counseling styles
7. Systemic analysis of decision making.

A complete explanation of the first three sciences can be found on pages 8-16-17 of the instrument used in this study (Appendix B).

The fourth science educational memory was still under development at the time of Hill's death. It was not included as a functioning part of the Educational Sciences. Neil (1975, pp. 75-77), however, aptly summarized and presented a theoretical framework for all seven sciences in the following way:

The first of Hill's seven sciences, which is concerned with symbols and their meanings, is based on research by John Dewey, C. S. Peirce, N. L. Champlin, F. T. Villemain, A. Korzybski, A. Rapaport, and others. Its primary assumptions are that humankind uses two kinds of symbols— theoretical and qualitative, and that these symbols are basic to the acquisition of knowledge and meaning. In the diagnosis of a student, a cognitive map is drawn up through extensive testing which indicates whether the student is primarily a reader or a listener. The extent to which he makes use of sensory stimuli; his capacity for programmed symbolic mediations requiring synthesis, such as playing an instrument or typewriting; and his sensitivity and ability in various other cultural codes such as empathy, responsibility or commitment, esthetics, kinesis and communication interaction. With the information gathered the counselor and instructor can begin to understand the student's unique approach to cognition.

The second science, cultural determinants of the meaning of symbols, draws on research by E. C. Kelley, M. Sherif, E. C. Tolman, R. K. Merton, and others. It centers on the cultural influences that affect what symbols mean
to particular individuals. Some students like to study alone, make decisions alone, put situations in their own words. Others like to study with associates or are influenced by their peers. Still others choose to relate to family values, solving problems or setting priorities in terms of their impact on family members. These preferences are discovered through testing, and the students' scores help the counselor-teacher choose strategies for learning.

The third science deals with the form of inference a student tends to use. Concepts derived from statistics and logic, plus research by J. Piaget, M. Wertheimer, J. Bruner, and J. P. Buelford, form its foundation. A student may use categorical reasoning, reason by comparison and contrast, synthesize a number of components into a related unity, or employ all of these processes to appraise the situation and draw a conclusion. Both inductive and deductive reasoning may be utilized.

The fourth science, memory-concern, emphasizes the neurological bases of memory. Early work in this field was done by D. O. Hebb, followed by D. Krech and the research group at the University of California at Berkeley. Short- and long-term memory functions and their relationships to energy and biochemical elements are exceedingly complex. The memory processes of recognition, retention, recall, and association are identified in the testing process by the 'concern' components relating to persons, processes, and properties.

Cognitive style, the fifth science, is the product of the first four sciences. G. W. Allport (1937) defined 'style' as the consistency and pattern of expressive behaviors. Other work in the context of personality and social variables has been done by H. A. Witkin, R. W. Gardner, J. Kagan, H. Moss, and I. Sigel.

The sixth science is teaching, counseling, and administrative style. Each of these styles is represented as a product of three sets of information pertaining to demeanor, emphasis, and symbolic orientation. R. K. Merton's role-set theory and the findings of other research by N. Cantor, D. E. Griffiths, N. Gross, E. H. Litchfield, D. McGregor, and R. L. Kahn are important aspects of this science.

The seventh science is systemic analysis decision making. Systems theory in education is based on the work of J. von Neuman and O. Morgenstern, N. Weiner, D. Cook, and L. von Bertalanffy. An educational program may be
defined as a social system composed of people, processes, and properties and their interconnections considered over a period of time. Basic to the system is the statement of goal of mission, which includes specific performance criteria and determines inputs. The outputs are measurements of how well the results fulfill the mission. The educational process requires much human feedback, communication, and modification or revision in order to keep the system adjusted. The purpose of systemic analysis is to make decisions based on a choice of options—decisions that are best for all parts of the system.

Hill (1976) experienced further that the Educational Science of cognitive style combined information included in the first four sciences (i.e., symbols and their meanings, cultural determinants of the meanings of symbols, modalities of inference, educational memory) by means of a Cartesian product of these four sets. The profiles distributed over the four sets graphically portrayed how a person may seek meaning. These profiles reflected the cognitive style "strengths" of the individual, and were vehicles for determining educational prescriptions to help him/her in the learning process.

Related Research

Many models and instruments have been proposed to account for and measure cognitive style. A list of the most prominent models with definitions, principal researchers, and measuring instruments is presented for reference in Appendix C. Most research on cognitive style was conducted using the models listed in Appendix C. Other research was done on the Hill model using his instrument for
determining cognitive style. Except where otherwise noted, only that
research which was done using the Hill model relating to the objec-
tives of this study, as enumerated in Chapter I, will be reported.

Objective 1. The first objective was to determine the effec-
tiveness of the mapping process by comparing the grades of the
mapped and unmapped students of the study.

Mustachio (1977) found that the degree of cognitive style inter-
pretation given students did not significantly influence their grade
point averages. Compton (1975) found that there were significant
gains in achievement tests scores for those students who were
mapped and allowed to choose multimedia material over the unmapped
control group.

Objectives 2 and 3. Research related to determining the effec-
tiveness of the mapping process by comparing the course dropouts of
mapped and unmapped students has been reported by Lange (1972,
p. 69). She noted conflicting findings with respect to matched and
unmatched students and withdrawal-failure rates:

The analysis of the data supports the following conclu-
sions: 1. When cognitive style and preferred teaching
style of students is matched with the cognitive style and
teaching style of the faculty the failure-withdrawal rate
is not significantly different when compared with base-
line data. 2. When the cognitive style and preferred
teaching style of students is matched with the cognitive
style and teaching style of faculty, the failure-withdrawal
rate of one matched group was significantly different from
the non-matched group.
In a study of community college algebra students, Grasser (1973) found a significant difference in the maps between those who had withdrawals or failures and those who received grades of A. The implications were that if these differences were accounted for in instructional techniques, the withdrawal or failure rate could be improved.

Objectives 4 and 6. Further objectives of this study were to determine if there was a difference among selected vocational areas identified.

Fragale (1969) found that, when compared with other students, a collective cognitive style for industrial technology students could be identified. Gural (1972) using Educational Sciences in the vocational counseling area, determined that: 1) vocational decision-making can be viewed as an educational task, and therefore the utilization of an educational cognitive style approach to vocational counseling can provide the means by which students can be assisted in accomplishing more realistically their eventual vocational decisions; and 2) the application of the Educational Science of cognitive style makes it possible to develop a taxonomic structure of occupational cognitive styles. In studying vocational maturity, Bartman (1974) found that the eleventh grade students who scored in the upper and lower range of the Crites' Career Maturity Inventory exhibited
collective elements and profiles of educational cognitive style.

Bartman (1974, p. 2) concluded:

... the 'unique' collective cognitive 'styles' of the two groups studied indicate trends which support the use of the Educational Sciences to examine a standardized inventory of vocational maturity.

Objective 5. The possibility of differences between male and female maps in different vocational areas must also be addressed.

Crowe (1974) conducted a study with a group of 85 twelfth grade students that contained a mixture of male and female and vocational and academic students. She found that vocational and academic "college-bound students" did not differ significantly in career maturity as measured by the Career Maturity Inventory. Also, the commonalities shown in the cognitive styles suggested that both males and females are probably capable of participating in vocational educational programs currently existing as one-sex, or largely one-sex, programs.

In a recent book, Sex-Related Cognitive Differences by Sherman (1978), extensive reporting was done on empirical studies. None of the studies cited, however, used the Hill instrument to measure differences. The studies were grouped in categories of verbal reasoning, visual-spatial perception, mathematics, and problem solving. Sherman's conclusion for the verbal reasoning category was (1978, p. 49), "... with the exception of the greater number of boys with
language deficits, the sexes are very similar in verbal performance." In the visual-spatial perception category (1978, p. 52), she concluded:

... it is possible to demonstrate larger differences between the sexes, in this case in favor of the males. The difference between the sexes, however, is still very small, accounting at most for four percent of the variance.

For mathematics (1978, p. 57), she concluded, "There is general agreement that there is no difference between the sexes in favor of males in mathematics performance below the age of ten." For the category of analytical skill and problem solving (1978, p. 59), she wrote, "Many aspects of generalizations that girls and women are not as analytical as boys and men are not supported by the evidence."

Sherman's general conclusion (1978, p. 64), was:

... theories which attempt to account for cognitive performance differences between male and female groups on the basis of biological variables associated with sex suffer acute embarrassment.

In summary, publications and research reviewed tend to support the premise that cognitive style is subject to definition, study, and evaluation. Several models and associated instruments are available to explain and measure cognitive style. Even though research and publications pertaining to the Hill instrument demonstrate that it was a viable measure to use in evaluating the objectives of this
study, it was determined that little research has used the modified Hill cognitive preference inventory in a "discipline-bound" study of vocational education.

**Oregon's Community College System**

Oregon's community colleges are designated as "comprehensive" in nature. As such the 13 colleges extend tax-supported postsecondary education to a broad cross-section of citizens. The term "comprehensive" as applied to the community college is defined in *Oregon Community Colleges: Education for People* (1978, p. 1) as:

- Vocation-technical training.
- The first two years of college course work.
- Community education programs, where a person can further his or her education, upgrade skills or retrain for a new employment opportunity.
- Developmental skills programs, which offer adult classes in basic educational needs, such as mathematics and reading at levels ranging from elementary school to high school either as an end goal or for necessary prerequisite to more advanced study.

Each community college is governed by a locally elected board. Citizen input is in the form of task-forces and advisory committees. The base of financial support varies slightly with each school with an overall, system-wide average being: 35 percent local taxes, 45 percent state assistance, 19 percent student tuition, 1 percent Federal vocational-technical funding (*Ibid.*, pp. 17, 18).
In 1965 the Oregon Legislative Assembly adopted 18 policies that define the philosophy and delimit the operation of Oregon community colleges (Ibid., pp. 2-4):

341.009 Policy. The Legislative Assembly finds that:

1. The community college is an educational institution which is intended to fill the institutional gap in education by offering broad, comprehensive programs in academic as well as vocational-technical subjects. It is designed to provide terminal two-year programs for some, serve a transitional purpose for others who will continue college work and serve to determine future educational needs for other students. For adults it can provide means for continuation of their academic education, vocational training or the attainment of entirely new skills as demands for old skills and old occupations are supplanted by new technologies.

2. Each community college should be so located as to be within commuting time of a substantial majority of students. As an economical method of providing education close to the student's home, the community college should remain a commuting institution.

3. The community college should not follow the established organizational patterns of other secondary and higher education institutions in order to maintain a unique quality of flexibility, the ability to change to meet changing needs.

4. The community college is a post-high school institution under the general supervision of the State Board of Education. It should not be a "starter" institution intended to evolve into a four-year baccalaureate institution. It should be concerned with programs terminating after two years or less, with exceptions made only for certain curricular offerings of a technical nature which may require more than two years for completion.

5. The community college should continue to be prohibited by law from becoming a four-year institution.

6. Admission to the community college should be open to high school graduates or to non-high school graduates who can profit from the instruction offered.

7. There should be close cooperation between those directing the community college program and those
responsible for higher education, so that lower-division college transfer programs of the community college will provide adequate preparation for entering four-year institutions, and so the students will be able to transfer with a minimum of difficulty.

8. The community college should offer as comprehensive a program as the needs and resources of the area which it serves dictate. Cost to student and quality of instruction in established private institutions should be among the factors in determining necessary duplication of effort.

9. It should be the policy of the community college to open its facilities to the high schools of its area on a sound contractual basis, for appropriate secondary courses, either academic or vocational, when it is within its ability to provide facilities and it is determined that the high school cannot or does not offer them.

10. To establish programs designed to meet the needs of the area served, surveys of the educational and service needs of the district should be made. Specific technical and vocational courses should be related not only to the employment opportunities of the area but of the state and nation as well. Such determination should be made in consultation with representatives of labor, business, industry, agriculture and other interested groups.

11. The State Board of Education should be responsible for coordinating the community college program of the state and should have general supervisory responsibilities for that program. The State Board of Education should prepare estimates and make the requests for legislative appropriations for a reasonable and consistent basis of support and establish standards for the distribution of that support.

12. The initiative for the establishment of new community colleges should come from the localities to be served, as a response to demonstrated educational needs of an area. However, these localities must not only be willing to assume the responsibility for the institutions but must be able to provide resources needed for an adequate educational and service program.

13. The governing board of the community college should be charged with the policy-making function. With respect to educational programming, the governing board should be
in cooperation with the State Board of Education: (a) Identify educational needs for the district; and (b) bring together the resources necessary to meet the needs.

14. The state should maintain a policy of substantial state participation in community college building costs and the maintenance of an adequate level of state support for operation. However, no state funds should be appropriated for buildings such as dormitories or athletic facilities for spectator sports. In the event that students from beyond commuting distance attend a community college, housing should be noncampus. The operating district should provide a substantial portion of the funds for capital improvement as well as for operation of a community college.

15. State appropriations for community colleges should be made separately from those for other segments of education.

16. The formula for the distribution of funds for operating costs should reflect the heavier operating costs and capital outlay for certain vocational-technical courses. Federal funds received for vocational-technical training should be used for that purpose only and be distributed separately from funds appropriated by the state and should be exempted from the computations of the present distribution formula for the operating costs.

17. The cost of education to the individual should be sufficiently low to permit students of low-income families to attend. This is particularly true of tuition costs. However, students should pay an amount sufficient to provide an incentive to profit from the instructional program offered.

18. Any eligible Oregon resident should have the right to attend a community college even though not residing in a district operating one, subject to the right of the governing board to limit the size of classes and to give preference to students residing in the district. Local districts should have the authority to negotiate the terms and conditions with the governing boards for the enrollment of students residing in such local districts.

The focus for this study was the vocational-technical programs offered within the community college setting. The involvement of
each community college in vocational technical education was from 24 percent to 48 percent of their total student credit hours (SCH) (Oregon School Directory, 1978-79). The next section offers an explanation of what is encompassed within vocational-technical education and gives a brief overview of the goals, policies, and delivery system for vocational-technical education in Oregon.

Vocational Education in Oregon

Vocational education in Oregon includes programs primarily at the secondary and community college levels in the technical areas of agriculture, business and distributive education, occupational homemaking, health occupations, and trade and industrial education. In a planning paper, Vocational Education for Oregon Learners (1979, p. 2), the State Board of Education has set down a broad goal statement for vocational education:

The statewide goal for vocational education is that high quality programs are readily accessible to all Oregon learners who can benefit from such training and that such training results in the availability of skilled workers.

To guide the board in the future development and operation of vocational programs nine policies were adopted and presented in the planning paper (Ibid., p. 3). These nine policies were:

1. Vocational education is an integral part of a comprehensive education program. It begins with junior high exploration programs, continues through high school, and
becomes more specific in community colleges, apprenticeship, private vocational-technical schools, the military service, on-the-job training, and in other occupational training programs.

2. All Oregon learners should have opportunities to prepare or train further in occupations of their choosing.

3. Vocational education at the high school level is organized around common teachable skills or clusters of occupations. The cluster approach helps students avoid the commitment to a narrow work specialization, but still provides preparation to enter the work force or post-secondary specialization.

4. Grant-in-aid assistance will be provided as resources permit for:
   - program development, maintenance and operation,
   - program improvement, including personnel, student leadership, curriculum, and model programs and exemplary practices development, as well as evaluation activities,
   - special projects for serving the disadvantaged and handicapped and eliminating discrimination, and
   - assistance for development of manpower prentice programs.

5. Program approval will give particular attention to the:
   - needs and desires of individuals, especially training for unemployed and underemployed,
   - potential for employment in areas of training,
   - elimination of discriminatory practices,
   - occupational health and safety factors needed in the curriculum,
   - coordination and articulation with labor and other training programs,
   - specific requirements of employers in business and industry, and
   - the cost effectiveness of the proposed program.

6. Technical assistance in program, personnel, student leadership, and curriculum development, vocational guidance and other supportive services will be provided through Department staff, regional coordinators, and/or contracted services.

7. Planning for vocational education will be sensitive to the needs of students and the impact of vocational preparation upon the individual, and the environment.
8. Planning for vocational education will be done in cooperation with other agencies and institutions providing occupational preparation.

9. Planning for vocational education will be sensitive to the need for skilled workers to maintain and improve business and industry’s economic development and expansion.

The first policy states that vocational education in Oregon begins at the junior high school level with exploratory activities. By examining elementary school instruction in the state of Oregon, it is found that career awareness begins early and continues through advanced levels of education. At the junior high school level the student has opportunities to explore chosen areas of occupations in a variety of ways. By the time students finish high school they are to have had an opportunity to prepare for employment in one or more of the designated clusters of occupations. The community colleges are to provide further specialized education in specific occupational areas.

Because of the rural nature of much of Oregon’s population, many of the state’s high schools have been able to offer vocational preparation in only one or two of the occupational cluster areas. Some have not been able to offer any vocational preparation. Therefore, the importance of the initial vocational preparation as well as advanced specialization has increased at the community college level.
Oregon community college administrators have sought methods to assist vocational programs as well as other offerings in becoming more effective. It can be noted by referencing the pilot survey (Appendix C) that involvement and interest in cognitive mapping in Oregon community colleges is significant. It was important, therefore, that the impact and implication of cognitive mapping regarding vocational education be explored before further resources were committed to this endeavor.
CHAPTER III

DESIGN OF THE STUDY

The study involved an empirical investigation of the effect of a treatment or procedure applied in some Oregon community colleges. The procedures followed in the study are presented in five major sections: 1) Population, 2) Sample Size, 3) Instrument, 4) Dependent Variables, and 5) Design Matrix and Method of Analysis.

Population

To be consistent with the purpose and objectives of the study, the population consisted of all students that declared majors in vocational education at Lane, Linn-Benton, and Mt. Hood community colleges. The rationale for selecting this population follows.

Objectives one, two and three measured effectiveness in terms of course completion, course failure and grades. Only those schools involved in cognitive mapping for a sufficient length of time to allow for longitudinal cause-and-effect relationships were considered for these objectives.

Objectives four, five, and six dealt with cognitive map similarities and differences among vocational areas and between sexes.
It was determined that students in schools which have new or experimental programs in cognitive mapping as well as those with established programs could be included in the investigation of these objectives.

Information gained from the pilot study (Appendix A) and subsequent interviews with personnel from Lane, Linn-Benton, Mt. Hood, Rogue, and Umpqua community colleges revealed that:

1. Mt. Hood was the only community college with extensive involvement in cognitive mapping for a period of more than one year.

2. Lane and Linn-Benton community colleges were involved in cognitive mapping on a limited basis in some vocational areas.

3. Rogue and Umpqua community colleges were only experimentally exploring the cognitive mapping process.

Based on the above findings, it was determined that Mt. Hood Community College students met the criteria to be used in the investigation of objectives one, two, and three. Furthermore, Lane, Linn-Benton, and Mt. Hood community college students all met the requirements to be included in the investigations of objectives four, five, and six.
Selection of Samples

The samples for this study were stratified by sex and vocational area. Then a proportional random selection was completed from the population identified. The sizes of the samples required were selected using power analysis tables provided by Cohen (1969). These tables provide a minimum sample size when the probability level ($\alpha$), effect size ($f$), degrees of freedom ($df$), and power levels are selected.

For the "t" test, Cohen (1969) suggested a medium effect size ($f$) of .50 and a power level of .80. Combining these with the probability level of ($\alpha$) = .05 the tables showed that a minimum sample of 50 was required for each group.

For the Chi-square ($\chi^2$) statistic used in testing the hypotheses for two and three, Cohen (1969) suggested a medium effect size ($f$) of .10 and a power level of .80. Combining these with the ($\alpha$) level of .05, the tables showed that a sample size of 112 was needed for each group. Since a total of 112 subjects was the required number of the Chi-square test, that group and number was also used for the "t" test. This followed the suggestion of Kerlinger (1973) that the sample size should be as large as possible to reduce sampling error.

For the ANOVA used testing the hypotheses for objectives four and five, Cohen (1969) suggested a medium effect size of .25 and a power level of .80. Combining these with the ($\alpha$) level of .05, the tables produced a minimum sample size of 45 for each group.
In total, data were collected on 512 experimental and control subjects. These samples were drawn from Lane, Linn-Benton, and Mt. Hood community colleges.

**Instrument**

The Instrument used in this study was the modified Hill cognitive style preference inventory (Appendix B). The inventory contains 224 statements concerning how a person prefers to perceive and process meaning. There are 28 elements with eight different statements pertaining to each of the elements. The elements are divided into four sections: 1) Theoretical Symbols, 2) Qualitative Symbols, 3) Cultural Determinants, and 4) Modalities of Inference. They are listed and explained as follows:

**Theoretical Symbols**

1. **T(AL):** Theoretical Auditory Linguistics--finding meaning through words you hear, a preference for hearing words
2. **T(AQ):** Theoretical Auditory Quantitative--finding meaning in spoken numbers, preferring to hear non-word symbols
3. **T(VL):** Theoretical Visual Linguistics--finding meaning from words you see, preferring to read
4. **T(VQ):** Theoretical Visual Quantitative--finding meaning in numerical symbols, a preference for seeing non-word symbols
Qualitative Symbols

5. Q(A): Qualitative Auditory (sound)--perceiving meaning through the sense of hearing. A major in this area probably distinguishes between sounds, tones of music and other purely sonic sensations. Sounds may interfere with (or help) concentration.

6. Q(O): Qualitative Olfactory (smell)--perceiving meaning through the sense of smell. Certain smells may interfere with the learning process of a person with a major.

7. Q(S): Qualitative Savory (taste)--perceiving meaning by the sense of taste. Majors usually smoke, chew gum, eat mints, or chew on pencils. They find tasting helps concentration.

8. Q(T): Qualitative Tactile (touch)--perceiving meaning by the sense of touch, temperature, and pain.

9. Q(V): Qualitative Visual (sight)--perceiving meaning through sight. Majors sometimes have trouble blocking out what they see.

10. Q(P): Qualitative Proprioceptive--perceiving meaning through synthesizing or combining parts of a task, such as typewriting or playing a musical instrument.

11. Q(CEM): Qualitative Code Empathetic--sensitivity to the feelings of others; putting yourself in another person's
place and seeing things from his or her point of view

12. Q(CES): Qualitative Code Esthetic--enjoying the beauty of an object or an idea. Beauty in surroundings or a well-turned phrase are appreciated by a person possessing a major in this area.

13. Q(CET): Qualitative Code Ethic--commitment to a set of values, a group of principles, obligations and/or duties. This commitment need not imply morality. Both a priest and a criminal may be committed to a set of values although the "values" may be decidedly different.

14. Q(CH): Qualitative Code Histrionic--exhibiting a deliberate behavior or "playing a role" to produce some particular effect on other persons. This type of person knows how to fulfill role expectations.

15. Q(CK): Qualitative Code Kinesics--understanding and communicating by facial expressions and body motion such as smiles and gestures. Majors use their hands to talk.

16. Q(CKH): Qualitative Code Kinesthetic--performing motor skills according to a recommended or acceptable form, such as bowling or golfing "correctly".

17. Q(CP): Qualitative Code Proxemics--judging the physical and social distance another person would permit. A major on this item knows how close to get and whom to call by first name.
18. **Q(CS): Qualitative Code Synnoetics**--personal knowledge of oneself

19. **Q(CT): Qualitative Code Transactional**--a major on this item is able to effectively put across an idea or sell a product or influence another's behavior

20. **Q(CTM): Qualitative Code Temporal**--a major on this item is aware of time and time expectations

**Cultural Determinants**

21. **A: Associates**--the degree of influence by friends or persons other than family

22. **F: Family**--the influence that might include immediate family, business, church or authority figures

23. **I: Individual**--the degree of independence in evaluating information; a preference for dealing with new information on an individual basis

**Modalities of Inference**

24. **M: Magnitude**--the degree to which an individual relies on and prefers a clear set of rules, classifications or definitions for accepting or rejecting an idea (categorical reasoning). Persons who need to define things or know the "policy" in order to understand reflect this modality
25. **D:** Difference--the person who reasons in this pattern always looks for differences between and among concepts. There is a strong preference for contrasting one idea against another when learning new information. If two theories about the same topic were encountered, this student would want to know how they were different. Often artists possess this modality as do creative writers and musicians; however, this does not imply this is a requirement to being a good writer, artist or musician. People with a major here often say, "What if . . .?"

26. **R:** Relationship--this modality requires that things be seen in terms of how they are alike. One looks at a number of specific cases and attempts to explain them all with one general rule.

27. **L:** Appraisal--the modality of inference employed by an individual who uses all three of the modalities noted above (M, D and R) giving equal weight to each. A student strong in this element prefers to cover new material slowly and in detail, with a lot of opportunities to ask questions. As a result, these individuals may take a long time to make decisions.

28. **(K):** Deductive--preference for solving problems in a step-wise fashion, reasoning from the general principle logically down to the specific case. Mathematical proofs and logical arguments are good examples of this type of information.
The participant was asked to respond to each statement by indicating if it "rarely," "sometimes," or "usually" pertained to him/her. The numbers of responses in the "rarely," "sometimes," and "usually" columns were multiplied by one, three, and five, respectively. These products were summed to produce a total score ranging from eight to 40 for each of the 28 items. These scores were then assigned to a "major," "minor," or "negligible" category by the following breakdown: major = 27-40, minor = 16-26, negligible = 0-15.

Scarborough (1976, p. 148), in addressing the reliability and validity of the Hill instrument, received a letter from Dr. Hill which contained the following statement:

I can provide you with validity and reliability indices that have been found, not only in some of our work here at the College, but in those doctoral dissertations (of the 84 that have been completed in this area) dealing with community college samples. Under these circumstances, validity coefficients associated with the elements of $T(VL)$, $T(VQ)$, $T(AL)$, and $T(AQ)$ are as shown below:

$T(VL)$  
- Females = .30  
- Males = .72

$T(AL)$  
- Females = .75  
- Males = .70

$T(VQ)$  
- Females = .72  
- Males = .73

$T(AQ)$  
- Females = .66  
- Males = .61

Reliability coefficients are derived by means of the Kuder Richardson formula, based upon the concept of domain sampling. The coefficients for $T(VL)$, $T(AL)$, $T(VQ)$, and $T(AQ)$ are shown below:
The validity and reliability coefficients associated with these elements of cognitive style mapping have been derived from sub-tests of the Differential Aptitude Tests (4th Ed. Forms L and M. The Psychological Corp. 1966), the Nelson-Denny Reading Test, the Carlsen-Brown Listening Test, and the quantitative section of the "Weschler." Point bi-serial correlation coefficients for the qualitative symbolic elements, the cultural determinant elements of individuality, associates, and family, the modalities of inference elements of magnitude, difference, relationship, and appraisal show the range of values in bi-serial correlation coefficients indicated below:

\[
\text{low } r_{bis} = .54, \text{ to } r_{bis} = .93
\]

The average bi-serial coefficient value for all these elements is:

\[
r_{bis} = .783
\]

The reliability for the inventories that provide results for the mapping of these elements of style is a Kuder Richardson: \( r = .81 \). In regard to the topic of predictability, this matter depends greatly upon the ability of the diagnostician to empirically map the style of the individual under consideration in the context, or intended context, of the instructional setting.

Even though relatively high indices of reliability and validity have been presented, the following assumptions underlie the administration and interpretation of this self-report inventory:

1. Persons frequently choose to do what they do best
2. Persons avoid what they do poorly

3. Persons know and will accurately report about themselves.

**Dependent Variables**

The dependent variable for objective one was the grade point average (GPA) of selected students. The independent variable was the category of the student with respect to being mapped or unmapped.

The dependent variable for objective two was the number of students who had course failures. The independent variable was the category of being mapped or unmapped.

The dependent variable for objective three was the number of students who withdrew from courses. The independent variable was the mapped or unmapped category.

The dependent variable for objectives four, five, and six was the score each student received in each of the 28 items on the cognitive preference inventory. The independent variable for objectives four and six was the selected vocational area while the independent variable for objective five was sex within each of the vocational areas.
Design Matrix and Method of Analysis

The following hypotheses, design matrix, and methods of analysis were used to investigate the identified objectives of this study:

1. Objective—to determine the effectiveness of the mapping process by comparing the grades of the mapped and unmapped students of the study.

\[ \text{H}_0: \] There is no significant difference in group mean grade point averages between mapped and unmapped students.

\[ \text{H}_{A1}: \] The mapped students will have a greater group mean grade point average.

\[ \text{H}_{A2}: \] The unmapped students will have a greater group mean grade point average.

The statistical tool used for these hypotheses was the Student's "t," shown in layout form in Table 3.1. Courtney and Sedgwick (1974, p. 2) indicated that this "parametric statistical test" can be used for descriptive and experimental studies. The requirements for the use of the "t" test are that the two samples are

Table 3.1
"t" Test Design Matrix
Students' GPA's

<table>
<thead>
<tr>
<th>MAPPED</th>
<th>UNMAPPED</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 112</td>
<td>n = 112</td>
</tr>
</tbody>
</table>
randomly and independently drawn from two distributions that are normal, that the population possesses homogeneity of variance, and that the data are of an equidistant interval type. Even though these assumptions underlie the use of the "t" test, Downie (1974, p. 173) cites work by Edwards in which he determined:

if the 't' test is applied to two independent random samples of size 25 or more, the 't' test is relatively unaffected by rather severe violations of the assumptions of homogeneity of variance and normality of distribution in the population.

Despite Edwards' assertions, homogeneity of variance was tested with Bartlett's F test to assure the sample was homogeneous prior to conducting the 't' test.

Downie (1974, p. 172) defines the 't' as the ratio of the difference between the means divided by the standard error of the difference as shown by the following formula:

$$ t = \frac{\overline{X}_1 - \overline{X}_2}{\frac{SD}{\sqrt{X}}} $$

Using this formula, a computed value for 't' was obtained. This value was compared to a table value. If the computed value was equal to or greater than the tabular value the null hypothesis was rejected and the group means were inspected to determine which alternate hypothesis would be retained. If the computed value was less than the tabular value the null hypothesis was retained.

In order to determine the tabular 't' value the desired significance level and the number of degrees of freedom for the sample must
be known. The significance level for testing hypotheses in this study was .05. The degrees of freedom for uncorrelated data were determined by the formula, \( df = n_1 + n_2 - 2 \), where \( n_1 \) was the number of unmapped students and \( n_2 \) was the number of mapped students. As noted from the earlier section on sample size an \textit{a priori} decision to include 112 subjects was made. Using the formula above and the "t" tables produced 222 degrees of freedom and a tabular value of 1.96 at the .05 significance level.

2. Objective--to determine the effectiveness of the mapping process by comparing the course failures of the mapped and unmapped students of the study.

\( H_0 \): There is no significant difference in the number of course failures between mapped and unmapped students.

\( H_{A1} \): Mapped students have significantly fewer course failures than unmapped students.

\( H_{A2} \): Unmapped students have significantly fewer course failures than mapped students.

3. Objective--to determine the effectiveness of the mapping process by comparing the dropout rates of the mapped and unmapped students of the study.

\( H_0 \): There is no significant difference in the number of course dropouts between mapped and unmapped students.
$H_{A1}$: Mapped students have significantly fewer course dropouts than unmapped students.

$H_{A2}$: Unmapped students have significantly fewer course dropouts than mapped students.

The statistical test for hypotheses of objectives two and three was Chi-square ($\chi^2$) as represented by Table 3.2. Downie (1974, p.188) describes $\chi^2$ as a "nonparametric or distribution free" statistic useful as a significance test with discrete or nominal data.

It was used as a test for independence.

| Table 3.2 |
| Chi-Square Design Matrix |

<table>
<thead>
<tr>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>n=112</td>
</tr>
<tr>
<td>MAPPED</td>
</tr>
<tr>
<td>failures or dropout</td>
</tr>
<tr>
<td>nonfailures or nondropout</td>
</tr>
<tr>
<td>m = a+b</td>
</tr>
</tbody>
</table>

The null hypothesis was tested to determine if dropouts and failures were related to the mapping process. The following formula which avoids the computation of the expected value was used for computing the $\chi^2$

$$\chi^2 = \frac{N(ad-bc)^2}{k \cdot pm \cdot n}$$
The number of degrees of freedom was determined by the formula, 
\[ df = (r-1)(c-1), \] where \( r \) equals the number of rows and \( c \) equals the number of columns in the contingency table. For the \( \chi^2 \) test, one degree of freedom was obtained which gave a \( \chi^2 \) tabular value of 3.841 at the .05 significance level. This value was compared with the computed value for a decision to reject or retain the null and alternate hypotheses.

4. Objective--to determine if there is a difference among selected vocational areas with regard to student cognitive maps.

\( H_0 \): There is no significant difference in cognitive map items among the identified vocational areas.

\( H_A \): There is a significant difference in cognitive map items among the identified vocational areas.

5. Objective--to determine if differences exist between male and female maps in each of the identified vocational areas.

\( H_0 \): There is no significant difference between the male and female maps in each of the identified vocational areas.

\( H_A \): There is a significant difference between male and female maps in each of the identified vocational areas.
The following null and alternate hypotheses concerning interaction pertains to objectives four and five.

\( H_0: \) There is no significant interaction effect between vocational area and sex.

\( H_A: \) There is significant interaction effect between vocational area and sex.

The initial statistic used for testing these hypotheses was the two-way analysis of variance, reflecting the fixed design as presented by Table 3.3.

### Table 3.3
Two-Way Analysis of Variance Design Matrix

<table>
<thead>
<tr>
<th>Item</th>
<th>AGRICULTURE</th>
<th>BUSINESS</th>
<th>HEALTH</th>
<th>TRADE AND INDUSTRY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>n = 45</td>
<td>n = 45</td>
<td>n = 45</td>
<td>n = 45</td>
</tr>
<tr>
<td>Female</td>
<td>n = 45</td>
<td>n = 45</td>
<td>n = 45</td>
<td>n = 45</td>
</tr>
<tr>
<td>Item 2</td>
<td>Male</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>Item 28</td>
<td>Female</td>
<td>:</td>
<td>:</td>
<td>:</td>
</tr>
</tbody>
</table>

Glass and Stanley (1970, p. 464) gave the following mathematical model for the two-way analysis of variance:
\[ X_{ijk} = \mu + \alpha_i + \beta_j + \alpha\beta_{ij} + \epsilon_{ijk} \]

where

- \( \mu \) = the grand mean
- \( \alpha_i \) = the differential effect of factor one
- \( \beta_j \) = the differential effect of factor two
- \( \alpha\beta_{ij} \) = the differential effect associated with interaction
- \( \epsilon_{ijk} \) = the error term normally and independently distributed with a mean of 0 and a variance of \( \sigma^2 \).

The assumptions and allowed violations were the same as for the "t" test.

The use of the two-way analysis of variance allowed analysis of data that was classified according to the two variables of vocational area and sex. Additionally, it tested for interaction or combined effects of the levels. When significant interaction occurred no further analyses were performed or explanations given relating to the individual effects of the variables of vocational area or sex. The location of the interaction was plotted and identified as ordinal or dis-ordinal.

The two-way analysis of variance was performed on each element (28) in the instrument. The two-way analysis of variance fixed design layout is presented in Table 3.4.
Table 3.4
Two-Way Analysis of Variance
Fixed Design Layout

<table>
<thead>
<tr>
<th>SOURCE OF VARIATION</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocational Area</td>
<td>3</td>
<td>A</td>
<td>A/3</td>
<td>A/3/D/352</td>
</tr>
<tr>
<td>Sex</td>
<td>1</td>
<td>B</td>
<td>B/1</td>
<td>B/1/D352</td>
</tr>
<tr>
<td>Interaction</td>
<td>3</td>
<td>C</td>
<td>C/3</td>
<td>C/3/D352</td>
</tr>
<tr>
<td>Error</td>
<td>352</td>
<td>D</td>
<td>D/352</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>359</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When significant differences occurred between levels of vocational area, Tukey's Honestly Significant Difference test, as recommended by Glass and Stanley (1970), was performed to isolate comparisons between means that caused the rejection of the null hypotheses.

6. Objective—to determine common composite maps for each of the four vocational areas.

The analysis used for this objective was R-mode factor analysis. According to Niess (1980), the R-mode is the most commonly used type of factor analysis for initial studies. Based on the students' scores on each of the 28 elements of the inventory, a varimax rotation to a terminal solution was calculated. This analysis
examined the relationship of every element with every other element and provided for a clustering of common elements. Factors with loadings of .70 or greater were identified for inclusion in the clusters.
CHAPTER IV

PRESENTATION OF FINDINGS

The analyses of data collected for the study are presented in five major sections. The first section describes the treatment as it relates to the experimental and control groups. The second section presents the results of the "t" test, which addressed objective one. The third section presents the results of the two Chi-square tests. The fourth section presents the results of the 28 two-way analysis of variance tests, which addressed the hypotheses for objectives four and five. In the fifth and final section the results of the factor analyses are presented.

Treatment

The treatment given the experimental group of the study consisted of two main parts. The first was the subjects' completion of the modified Hill cognitive style preference inventory. The second part was the explanation and suggested implementation of prescriptive techniques offered by school personnel.

Findings represent difference or lack of difference between the experimental group, which received treatment, and
the control group, which did not receive the treatment. Findings are also presented relating to certain characteristics of the experimental group, concerning certain elements of the preference inventory.

"t" Test Results

One purpose of the study was to determine if differences resulted from using the mapping process with respect to student grades. To determine the potential effect of the mapping process on student grades the "t" test was applied to the experimental and control groups. Before the "t" test was calculated, Bartlett's F test was performed to determine homogeneity of variance. An F value of 1.280 was calculated. This value was not significant at the .05 level; therefore, the two groups possessed homogeneity of variance.

The results of the "t" test produced a computed value of .690 which, when compared to the tabular value of 1.960, was not significant at the .05 level. This led to the retention of the null hypothesis for objective one: There is no significant difference in group mean grade point averages between mapped and unmapped students.

Chi-Square Test Results

The Chi-square test was used to determine if the mapping process had a significant effect on the number of course dropouts and course failures of mapped and unmapped students.
Table 4.1 presents the following data on the number of students failing and not failing courses: 12 of the 112 mapped students failed courses, 19 of the 112 unmapped students failed courses.

Table 4.1

Results of Course Failures

<table>
<thead>
<tr>
<th></th>
<th>FAILED COURSES</th>
<th>DID NOT FAIL COURSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapped</td>
<td>12</td>
<td>100</td>
</tr>
<tr>
<td>Unmapped</td>
<td>19</td>
<td>93</td>
</tr>
</tbody>
</table>

The data in Table 4.1 produced a Chi-square value of 1.834 which was less than the table value of 3.841 and therefore not significant at the .05 level. This caused the retention of the null hypothesis for objective two: There is no significant difference in the number of course failures between mapped and unmapped students.

Table 4.2 presents the following distribution for the number of student-dropped courses among the mapped and unmapped students: 22 of the 112 mapped students dropped courses, 22 of the 112 unmapped students dropped courses.
Table 4.2

Results of Course Dropouts

<table>
<thead>
<tr>
<th></th>
<th>DROPPED COURSES</th>
<th>DID NOT DROP COURSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mapped</td>
<td>22</td>
<td>90</td>
</tr>
<tr>
<td>Unmapped</td>
<td>22</td>
<td>90</td>
</tr>
</tbody>
</table>

Since the same number of mapped and unmapped students dropped or did not drop courses, the Chi-square value was zero. Zero is less than the table value of 3.841 and therefore led to the retention of the null hypothesis for objective three: There is no significant difference in the number of course dropouts between mapped and unmapped students.

Two-Way Analysis of Variance Results

The two-way analysis of variance was performed on each of the 28 instrument items for the purpose of addressing the three questions: differences among vocational areas, differences between male and female respondents, and interaction effect of vocational areas and sex.

The first question was to determine if there were significant differences among the vocational areas with regard to the map items. An analysis of the 28 items across the four vocational areas produced a computed F value less than the critical value of 2.635.
for the following 18 elements: $T(AL)$, $T(AQ)$, $T(VQ)$, $Q(A)$, $Q(O)$, $Q(S)$, $Q(T)$, $Q(V)$, $Q(P)$, $Q(CH)$, $Q(CK)$, $Q(CKH)$, $A$, $I$, $M$, $R$, $L$, $K$. The null hypothesis, that there is no significant difference in cognitive map items among vocational areas, was retained for these 18 elements. Of the remaining ten elements only eight generated an $F$ value equal to or greater than the critical value of 2.635 without also having significant interaction. The alternate hypothesis that there is a significant difference in cognitive map items was retained for the following eight elements: $T(VL)$, $Q(CES)$, $Q(CET)$, $Q(CP)$, $Q(CS)$, $Q(CTM)$, $F$, $K$. Tukey's Honestly Significant Difference Test was applied to the results of the two-way analysis of variance tests in these eight cases to determine where the difference occurred. The following results were found:

- $T(VL)$: Health > Agriculture
  Health > Trade and Industrial

- $Q(CES)$: Health > Agriculture
  Health > Business
  Health > Trade and Industrial

- $Q(CET)$: Health > Agriculture
  Health > Business
  Health > Trade and Industrial

- $Q(CP)$: Health > Trade and Industrial

- $Q(CS)$: Health > Trade and Industrial

- $Q(CTM)$: Health > Trade and Industrial
  Business > Agriculture
The second question was to determine if there was a significant difference between male and female responses with regard to map items. An analysis of the male and female responses to the 28 items produced a computed $F$ value less than the critical value of 3.870 for the following 14 items: $T(AQ)$, $T(VL)$, $Q(V)$, $Q(P)$, $Q(CH)$, $Q(CP)$, $Q(CS)$, $Q(CT)$, $Q(CTM)$, $A$, $F$, $M$, $R$, $L$. The null hypothesis that there is no significant difference between male and female maps in each of the vocational areas was retained for these 14 items. Of the remaining 14 items, nine generated an $F$ value equal to or greater than the critical value of 3.870 without also having significant interaction. The alternate hypothesis that there is significant difference between male and female maps in each of the vocational areas identified was retained for nine items. The nine items are presented with the findings:

- $T(AL)$ : $M > F$
- $T(VQ)$ : $F > M$
- $Q(O)$ : $F > M$
- $Q(S)$ : $F > M$
- $Q(CES)$ : $F > M$
- $Q(CE T)$ : $F > M$
Q(CKH) : M > F
I : M > F
K : M > F

The third question explored by the two-way analysis of variance was to determine the interactive effect for levels of vocational area and sex on the 28 map elements. The analysis produced a computed F value less than the critical value of 2.635 for the 22 items of: T(AL), T(AQ), T(VL), T(VQ), Q(O), Q(S), Q(V), Q(CES), Q(CET), Q(A), Q(CKH), Q(CP), Q(CT), Q(CS), A, F, I, M, D, R, L, K. The null hypothesis, that there is no significant interaction effect between vocational areas and sex, was retained for these 22 items. The six elements of Q(A), Q(T), Q(P), Q(CEM), Q(CK), and Q(CT) produced a computed F value equal to or greater than the critical value of 2.635. The null hypothesis was rejected for these six items and the alternate hypothesis that there was significant interaction was retained. The results of the interactions in each element were plotted. These plots are found in Appendix D. No further tests were performed or consideration given to the data when significant interaction occurred because the interaction effect reduced confidence in the ability of the data to determine significant differences among vocational areas or between sexes.

The results of calculations performed for the hypotheses for objective four and five are summarized in Table 4.3. This table
### Table 4.3
Results of Two-way Analysis of Variance

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>Vocational Area</th>
<th>Sex</th>
<th>Interaction</th>
<th>Significant Effects</th>
<th>Results of Multiple Comparison Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(A)</td>
<td>.140</td>
<td>3.872*</td>
<td>.097</td>
<td>S</td>
<td>M &gt; F</td>
</tr>
<tr>
<td>T(1AQ)</td>
<td>2.366</td>
<td>3.142</td>
<td>.939</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T(1HQ)</td>
<td>3.920*</td>
<td>1.186</td>
<td>1.732</td>
<td>V</td>
<td>H &gt; A, T</td>
</tr>
<tr>
<td>T(1OQ)</td>
<td>.019</td>
<td>4.690*</td>
<td>2.179</td>
<td>S</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>(QA)</td>
<td>.420</td>
<td>4.727*</td>
<td>2.887*</td>
<td>S, I</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>(QO)</td>
<td>.908</td>
<td>12.179*</td>
<td>.423</td>
<td>S</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>(QV)</td>
<td>.221</td>
<td>6.425*</td>
<td>.156</td>
<td>S</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>(QV)</td>
<td>2.233</td>
<td>22.501*</td>
<td>2.700*</td>
<td>S, 1</td>
<td></td>
</tr>
<tr>
<td>(QV)</td>
<td>.324</td>
<td>952</td>
<td>.335</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(QV)</td>
<td>.356</td>
<td>3.096</td>
<td>2.966</td>
<td>V, S, I</td>
<td></td>
</tr>
<tr>
<td>(QV)</td>
<td>3.585*</td>
<td>5.320*</td>
<td>2.067</td>
<td>S</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>(QV)</td>
<td>2.906</td>
<td>25.804*</td>
<td>2.067</td>
<td>S</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>(QV)</td>
<td>7.097*</td>
<td>8.529*</td>
<td>.106</td>
<td>V, S, I</td>
<td></td>
</tr>
<tr>
<td>(QV)</td>
<td>1.724</td>
<td>360</td>
<td>2.058</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(QV)</td>
<td>1.283</td>
<td>24.946*</td>
<td>3.900*</td>
<td>S, 1</td>
<td></td>
</tr>
<tr>
<td>(QV)</td>
<td>.023</td>
<td>9.229*</td>
<td>.863</td>
<td>S</td>
<td>M &gt; F</td>
</tr>
<tr>
<td>(QV)</td>
<td>4.023*</td>
<td>1.046</td>
<td>1.999</td>
<td>S</td>
<td>F &gt; M</td>
</tr>
<tr>
<td>(QV)</td>
<td>4.485*</td>
<td>493</td>
<td>1.555</td>
<td>V</td>
<td>H &gt; T</td>
</tr>
<tr>
<td>(QV)</td>
<td>4.277*</td>
<td>224</td>
<td>3.234*</td>
<td>S, 1</td>
<td></td>
</tr>
<tr>
<td>(QV)</td>
<td>1.460*</td>
<td>0.10</td>
<td>1.333</td>
<td>V</td>
<td>H &gt; T</td>
</tr>
<tr>
<td>A</td>
<td>.133</td>
<td>0.28</td>
<td>.860</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>4.005*</td>
<td>1.29</td>
<td>.156</td>
<td>V</td>
<td>B &gt; A</td>
</tr>
<tr>
<td>1</td>
<td>.188</td>
<td>6.356*</td>
<td>1.972</td>
<td>S</td>
<td>M &gt; F</td>
</tr>
<tr>
<td>M</td>
<td>2.429</td>
<td>0.49</td>
<td>.034</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>.497</td>
<td>035</td>
<td>2.060</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>.540</td>
<td>7.210</td>
<td>.850</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>1.750</td>
<td>3.095</td>
<td>2.444</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>3.271*</td>
<td>6.636*</td>
<td>1.050</td>
<td>V, S, I</td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND**

Tabular F Values, α = .05

- Vocational Area = 2.635
- Sex = 3.870
- Interaction = 2.635

Significant Effects:

- V = Vocational Area
- S = Sex
- 1 = Interaction

Results of Multiple Comparison Test:

- A = Agriculture
- B = Business
- H = Health
- T = Trade and industrial

* Significant at α = .05
presents the computed and tabular F values for vocational areas, sex and interaction, the significant results when the computed and tabular F values are compared, and the results of Tukey's multiple comparison tests.

**Factor Analysis Results**

Factor analysis was performed on each vocational area individually for the purpose of identifying elements that would best describe each vocational area. The R-mode factor analysis using principal factor with iterations, was utilized to identify cluster related elements. Elements with factor loadings of .70 or higher were recorded as being clustered within an area. This value was used in similar studies by a national test construction company, American College Testing Company (1977). Table 4.4 summarizes the elements held in common by the vocational areas.

The results showed that vocational agriculture students possessed the following eight elements in common: T(AL), T(VL), Q(CES), Q(CH), Q(CK), Q(CKH), I, D. Business students possessed the following seven elements: T(AL), T(AQ), Q(T), Q(CK), Q(CKH), Q(CEM), D. Health students held the following ten elements in common: T(VL), T(VQ), Q(V), Q(P), Q(CET), Q(CS), Q(CT), I, D, R. Elements common to the trade and industrial students were: Q(T), Q(V), Q(CES), Q(CKH), Q(CT), K.
Table 4.4

Results of Factor Analysis Clusters--Vocational Areas with Commonly Held Elements

<table>
<thead>
<tr>
<th>AGRICULTURE</th>
<th>BUSINESS</th>
<th>HEALTH</th>
<th>TRADE AND INDUSTRIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>T(AL)</td>
<td>T(AL)</td>
<td>T(VL)</td>
<td>Q(T)</td>
</tr>
<tr>
<td>T(VL)</td>
<td>T(AQ)</td>
<td>T(VQ)</td>
<td>Q(V)</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>Q(T)</td>
<td>Q(V)</td>
<td>Q(CES)</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>Q(CK)</td>
<td>Q(P)</td>
<td>Q(CKH)</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>Q(CKH)</td>
<td>Q(CET)</td>
<td>Q(CT)</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>Q(CEM)</td>
<td>Q(CS)</td>
<td>K</td>
</tr>
<tr>
<td>D</td>
<td>D</td>
<td>I</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>I</td>
<td>R</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>D</td>
<td></td>
</tr>
</tbody>
</table>

The percentage of common variance accounted for in each analysis along with the cumulative percentages appear in Appendix E. The factor solutions presented in each case were considered to be adequate in terms of such analysis.
CHAPTER V

SUMMARY, CONCLUSIONS, IMPLICATIONS
AND RECOMMENDATIONS

This study was conducted for three purposes. One purpose was to determine the effect of the cognitive mapping treatment on the vocational students in Oregon community colleges. A second purpose was to explore similarities and differences among four different vocational areas and between males and females in these areas with regard to the different elements of cognitive preference. A third purpose was to discover and describe cognitive elements that each of the four vocational groups individually held in common.

Data were collected on a total of 512 experimental and control subjects for this study. Subjects were obtained by proportional random samples from Lane, Linn-Benton, and Mt. Hood community colleges. Cognitive maps, course dropouts, and course failures were collected by stratified random samples to aid in obtaining normality and homogeneity of variance.

The "t" test, Chi-square, ANOVA, and R-mode factor analysis procedures were used to generate data for interpretation.
Summary of Findings

Results of 't' Test

The 't' test was used to test the null hypothesis that there was no significant difference between the mean grade point average of the control group and the experimental group. The null hypothesis was retained at the .05 significance level.

Results of the Chi-Square Tests

Chi-square tests were performed to test the following null hypotheses: There was no significant difference in course dropouts for the experimental and control group, and there was no significant difference in course failures for the experimental and control group. The results of the Chi-square tests led to the retention of both null hypotheses at the .05 significance level.

Results of the Two-Way Analysis of Variance

Twenty-eight two-way analysis of variance tests were performed to test three null hypotheses relating to each of the 28 elements of the modified Hill cognitive style preference inventory. The three null hypotheses stated there was no significant effect of vocational areas, sex or interaction in relation to the cognitive map element mean scores.
The null hypothesis relating vocational area effect was retained for 18 of the elements and rejected for ten. Two of the ten that were significant also had significant interaction. The remaining eight were subjected to Tukey's Honestly Significant Difference Test to determine where the differences occurred.

The null hypothesis relating to sex effect was retained for 14 elements. The remaining 14 elements produced a significant difference. Nine of the 14 were without significant interaction. The male/female map scores were examined for interpretation and presentation.

The null hypothesis addressing the interactive effect of vocational area and sex was retained for 22 of the map elements. For the six elements that produced significant interaction, two items were shown to have ordinal interaction between at least two adjacent areas with four items showing disordinal interaction characteristics. Of the six elements showing interaction, four possessed both ordinal and disordinal types.

Results of the R-Mode Factor Analysis

The R-mode factor analysis was used to cluster common map elements in each vocational area. Four separate analyses were completed. The following number of common elements above a
loading of . 70 were identified in the respective areas: Agriculture, eight; Business, seven; Health, ten; Trade and Industrial, six.

Conclusions

Objectives One, Two and Three

These objectives were designed to determine the effectiveness of the cognitive mapping process on grade point average, course failure rate, and course dropout rate. All three null hypotheses were retained. Therefore, it can be concluded that cognitive mapping, as implemented by the community colleges in this study, has little or no effect on students' success, as measured by the selected variables.

Objective Four

The fourth objective concerned determining differences among the four selected vocational areas regarding cognitive map items. The two-way analysis of variance yielded eight elements in which two or more of the vocational areas were significantly different without interaction. The differences were interpreted in the following manner:

1. Health students chose to find meaning through words they hear more often than did agriculture or trade and industrial students. The health students possessed a greater preference for hearing
words than agriculture or trade and industrial students

2. Health students gained greater enjoyment from the beauty of an object or idea than did the agricultural students

3. Health students viewed themselves higher in commitment to a set of values, a group of principles, obligations and/or duties than did the agriculture, business, or trade and industrial students

4. Health students viewed themselves higher in judging the physical and social distance another person would permit than did trade and industrial students

5. Health students viewed themselves higher in personal knowledge of themselves than did trade and industrial students

6. Health students possessed a greater awareness of time and expectations than did trade and industrial students

7. Business students experienced a higher influence of immediate family, business, church, or authority figures than did agricultural students

8. Health students exhibited a greater preference than agricultural students for solving problems in a step-wise fashion, reasoning from the general principle logically down to the specific case.

Conclusions which can be drawn from the above interpretations include:
1. Health occupation students as a group possess the greatest number of perceived unique elements

2. Health occupation students possess a greater preference to function through the qualitative social codes.

Objective Five

The fifth objective was to determine if differences existed in the male and female maps. The two-way analysis of variance procedure resulted in nine map elements where males and females were significantly different without interaction. The differences were interpreted in the following manner:

1. Male students exhibited a higher preference than females to find meaning through hearing words spoken

2. Females exhibited a higher preference than males in finding meaning in spoken numbers or non-word symbols

3. Females exhibited greater preferences than males in perceiving meaning through sounds, tones of music and other purely sonic sensations

4. Females possessed a greater preference than males in perceiving meaning through the sense of taste. Females reported that smoking, chewing gum, eating mints, or chewing on pencils helped their concentration
5. Females found a greater enjoyment in the beauty of an object or an idea than did males
6. Females exhibited a higher commitment to a set of values, a group of principles, obligations and/or duties than did males
7. Males were higher in performance motor skills according to the recommended or accepted form than were females
8. Males possessed a higher degree of independence in evaluating information and a greater preference for dealing with new information on an individual basis
9. Male students exhibited a greater preference than female students for solving problems in a step-wise fashion, reasoning from the general principle logically down to the specific case.

Conclusions which can be drawn from the interpretations outlined above are:

1. Females tend to function with abstract concepts more effectively than do males
2. Males tend to function more logically and independently with concrete objectives than do females.

Timm (1979) reported finding several sex biased questions in the instrument used for this study. Therefore the conclusions of the few male-female significantly different elements identified may be open to question. The fact that so few differences were found
supports the premise that males and females may succeed equally well in all vocational areas examined by the study.

**Objective Six**

The sixth objective of this study was to establish common composite maps for each of the four vocational areas identified. The conclusions pertaining to these findings for each vocational area are:

1. Agriculture students prefer to learn through hearing and gesture assimilation. They tend to see the beauty of an object while maintaining time expectations, and also reason in a logical, step-wise fashion. This tends to be consistent with those who work with nature.

2. Business students prefer to learn through spoken words and numbers as well as through touch. They follow recommended patterns of motor skills. This tends to be consistent with those who possess necessary business skills in the areas of accounting and word processing.

3. Health occupation students prefer to learn through words seen as well as through written non-word symbols. They receive meaning through sight and must see how things are alike. They combine parts and independently evaluate information. This tends
to be consistent with the characteristics expected of a successful practitioner in the allied health field.

4. Trade and industrial students prefer to learn through touch and motor skill development. They combine operations of a task in the acceptable manner. They reason deductively and can see the beauty of an object. This tends to be consistent with the concepts of applied concrete functionality required of those in this area.

**Implications**

Based upon the review of literature, analyses, findings, and conclusions cited, the following are proposed as having significant implications regarding the future use of cognitive mapping.

1. Since cognitive mapping is ineffective as it is presently implemented in Oregon community colleges, it appears the mapping process should either be eliminated or expanded to a level which would allow implementation to the extent designated by Hill (1967). The Hill model was intended to match student preferences, instructor styles, and total learning environment elements.

2. In order for cognitive mapping to have potential for success it must be adequately funded. That is, counselors and instructors
must be well-trained to identify cognitive styles and to advise students regarding learning strategy and career selection. Alternative learning situations must be available from which to choose. This can best be accomplished to its fullest extent if proper funding in the areas of program development, staff development, and implementation is provided. Resources must be available not only to identify and explain cognitive styles, but also to give guidance in the utilization of the varied learning situations which must be provided. Funding is a critical concern for successful cognitive mapping, as it is for other areas of vocational programming. The study indicated that the current level of involvement in cognitive mapping at the community colleges sampled is largely ineffective for the variables examined. This does not necessarily imply that cognitive mapping is ineffective, but rather that more complete involvement is required for potential success.

3. The similarities and differences identified among the four vocational groups with regard to cognitive style should be complemented and supplemented by vocational program facilitators and instructors to maximize assistance for vocational students' success. The unique characteristics of vocational students
should dictate the development of flexible curriculum materials. This would facilitate the process of matching students' cognitive styles with the educational environment. Some students need to see concepts written down and be able to refer to them in order to gain a full understanding of them. Other students need to verbalize concerning material they are assimilating. For these individuals small group social activity facilitates comprehension. Flexible and yet comprehensive curriculum designs should allow for enrichment and mediation with a variety of presentation techniques.

4. Career guidance and counseling sometimes focuses on presenting an array of careers in which a person may find success based on areas of interest and ability. Since cognitive mapping is based on a preference inventory, it could be used to assist persons in finding occupations that would parallel their cognitive strengths. In order to bring usefulness to the cognitive mapping process counselors must be able to identify and explain student cognitive preferences. They then could assist students by prescribing courses, instructors, or special learning strategies and suggesting possible career options.

5. The success of special needs students in education is often dependent on determining what changes are needed in the
learning environment as dictated by the student. The special needs student is often unable to adapt to the learning situation as well as other students. Therefore, matching the climate and the students' cognitive style may be very important in order for the student to experience initial success. Later, emphasis may be placed on strengthening the students' learning style weaknesses with help in developing adapting skills. If instructors receive cognitive style maps for individual students as well as class profiles, they may be able to detect special needs as well as general trends for overall class preference. Teaching strategies adopted to these needs or trends have the potential for increasing the success of all students.

Recommendations for Further Study

1. It is suggested that a study be conducted on the results of a process that more fully employs the prescriptive techniques as suggested by the original Hill model. This would include altering learning materials, time, space, teaching style, and activities.

2. The cognitive mapping process in the study occurred six months prior to the measures of grade-point averages and course failures. It is recommended that additional studies be conducted
the term following the mapping process to determine if there were immediate gains that were not detected by the study.

3. It is recommended that further studies be conducted to determine the effect of the mapping treatment on student dropout rates and on students' self-concept.

4. To facilitate the use of the cognitive mapping process as a career guidance tool, it is recommended that a study be conducted to determine cognitive profiles of successful persons in specific vocational fields.

5. It is recommended that a study be conducted to determine if a person's cognitive map changes over a period of time. Directions, rates and causes should be determined.

6. A longitudinal experimental study should be conducted to determine if gains are the greatest when teaching to preferred styles or when strengthening non-preferred styles.

7. Educational prescriptive techniques need to be developed for implementing other models and instruments that describe cognitive style. Further studies need to be accomplished that will adequately compare the different models.
BIBLIOGRAPHY


Hollis, Joseph Henry. "A Pilot Study of Personalized Mathematics Program for Fourth, Fifth, and Sixth Grade Students to Explore


APPENDICES
APPENDIX A

PILOT SURVEY AND RESULTS:
OREGON COMMUNITY COLLEGE INVOLVEMENT
IN COGNITIVE MAPPING
The following letter and pre-addressed and stamped post cards were sent to the 13 community colleges in Oregon on October 15, 1979. A response from each institution was received by November 15, 1979. The following results were obtained.

**Schools Involved in Cognitive Style Mapping**
- Lane Community College
- Linn-Benton Community College
- Mt. Hood Community College
- Rogue Community College
- Umpqua Community College

**Schools Not Involved in Cognitive Style Mapping**
- Central Oregon Community College
- Chemeketa Community College
- Clackamas Community College
- Clatsop Community College
- Portland Community College

**Schools Studying or Expressing Interest in Cognitive Style Mapping**
- Blue Mountain Community College
- Southwestern Oregon Community College
- Treasure Valley Community College
October 25, 1979

Dean of Instruction

Dear Dean of Instruction,

I am involved in some research to determine the effect of cognitive style mapping on vocational programs in Oregon community colleges.

If your department, any other instructional unit, or anyone on campus is involved in assisting students to determine their preferred learning styles would you please indicate the person in charge on the enclosed card.

If there is no involvement at your school please return the card appropriately marked so I will know this information has reached you.

Thank you for your assistance.

Sincerely,

Allan Fisher, VEPD Fellow
Vocational Technical Division
Oregon State University
APPENDIX B

COGNITIVE STYLE MAPPING INSTRUMENT
AND EXPLANATION BOOKLET
COGNITIVE
STYLE
MAPPING
MAPPING BOOK

MT. HOOD COMMUNITY COLLEGE
COGNITIVE STYLE MAPPING BOOKLET

The purpose of Cognitive Style Mapping is to give you information about your learning style. The resultant map should help you determine the manner in which you best learn. This instrument is not a test -- it does not measure what you know -- there are no right or wrong answers. The results will give a picture of the ways in which you derive meaning from your environment and experiences. It will reflect only the accuracy with which you respond to the statements. An interpretation of this map should enable you to use better judgement concerning how you structure your learning environment, and give information to instructors familiar with Cognitive Style Mapping to help provide learning alternatives for you.

This should not be an awesome, threatening exam, but rather an adventure in self-understanding.

Directions for use of hand-scored Tally Sheet:
To complete the map by this method you will need:

1. The map booklet
2. Tally Sheet
3. Something with which to write
4. From 45 minutes to 1 hour of time

TO RESPOND:

1. Read each statement carefully.
2. There are 8 sets of statements, and each set is made up of 28 statements. Mark your answers on the Tally Sheet on the line which corresponds with the statement. For example, statements numbered 4 should be answered on line 4 of the Tally Sheet. Statements numbered 12 should be answered on line 12 of the Tally Sheet, etc.
3. After reading a statement, decide if it pertains to you "rarely", "sometimes", or "usually". Then, put a tally mark in the appropriate column or the appropriate line.

PLEASE DO NOT MARK IN THE BOOKLET
1. I prefer the traditional lecture-type of classes.
2. I find it easy to add in my head numbers that are spoken to me.
3. I would rather read a map than listen to someone give me directions.
4. If I had to learn how to fill out an income tax form, I could learn how to do it.
5. I can listen to a song and recognize the “tune” the next time I hear it.
6. An unpleasant smell bugs me more than it does others.
7. I return to a restaurant because of the taste of food served there.
8. I would feel the material in an outfit before buying it.
9. I can understand a story better in a movie than in a book.
10. I am considered to be a “good” amateur athlete.
11. I understand how a person feels when he is being punished.
12. I enjoy listening to music when the quality of the sound is good.
13. I live my life according to my own moral values.
14. I can act friendly and helpful in order to get something I want.
15. Even on the phone I “talk with my hands.”
16. I think it is important to learn to throw a ball the right way.
17. I know how close I can stand to another person without making him uncomfortable.
18. I know when I have too many things worrying me.
19. I am able to put others at ease in tense situations.
20. I know how long it will take to complete most tasks.
21. I learn something better when I can discuss it with friends.
22. I will always try to live by what my family says is right or wrong.
23. I solve my own problems without suggestions from others.
24. Life is simple when I go by the rules.
25. When I meet someone new I notice how we are different.
26. I like to take school subjects that have a lot in common.
27. I take longer to solve a problem than do others because I want to know more about it than do most people.
28. I believe I think in a very logical fashion.
1. After I write something I like to hear it aloud so that I know how it sounds.
2. I can remember a telephone number once I hear it.
3. I prefer to read a newspaper myself rather than have someone read it to me.
4. I can read most graphs and charts without too much trouble.
5. I can listen to familiar sounds like a car engine or an air-conditioner and tell if something is wrong with it.
6. I can tell fresh fruit from stale fruit by the smell.
7. I choose a drink because of the way it tastes.
8. I would touch a realistic-looking plastic flower to see if it were real.
9. It bothers me when a movie picture is slightly fuzzy.
10. I can look at something with my eyes and do some task with my fingers all at the same time.
11. I can be patient with someone who is "in love" and can't seem to keep his/her mind on the subject.
12. Sometimes I read a poem or words of a song over and over because the words are so beautiful.
13. I do not let personal affairs interfere with completing an assignment.
14. I pretend to feel a certain way when I really don't feel that way at all.
15. I can fix things without looking at my hands.
16. I am able to tell if it is O.K. to introduce myself or wait to be introduced.
17. I can do what I set out to do.
18. I am able to talk people who are having an argument into solving their problems.
19. I know exactly how many minutes it takes me to go places that I go a lot.
20. I enjoy an activity more if my friends do it with me.
21. I check with my close family before making most decisions.
22. I consider my own goals ahead of the goals of others.
23. I have no sympathy for people who break the law.
24. I learn how to be successful by looking at my mistakes.
25. I tend to see all parts of the world as being related.
26. I change my mind about decisions I have made.
27. I avoid guessing when solving problems.

You should have 2 tally marks on each line. (Turn to page 3)
1. I prefer to follow spoken directions rather than written ones.
2. I talk about "sale" prices with others before I go shopping.
3. I would rather take a written English test than an oral English test.
4. I do my best math work on written tests rather than on oral ones.
5. I can tell the difference between two closely pitched sounds.
6. I am among the first to smell gas odors in a car.
7. I carry with me either cigarettes, gum, mints, a pen, etc., that I can chew on.
8. I prefer to write with a pen or pencil that "fits" my fingers.
9. I can understand a speaker better if I can see him talking.
10. I have been told I am a good dancer.
11. My friends tell me I am understanding.
12. I want useful things to be as pretty as possible.
13. I believe a promise should be kept.
14. I can act interested even though I am bored when listening to a teacher.
15. I can blush in situations where many others do not.
16. I am better coordinated than most people.
17. I can tell which boss or teacher to call by their first names.
18. I know how well I have done on a test before I get my score back.
19. I can get a group to decide something when I am ready for them to finish.
20. It bothers me for a friend to be late for an appointment with me.
21. I like for my friends to help me make decisions.
22. I enjoy activities more when I am with my family.
23. I like to make up my own mind about what is right and wrong.
24. I must know what the rules are in order to know whether a person has done right or wrong.
25. I think that holidays are different from other days of the year.
26. I solve a problem by seeing if it is like other problems I have solved.
27. I think decisions are better ones if I think about them for a long time.
28. I find reasoning like the following helps me to understand my thinking: All dogs have four legs. Rover is a dog. Therefore, Rover has four legs.

You should have 3 tally marks on each line. (Turn to page 4)
1. I do better on tests which cover information I have heard rather than read.
2. Oral math tests are easier for me than written ones.
3. I write an explanation better than I tell it.
4. In order to add seven or eight numbers I have to write them down.
5. Outside noises take my attention from what I am doing.
6. I feel that the smell of a store has a lot to do with its sales.
7. I can taste the difference between Coke and Pepsi Cola with my eyes closed.
8. I can button my coat in the dark.
9. I like looking at art work.
10. I can write without looking at my hands.
11. I "feel" the emotions of others as they feel them.
12. I think poetry is beautiful because of its ideas and words.
13. I would stop at a stop sign at three in the morning even if there were no one else around.
14. I laugh at jokes that I don't think are funny.
15. When I shake hands my handshake tells the other person how sincere I am.
16. I walk up a staircase without falling or slipping.
17. I can tell how friendly I can be with a stranger.
18. I know my weak points.
19. I can "take charge" of a situation.
20. It bothers me when events do not start on time.
21. I like to work in groups in class.
22. My political choices are influenced by my family's views.
23. I make my own political choices.
24. I follow the rules of most games and do not "cheat".
25. I could learn how to drive a new car by comparing how it was different from my old car.
26. When I look at something (like a painting, building, statue) I like to compare it to others I have seen.
27. I have to decide things before I can get enough information.
28. I like to solve a problem by starting with something I know is true.

You should have 4 tally marks on each line. (Turn to page 5)
1. I would rather say something than write it.
2. I find it easy to solve arithmetic problems that are read to me.
3. I would rather read directions than hear them read to me.
4. I solve math problems faster if they are written down.
5. I tune a radio by the sounds I hear and not by the numbers on the dial.
6. I can identify familiar flowers or plants by their smell.
7. I can concentrate better when I have something on which to chew or to eat.
8. I can tell a nickel from a dime in my pocket with my fingers.
9. Pictures in textbooks help me to understand what the book is saying.
10. I do well in activities that require hand-eye coordination.
11. When I am around someone who is hurt I feel hurt, too.
12. I enjoy the way an author writes as much as the story he tells.
13. I would give up something right now rather than do anything I think is wrong.
14. I can pretend to be happy and comfortable even when I am not.
15. People say that when I talk my eyes talk, too.
16. I do well in sports.
17. I know how much I need to apologize when I bump into someone in a store.
18. I know when I have taken on too much responsibility.
19. I am able to verbally stop arguments between other people.
20. I am among the first to come to a meeting.
21. I like to have a friend go with me when I go shopping to help me make choices.
22. I talk with my family before doing anything that might affect them.
23. I would rather do things my way even if it disappoints my family.
24. I think that rules and regulations should be followed.
25. I could better learn a topic if I see how it differs from other topics.
26. I get to know someone new by finding all the ways we react alike.
27. I worry about decisions because I see so many possible ways to solve the problem.
28. I understand theorems used in geometry.

You should have 5 tally marks on each line. (Turn to page 6)
1. People would say I speak more understandably than I write.

2. If I were buying a car I could learn more about the engine if someone told me about it than if I had to read about it.

3. I understand information better when I read it rather than when I hear it.

4. I can better understand a math problem if I see it in writing.

5. It bothers me when the radio is not tuned just exactly right.

6. I can identify familiar foods by their smell.

7. The taste of food is more important to me than the way it looks.

8. I would pick up and feel vegetables and fruits in a store before buying them.

9. I learn more from a picture than I do from a written description.

10. I can write while another person dictates to me.

11. I can understand and be patient with someone who is frightened.

12. I would go out of my way to see beautiful scenery.

13. When I decide to do something I usually carry through and do it.

14. I shout and act tough in order to show others that I am not scared.

15. I can tell how a person feels by the way he sits or stands.

16. I am willing to practice the steps to a new dance until I can do them really well.

17. I can tell when it is O.K. to tell a joke or not.

18. I know my strong points.

19. I can talk others into doing what I would like for them to do.

20. I turn in assignments when they are due.

21. I would want to talk with my friends before I took a new job.

22. I think of my boss or instructor as if he or she is a father or mother figure; I don't want them to be "one of the gang".

23. I prefer to work alone most of the time when given a choice.

24. I would rather work where the rules and standards are clearly stated.

25. I use jokes or funny remarks to change the point of view in many situations.

26. I can put together most jigsaw puzzles.

27. I like to look at a problem from as many ways as possible.

28. I enjoy riddles or puzzles that must be solved where the correct answers can be figured out from information in the rules.

You should have 6 tally marks on each line. (Turn to page 7)
1. I can make more sense out of what a person means when he speaks to me rather than if he writes to me.

2. I find it easy to "talk in formulas" with my classmates and teachers in math class.

3. I score well on tests which depend upon my knowing what I have read.

4. I need to write down a phone number in order to remember it.

5. When I listen to music I can tell one instrument from another.

6. I think the "smell" of a new car is one of the nicest things about it.

7. I enjoy new foods because I like new tastes.

8. I can feel the difference between cotton and silk.

9. I choose clothes mostly because of the way they look on me.

10. There is a sport I can play well enough to enjoy.

11. I try not to say something which might hurt someone's feelings.

12. I enjoy the beauty of a well-designed building.

13. I would give up money before I would give up what I believe in.

14. I would probably be a good actor in a play.

15. I use my hands to help me talk.

16. I learned to write clearly by practicing my handwriting.

17. I know when it is O.K. for me to put my hand on another person's shoulder.

18. I can accept it when someone criticizes me.

19. My friends involve me in solving their problems.

20. I arrive at class on time.

21. I am influenced by my friends' political opinions.

22. My family is the biggest influence on my religious beliefs.

23. I prefer classes where I can do independent work.

24. Because there is a law which says we stop for red lights, I would always stop for a red light.

25. If I had to explain soccer to someone I would tell them how it differs from other sports they knew about, like football.

26. I like to figure out how parts of a whole fit together.

27. I want to know as much about a problem as I can before I make a decision.

28. I enjoy the reasoning patterns used in math courses.

You should have 7 tally marks on each line. (Turn to page 8)
1. I understand the news better when I hear it rather than when I read it.

2. It is easy for me to remember numbers and prices I have heard during a conversation.

3. I prefer classes where we have to read textbooks rather than just listen to a lecture.

4. It helps me if I keep a written record of how I spend money.

5. I can tell who is on the phone just by listening to the voice for a few seconds.

6. I can tell "what's cooking" by the smell of the food.

7. I can tell by tasting if vegetables have just the right amount of seasoning.

8. I can tell my hair needs washing by the way it feels when I touch it.

9. I use the numbers on the dial when I tune a radio.

10. I can catch a ball that has been struck or thrown.

11. I can offer criticism to someone without hurting them.

12. I prefer a tidy room or desk.

13. I keep working hard even when no one is watching.

14. I can act like I know what I am doing when it seems like a good thing to do.

15. I use facial expressions to show how I feel.

16. I can hit with a bat a ball that is thrown to me.

17. I know whom I can ask a favor of without imposing.

18. I can predict how I will react in various situations.

19. I am a good salesperson.

20. I keep my appointments on time.

21. I like class projects where there is a lot of group work.

22. I make it a point not to let other things interfere with family plans.

23. I would rather do a class project alone than do it with a group.

24. If I find the article I had in mind I buy it without shopping further.

25. I wear contrasting colors in my choice of clothing.

26. I learn what other people believe in by seeing how it is similar to what I believe in.

27. It takes me a long time to shop for clothes because I go to several places to compare.

28. I like games that require me to use logic.

THIS CONCLUDES YOUR COGNITIVE STYLE MAPPING SESSION.
DIRECTIONS FOR SCORING THE TALLY SHEET

Turn tally sheet over. Fold tally portion as indicated.

1. Look across each line. You should have 8 tally marks on each line. If you have more (or less) than 8 tally marks, then you have goofed someplace. Check it out.

2. You are now ready to compute your score. Feel free to mark on your Tally sheet, but please do not mark yet in the column entitled “Score.”

First, look at line number 1. For each tally mark under “Rarely,” give yourself one point. For each tally mark under “Sometimes,” give yourself three points. For each tally mark under “Usually,” give yourself five points. Your subtotals should be placed in the “Sub-Total” column next to your tally marks.

Look at the example below:

<table>
<thead>
<tr>
<th>NUMBERS</th>
<th>RARELY</th>
<th>SOMETIMES</th>
<th>USUALLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>9</td>
<td>20</td>
</tr>
</tbody>
</table>

RARELY SOMETIMES USUALLY

For No. 1, you would get 4 points for “Rarely” (1 x 4 = 4), 9 points for “Sometimes” (3 x 3 = 9), and 5 points for “Usually” (1 x 5 = 5). Now add up your sub-totals across the line, and place that number in the column entitled “Score.” For example, on line NO. 1, the Score would be 18 because 4 + 9 + 5 = 18.

On line NO. 2, the Score is 30 (1 point for “Rarely,” 9 points for “Sometimes,” and 20 for “Usually”). Thus the Score is 30.

If you are now completely confused, please ask for assistance. Otherwise, continue to compute your scores for each of the 28 lines.

3. After you have computed all 28 scores, you should record your scores on your Cognitive Style Map Score Sheet.
COGNITIVE STYLE MAPPING

TALLY SHEET

NAME: ________________________________

DATE: ____________ S.S. # ______________

CLASS AND INSTRUCTOR: ________________________________

1. Insert tally sheet under your booklet
2. Line up by number for each page.

INSTRUCTIONS: Read each statement. Decide if it pertains to you "rarely", "sometimes", or "usually". Put a tally ( __ ) mark in the appropriate column on the line corresponding to your statement number.

Upon completion, return the booklet. If the map is to be computer scored, return this tally sheet. If it is to be self scored, follow the instructions on the back page of your CSM instrument. You should have 8 marks on each line, if you do not, recheck your instrument book and correct response.

ENJOY YOURSELF
<table>
<thead>
<tr>
<th>RARELY</th>
<th>SOMETIMES</th>
<th>USUALLY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RARELY</th>
<th>SOMETIMES</th>
<th>USUALLY</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T(A)1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>T(A0)2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>T(VL)3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>T(V0)4</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Q(A) 5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Q(O) 6</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Q(S) 7</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Q(T) 8</td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>Q(V) 9</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>Q(F)10</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Q(CEM)11</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Q(CES)12</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>Q(CET)13</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>Q(CH) 14</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>Q(K) 15</td>
<td>15</td>
</tr>
<tr>
<td>16</td>
<td>Q(CKH)16</td>
<td>16</td>
</tr>
<tr>
<td>17</td>
<td>Q(CP) 17</td>
<td>17</td>
</tr>
<tr>
<td>18</td>
<td>Q(CS) 18</td>
<td>18</td>
</tr>
<tr>
<td>19</td>
<td>Q(CT) 19</td>
<td>19</td>
</tr>
<tr>
<td>20</td>
<td>Q(CTM)20</td>
<td>20</td>
</tr>
<tr>
<td>21</td>
<td>A  21</td>
<td>21</td>
</tr>
<tr>
<td>22</td>
<td>F  22</td>
<td>22</td>
</tr>
<tr>
<td>23</td>
<td>I  23</td>
<td>23</td>
</tr>
<tr>
<td>24</td>
<td>M  24</td>
<td>24</td>
</tr>
<tr>
<td>25</td>
<td>D  25</td>
<td>25</td>
</tr>
<tr>
<td>26</td>
<td>R  26</td>
<td>26</td>
</tr>
<tr>
<td>27</td>
<td>L  27</td>
<td>27</td>
</tr>
<tr>
<td>28</td>
<td>(K) 28</td>
<td>28</td>
</tr>
</tbody>
</table>

Fold under to score.

To Score - see directions on the back page of your booklet.
COGNITIVE STYLE MAPPING

STUDENT GUIDE

MT. HOOD COMMUNITY COLLEGE
COGNITIVE STYLE MAP

NAME ____________________________

DIRECTIONS FOR Completing YOUR MAP:

In order to complete your map you will need your scored Tally Sheet.

Look at the score on Line 1 of your CSM Tally Sheet. If it is between 27 and 40, place your score number in the column labeled "Major." If your score for T(AL) Line 1 is between 16 and 26, place your score in the column entitled "Minor." If your score is 15 or below, place your score in the "Negligible" column. Continue for each of the 28 scores on your Tally Sheet.

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>ITEM</th>
<th>Major</th>
<th>Minor</th>
<th>Negligible</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T(AL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>T(AQ)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>T(VL)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>T(VQ)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Q(A)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Q(O)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Q(S)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Q(T)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Q(V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Q(P)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Q(CEM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Q(CES)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Q(CET)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Q(CH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Q(CK)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Q(KH)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Q(KP)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Q(CSI)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Q(CT)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Q(CTM)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>F</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>(K)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In order to interpret your scores you will need additional materials such as the Student Guide or other interpretation materials.
STUDENT GUIDE COGNITIVE STYLE MAPPING

Recently you completed an instrument to aid in determining your Cognitive Style. This guide has been developed to give you an explanation of the terms so that you might learn what your preferred learning style appears to be.

The Cognitive Style Map (CSM) questionnaire was designed to help you determine the manner in which you prefer to learn. The questionnaire is not a test. It draws a picture or a map of the ways in which you prefer to get meaning from your environment and experiences. As you learn about your preferences, you will be uncovering information about yourself. You will probably not be surprised by what you discover. You probably will actually know everything the map shows you. However, you likely have never organized your preferred way of learning into any system. The purpose of this interpretation is to search for and find your most effective way for getting information.

There are no right or wrong answers, no high or low scores, no good or bad maps. Your map reflects your preferred learning style; therefore, it is good and right for you. No other map is better! Also, your map is not absolute. If you and your instructor or counselor agree the map is incorrect for you on an item, it is! Change your map!

There are several ways you may learn about your style of learning here at Mt. Hood Community College. You may view a video tape or check out a cassette tape. Both are available in the Library Resources Center. You may see a slide tape presentation or have an oral discussion in your class. You may meet individually with your instructor or your counselor. This Student Guide and your copy of your map are yours to be used with any of the methods you use for map interpretation. You may take notes, underline or write in them as you like. A work sheet for entering your scores and determining how correct they seem to be for you follows the Text of the Guide Book. You might complete it to make this interpretation more valuable for you.

Now let's get on with discovering your cognitive style.

Explanation of Cognitive Style Mapping

You should have your map before you.

Your map contains 28 items or elements divided into: Theoretical and Qualitative Symbols, Cultural Determinants and Modalities of Inference. These are listed down the left side of your map.

Looking again at your map, you will note four columns across the top: "Items", "Major", "Minor", and "Negligible". By looking at an item, such as 1. T(AL) and moving across the page, you will note a number under the "Major", "Minor", or "Negligible" column. That score places your preference for learning in that way. You may have all majors or no majors in any group. The important thing is not your score but a comparison of each of your scores to your other scores in the set.

Major - your score fell between 27 and 40.
A Major indicates that you prefer to use that element much of the time.

Minor - you have a score between 16 and 26.
A Minor indicates that you use the characteristic being described. However, you probably do not derive as much meaning through one of the "minor" elements as you do "major" elements.

Negligible - you have a score between 0 and 15.
A Negligible indicates that you derive little meaning from that characteristic. You prefer not to learn in that manner.
ELEMENTS OF COGNITIVE STYLE

Theoretical Symbols

The first set of elements are theoretical symbols and qualitative symbols. The theoretical elements include the same areas that are measured on virtually all academic aptitude, achievement, or ability tests, i.e., verbal and mathematical. They are commonly considered essential for academic success. On your Cognitive Style Map, they are referred to as Linguistic (verbal) and Quantitative (numerical) and are symbolized by the letters L and Q respectively.

This map is different from achievement or ability measurements in that it helps measure your preference for working with words or numbers that you SEE and with those you HEAR. Hence, we have:

1. T(AL) Theoretical Auditory Linguistics - Finding meaning through words you hear, a preference for hearing words.
2. T(AQ) Theoretical Auditory Quantitative - Finding meaning in spoken numbers, preferring to hear non-word symbols.
3. T(VL) Theoretical Visual Linguistics - Finding meaning from words you see, preferring to read.
4. T(VQ) Theoretical Visual Quantitative - Finding meaning in numerical symbols, a preference for seeing non-word symbols.

Stop now and review your scores on the first four elements. Fill in the work sheet at the end of this Guide. Do your scores uncover your preferred learning styles?

Qualitative Symbols

Since it is assumed that theoretical ability is supplemented by other abilities, we must consider the personal abilities you have. There are sixteen qualities that will be shown on your map and scored again as Major, Minor, or Negligible.

The first of these qualities are those which indicate meaning perceived through the basic senses. They are shown on your map as:

5. Q(A) Qualitative Auditory (Sound) - Perceiving meaning through the sense of hearing. A major in this area probably distinguishes between sounds, tones of music and other purely sonic sensations. Sounds may interfere with (or help) concentration.
6. Q(O) Qualitative Olfactory (Smell) - Perceiving meaning through the sense of smell. Certain smells may interfere with the learning process to a person with a major.
7. Q(S) Qualitative Savory (Taste) - Perceiving meaning by the sense of taste. Majors usually smoke, chew gum, eat mints, or chew on pencils. They find tasting helps concentration.
8. Q(T) Qualitative Tactile (Touch) - Perceiving meaning by the sense of touch, temperature, and pain.
9. Q(V) Qualitative Visual (Sight) - Perceiving meaning through sight. Majors sometimes have trouble blocking out what they see.
10. Q(P) Qualitative Proprioceptive - Perceiving meaning through synthesizing or combining parts of a task, such as typing or playing a musical instrument.
The other qualities are social codes:

11. Q(CEM) Qualitative Code Empathetic - Sensitivity to the feelings of others; putting yourself in another person's place and seeing things from his or her point of view.

12. Q(CES) Qualitative Code Esthetic - Enjoying the beauty of an object or an idea. Beauty in surroundings or a well-turned phrase are appreciated by a person possessing a major in this area.

13. Q(CET) Qualitative Code Ethic - Commitment to a set of values, a group of principles, obligations and/or duties. This commitment need not imply morality. Both a priest and a criminal may be committed to a set of values although the "values" may be decidedly different.

14. Q(CH) Qualitative Code Histrionic - Exhibiting a deliberate behavior or "playing a role" to produce some particular effect on other persons. This type of person knows how to fulfill role expectations.

15. Q(CK) Qualitative Code Kinesics - Understanding and communicating by facial expressions and body motion such as smiles and gestures. Majors use their hands to talk.

16. Q(CKH) Qualitative Code Kinesthetic - Performing motor skills according to a recommended, or acceptable form, such as bowling or golfing "correctly".

17. Q(CP) Qualitative Code Proxemics - Judging the physical and social distance another person would permit. A major on this item knows how close to get and whom to call by first name.

18. Q(CS) Qualitative Code Synnoetica - Personal knowledge of oneself.

19. Q(CT) Qualitative Code Transactional - A major on this item is able to effectively put across an idea or to sell a product or influence another's behavior.

20. Q(CTM) Qualitative Code Temporal - A major on this item is aware of time and time expectations.

Review your map and see if these elements are appropriately placed for you.

Cultural Determinants

This second set, cultural determinants, shows which elements are chief influences on theoretical and qualitative symbols. Who helps to determine or influence your value judgments, decisions and actions? These scores will be found under "Cultural Determinants" on your map.

21. A Associates - The degree of influence by friends or persons other than family.

22. F Family - The influence that might include immediate family, business, church or authority figures.

23. I Individual - The degree of independence in evaluating information: a preference for dealing with new information on an individual basis.
Modalities of Inference

The third set, modalities of inference, shows patterns of thinking or how you make inferences. There are five different elements in this last set on your map.

24. **M**
   Magnitude - The degree to which an individual relies on and prefers a clear set of rules, classifications or definitions for accepting or rejecting an idea (categorical reasoning). Persons who need to define things or know the "policy", in order to understand, reflect this modality.

25. **D**
   Difference - The person who reasons in this pattern always looks for differences between and among concepts. There is a strong preference for contrasting one idea against another when learning new information. If two theories about the same topic were encountered, this student would want to know how they are different. Often artists possess this modality as do creative writers and musicians; however, this does not imply this is a requirement to being a good writer, artist or musician. People with a major here often say, "What if...".

26. **R**
   Relationship - This modality requires that things be seen in terms of how they are alike. One looks at a number of specific cases and attempts to explain them all with one general rule.

27. **L**
   Appraisal - The modality of inference employed by an individual who uses all three of the modalities noted above (M, D and R) giving equal weight to each. A student strong in this element prefers to cover new material slowly and in detail, with a lot of opportunities to ask questions. As a result, these individuals may take a long time to make decisions.

28. **(K)**
   Deductive - Preference for solving problems in a stepwise fashion, reasoning from the general principle logically down to the specific case. Mathematical proofs and logical arguments are good examples of this type of information.
### SUMMARY OF CSM SYMBOLS AND THEIR MEANINGS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (TA)</td>
<td>Finding meaning through words you hear.</td>
</tr>
<tr>
<td>2 (AQ)</td>
<td>Finding meaning in spoken numbers or non-word symbols.</td>
</tr>
<tr>
<td>3 (TL)</td>
<td>Finding meaning in seeing numerical or non-word symbols.</td>
</tr>
<tr>
<td>4 (TO)</td>
<td>Finding meaning through the sense of hearing.</td>
</tr>
<tr>
<td>5 (OT)</td>
<td>Perception through the sense of smell.</td>
</tr>
<tr>
<td>6 (OL)</td>
<td>Perception through the sense of taste.</td>
</tr>
<tr>
<td>7 (OT)</td>
<td>Perception through the sense of touch, temperature, and pain.</td>
</tr>
<tr>
<td>8 (OA)</td>
<td>Perception through synthesizing or combining parts of a task-like driving a car or playing a piano.</td>
</tr>
<tr>
<td>9 (CE)</td>
<td>Sensitivity to another's feelings. Putting yourself into another person's place.</td>
</tr>
<tr>
<td>10 (C)</td>
<td>Enjoying the beauty of an object, scene or idea.</td>
</tr>
<tr>
<td>11 (E)</td>
<td>Commitment to a set of values, principles, obligations and/or duties. (Does not imply morality.)</td>
</tr>
<tr>
<td>12 (HE)</td>
<td>Exhibiting a deliberate behavior or &quot;playing a role&quot; to influence others.</td>
</tr>
</tbody>
</table>

#### YOUR MAP ANALYSIS

<table>
<thead>
<tr>
<th>YOUR SCORE</th>
<th>TENDENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major</td>
<td>Tend to Agree</td>
</tr>
<tr>
<td>Minor</td>
<td>Tend to Disagree</td>
</tr>
<tr>
<td>Undecided</td>
<td>Neutral</td>
</tr>
<tr>
<td>Highlight</td>
<td>Noticeable</td>
</tr>
<tr>
<td>Negligible</td>
<td>Insignificant</td>
</tr>
</tbody>
</table>

#### YOUR MAP ANALYSIS

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (TA)</td>
<td>Finding meaning through words you hear.</td>
</tr>
<tr>
<td>2 (AQ)</td>
<td>Finding meaning in spoken numbers or non-word symbols.</td>
</tr>
<tr>
<td>3 (TL)</td>
<td>Finding meaning in seeing numerical or non-word symbols.</td>
</tr>
<tr>
<td>4 (TO)</td>
<td>Finding meaning through the sense of hearing.</td>
</tr>
<tr>
<td>5 (OT)</td>
<td>Perception through the sense of smell.</td>
</tr>
<tr>
<td>6 (OL)</td>
<td>Perception through the sense of taste.</td>
</tr>
<tr>
<td>7 (OT)</td>
<td>Perception through the sense of touch, temperature, and pain.</td>
</tr>
<tr>
<td>8 (OA)</td>
<td>Perception through synthesizing or combining parts of a task-like driving a car or playing a piano.</td>
</tr>
<tr>
<td>9 (CE)</td>
<td>Sensitivity to another's feelings. Putting yourself into another person's place.</td>
</tr>
<tr>
<td>10 (C)</td>
<td>Enjoying the beauty of an object, scene or idea.</td>
</tr>
<tr>
<td>11 (E)</td>
<td>Commitment to a set of values, principles, obligations and/or duties. (Does not imply morality.)</td>
</tr>
<tr>
<td>12 (HE)</td>
<td>Exhibiting a deliberate behavior or &quot;playing a role&quot; to influence others.</td>
</tr>
<tr>
<td>No.</td>
<td>SYM.</td>
</tr>
<tr>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>15.</td>
<td>Q(CK)</td>
</tr>
<tr>
<td>16.</td>
<td>Q(CH)</td>
</tr>
<tr>
<td>17.</td>
<td>Q(CP)</td>
</tr>
<tr>
<td>18.</td>
<td>Q(CS)</td>
</tr>
<tr>
<td>19.</td>
<td>Q(CT)</td>
</tr>
<tr>
<td>20.</td>
<td>Q(CTM)</td>
</tr>
<tr>
<td>21.</td>
<td>A</td>
</tr>
<tr>
<td>22.</td>
<td>F</td>
</tr>
<tr>
<td>24.</td>
<td>M</td>
</tr>
<tr>
<td>25.</td>
<td>D</td>
</tr>
<tr>
<td>27.</td>
<td>L</td>
</tr>
<tr>
<td>28.</td>
<td>(K)</td>
</tr>
</tbody>
</table>
SUMMARY

Now let's try to summarize: the CMS questionnaire is a systematic way of mapping out your cognitive style. The results of your map should help guide you in planning your educational program. It measures first your preference for working with theoretical, academic skills that are largely verbal and mathematical. Also measured are your preferred behavioral, sensory and social qualities. Second, it measures your preferences for being influenced in decisions by associates, family or yourself. These influences are labeled cultural determinants. Finally, your preferences for ways of reasoning are measured. These include reasoning categorically or emphasizing differences, discovering relationships through careful analysis, or by logic. There are many questions which a particular student might have at this point. Below are a number of common concerns that many students express.

Is the map always right? No! Usually we find students feel it is accurate in most areas--usually more than 25 of the 28.

If the map is correct, will I always learn this way? No! Circumstances may change your map...or...you may purposely set about to change how you learn.

Can I compare my map with someone else's to see who will probably learn better in any given setting? No! Your map compares how you learn in one situation with how you learn in another. in no way does it compare how any two people learn.

Does the map tell me how well I read or how well I should do in math? No! Only how you learn is reported by your map. To determine your level of reading, your ability, or any other personal characteristics, you should work with your counselor and instructor to take other diagnostic instruments.

Why don't you call this a "Test"? Because "tests" usually have right or wrong answers, good or bad scores, high or low grades, etc. Your map is not measured in terms of "bad" or "good", or "low". It is just a description - a MAP — OF HOW YOU GAIN MEANING.

How can I use this information? Through understanding of your cognitive style, you can adapt your learning activities to maximize your learning potential. For example, if you are a TVL, you should take copious notes and review these each evening.

By discussing your cognitive style map with your instructor, both become aware of your style and improve your chances of success in the course. You can understand why you are doing better (or worse) than you wish without deciding you are just "dumb!" (or your instructor is) by realizing we each learn differently. Outside of school you can make choices of how you learn, what you will enjoy doing and countless other decisions based on how you learn. Incidentally, you will also understand others and be less critical of friends and family by realizing that they have a unique cognitive style just as you do.

How can I get another copy of my map? Ask the Testing Center for it.

Again, if you would like more information about yourself, your cognitive style, goal setting, and goal achievement, your Mt. Hood Community College instructors and counselors would welcome the opportunity to work with you.
APPENDIX C

COGNITIVE STYLE MODELS
<table>
<thead>
<tr>
<th>MODEL</th>
<th>DEFINITIONS</th>
<th>PRINCIPAL RESEARCH</th>
<th>MEASURING INSTRUMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Educational Science</td>
<td>Cognitive style is the way individuals seek meaning from their environment, how they become informed. Cognitive maps are constructed in the form of Cartesian product of three sets. The first set indicates a student's tendency to use certain types of symbols, one's ability to understand words and numbers, qualitative programmatic symbols, and qualitative codes. The second set indicates influences which the student brings to bear in deriving meaning from symbols. These influences are effected mainly in terms of one's own individuality (I), or one's associates (A), or those of one's family (F). The third set indicates the manner in which the individual reasons, or the way in which one infers. Whether the individual thinks in categories (M), or in terms of differences (D), or synthesizes multiple relationships (R), or uses all three (L).</td>
<td>Hill and Wayne State University</td>
<td>Cognitive Style Test Inventory</td>
</tr>
<tr>
<td>MODEL</td>
<td>DEFINITIONS</td>
<td>PRINCIPAL RESEARCH</td>
<td>MEASURING INSTRUMENT</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>-------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Constricted vs. flexible control</td>
<td>Constricted control shows greater susceptibility to interference by irrelevant information while flexible control is evidenced by resistance to interference.</td>
<td>Menninger Foundation; Kleen</td>
<td>Stroop Color-Word Test</td>
</tr>
<tr>
<td>Tolerance vs. intolerance for incongruous or unrealistic experiences</td>
<td>Tolerance is revealed by more frequent reversals, readier adaptation to unusual perceptions. Intolerance involves the demand for more information before the unusual is accepted.</td>
<td>Menninger Foundation</td>
<td>Aniseikonic lenses; reversible figures</td>
</tr>
<tr>
<td>Impulsive vs. reflective responding</td>
<td>Impulsivity is characterized by quick responding while reflectiveness involves considering alternate classification or responses. When right, the impulsive is faster; the reflective makes fewer errors.</td>
<td>Fels Institute; Jerome Kagan</td>
<td>Matching Familiar Figures; Identical pictures</td>
</tr>
<tr>
<td>Analytic vs. nonanalytic conceptualized styles</td>
<td>Analytic style entails differentiating properties or attributes while nonanalytic responses may be thematic-descriptive or relational. The analytic is more attentive to similarities in property, the modality of inference influences, and is influenced by symbols and numbers.</td>
<td>Fels Institute; Jerome Kagan</td>
<td>Conceptual Style Test</td>
</tr>
<tr>
<td>MODEL</td>
<td>DEFINITIONS</td>
<td>PRINCIPAL RESEARCH</td>
<td>MEASURING INSTRUMENT</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
<td>--------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Field independence vs. field dependence</td>
<td>Differentiated (independent) vs. undifferentiated future-ground relationships. Field independents tend to extract a figure from its ground or background. Field dependents tend to see figures only in relation to their ground; they are superior to field independents in such tasks as memory for faces and they seem to be socially more sensitive.</td>
<td>Witkin</td>
<td>Embedded Figures Test, Rod &amp; Frame Test; Body Adjustment Test</td>
</tr>
<tr>
<td>Scanning vs. focusing (defined as strategies, not as attentional differences)</td>
<td>Posed a problem requiring identification of relevant as opposed to irrelevant information, scanners look for attributes and proceed in a constraint-seeking, broad to narrow fashion; while focusers generate more self-sufficient or all-encompassing hypotheses, proceeding in a trial-and-error fashion. If a scanner makes an error, he has nonetheless learned something while a focuser cannot tell.</td>
<td>Menninger Foundation; Schlesinger; Bruner Goodnow, Austin</td>
<td>Twenty operations Concept Attainment Tasks e.g., Bruner et al., in <em>A Study of Thinking</em></td>
</tr>
<tr>
<td>MODEL</td>
<td>DEFINITIONS</td>
<td>PRINCIPAL RESEARCH</td>
<td>MEASURING INSTRUMENT</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Broad vs. narrow categorizing</td>
<td>The broad categorizer prefers a small number of categories containing a large number of members. The broad categorizer admits more items or ideas as similar while the narrow categorizer reflects items and differentiates concepts more thoroughly.</td>
<td>Menninger Foundation</td>
<td>Category width</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tasks, Object sorting Tasks</td>
<td></td>
</tr>
<tr>
<td>Leveling vs. Sharpening</td>
<td>In taking in new information, the leveler shows greater readiness to assimilate new stimuli to previous categories while the sharpener tends to differentiate new instances from old. While categorizing style applies to free categorizing exercises, leveling and sharpening are examined, in a more controlled way using successive presentation of stimuli rather than simultaneous presentation.</td>
<td>Menninger Foundation; Gardner; Santostephano</td>
<td>Schematizing Test; Wagon Test</td>
</tr>
<tr>
<td>MODEL</td>
<td>DEFINITIONS</td>
<td>PRINCIPAL RESEARCH</td>
<td>MEASURING INSTRUMENT</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Risk-taking vs. caution</td>
<td>The risk-taker will take the risk when there is a low probability of a high payoff, while caution entails preferring low risk with a high probability of low payoff. In the cost payoff situations, the risk-taker tries to outwit the odds, the cautious person tries to identify the safer odds.</td>
<td>Kogan and Wallach</td>
<td>Cost-payoff games</td>
</tr>
<tr>
<td>Cognitive complexity vs. simplicity</td>
<td>Cognitive complexity is characterized by hierarchic integration while cognitive simplicity is reflected by use of dimensions of difference. Cognitive simplicity is favored when only horizontal analysis along a dimension is necessary. Cognitive complexity is favored when vertical analysis of relations between dimensions is necessary.</td>
<td>Kelly; Shroder, Driver, Streufert</td>
<td>REP Test Paragraph completion This I Believe Test</td>
</tr>
</tbody>
</table>
MODEL
McKenney two-dimensional model
Assimilation:
preceptive vs. receptive planning;
Systematic vs. intuitive

DEFINITIONS
The preceptive individual assimilates information to his concepts or categories while the receptive individual assimilates data as raw as possible. Perceptives categorize or chunk information as it comes to them while receptives can more often take a new look at the data presented, since they have stored it as data not concepts. Systematic individuals create orderly, sequential plans or strategies; if you have a good plan, you Intuitives prefer ideas, identifying the problem and skipping from part to whole analysis; a good solution for them is good because it solves the problem they defined.

PRINCIPAL RESEARCH
McKenney, Keen, Nelson, Botkin

MEASURING INSTRUMENT
Tasks Assessing each mode, e.g., Identical Pictures (Receptive), Elaboration (Preceptive), Paper Folding (Systematic), Scrambled Words (Intuitive)
APPENDIX D

SIGNIFICANT INTERACTION PLOTS:
TWO-WAY ANALYSIS OF VARIANCE
Two-way Analysis Interaction Plot
Qualitative Proprioceptive Mean Scores

male
female

Agriculture  Business  Health  Trade and Industrial

ordinal  disordinal
Two-way Analysis Interaction Plot
Qualitative Tactile Mean Scores

Agriculture
Business
Health
Trade and Industrial

male
female

ordinal
ordinal
Two-way Analysis Interaction Plot
Qualitative Code Transactional Mean Scores

male
female

Agriculture Business Health Trade and Industrial

disordinal ordinal
Two-way Analysis Interaction Plot
Qualitative Code Kinesthetic Mean Scores

male

female

Agriculture Business Health Trade and Industrial

ordinal ordinal ordinal ordinal
Two-way Analysis Interaction Plot
Qualitative Code Empathetic Mean Scores

Agriculture  Business  Health  Trade and Industrial

male

female

disordinal  ordinal  ordinal
APPENDIX E

PERCENTAGES OF COMMON VARIANCE AND CUMULATIVE PERCENTAGES FOR THE R-MODE FACTOR ANALYSIS
<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
<th>Cumulative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q(CHK)</td>
<td>30.6</td>
<td>30.6</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>14.4</td>
<td>44.9</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>12.8</td>
<td>57.8</td>
</tr>
<tr>
<td>D</td>
<td>9.7</td>
<td>67.5</td>
</tr>
<tr>
<td>T(VL)</td>
<td>9.1</td>
<td>76.6</td>
</tr>
<tr>
<td>I</td>
<td>8.4</td>
<td>85.0</td>
</tr>
<tr>
<td>T(AL)</td>
<td>6.8</td>
<td>91.7</td>
</tr>
<tr>
<td>Q(CH)</td>
<td>4.3</td>
<td>96.1</td>
</tr>
</tbody>
</table>
### Business: Percentage of common variance and cumulative percentages for the R-mode analysis

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
<th>Cumulative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>27.0</td>
<td>27.0</td>
</tr>
<tr>
<td>Q(CKH)</td>
<td>14.4</td>
<td>41.4</td>
</tr>
<tr>
<td>Q(CEM)</td>
<td>11.1</td>
<td>55.5</td>
</tr>
<tr>
<td>Q(CK)</td>
<td>10.1</td>
<td>65.6</td>
</tr>
<tr>
<td>Q(T)</td>
<td>8.8</td>
<td>74.4</td>
</tr>
<tr>
<td>T(AQ)</td>
<td>5.8</td>
<td>80.2</td>
</tr>
<tr>
<td>T(AL)</td>
<td>4.5</td>
<td>84.7</td>
</tr>
</tbody>
</table>
### Health: Percentage of common variance and cumulative percentages for the R-mode analysis

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
<th>Cumulative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q(CT)</td>
<td>31.0</td>
<td>31.0</td>
</tr>
<tr>
<td>D</td>
<td>14.5</td>
<td>45.5</td>
</tr>
<tr>
<td>T(VL)</td>
<td>11.8</td>
<td>57.3</td>
</tr>
<tr>
<td>Q(P)</td>
<td>9.4</td>
<td>66.8</td>
</tr>
<tr>
<td>I</td>
<td>7.7</td>
<td>74.5</td>
</tr>
<tr>
<td>T(VQ)</td>
<td>6.1</td>
<td>80.6</td>
</tr>
<tr>
<td>R</td>
<td>5.8</td>
<td>86.4</td>
</tr>
<tr>
<td>Q(CET)</td>
<td>5.0</td>
<td>91.4</td>
</tr>
<tr>
<td>Q(CS)</td>
<td>4.7</td>
<td>96.1</td>
</tr>
<tr>
<td>Q(V)</td>
<td>3.9</td>
<td>100.0</td>
</tr>
</tbody>
</table>
Trade and Industrial: Percentages of common variance and cumulative percentages for the R-mode analysis

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage</th>
<th>Cumulative Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q(CKH)</td>
<td>43.7</td>
<td>43.7</td>
</tr>
<tr>
<td>Q(T)</td>
<td>16.8</td>
<td>60.5</td>
</tr>
<tr>
<td>Q(CT)</td>
<td>10.2</td>
<td>70.7</td>
</tr>
<tr>
<td>Q(CES)</td>
<td>8.3</td>
<td>79.0</td>
</tr>
<tr>
<td>Q(V)</td>
<td>6.9</td>
<td>68.0</td>
</tr>
<tr>
<td>K</td>
<td>5.8</td>
<td>91.7</td>
</tr>
</tbody>
</table>