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INVESTIGATION OF THE RELATIONSHIP BETWEEN OCCUPATION,
LEARNING STYLE, AND PRODUCTIVITY PREFERENCE

by

Charlotte Wenham

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Education
Department of Educational Leadership

Western Michigan University
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INVESTIGATION OF THE RELATIONSHIP BETWEEN OCCUPATION,
LEARNING STYLE, AND PRODUCTIVITY PREFERENCE

Charlotte Wenham, Ed.D.

Western Michigan University, 1987

Businesses spend millions of dollars each year on selection and placement of personnel, on training, and on organizational development activities. Each one involves the learning processes of the individual; the effectiveness of these activities is dependent upon the receptiveness of the individual learner or worker to the specific activity. The purpose of this study was to verify if certain occupational groups demonstrated particular learning styles and productivity preferences and to determine if there were systematic differences among the occupational groups and the magnitude of those differences. Members of nine different occupational groups working in a branch facility of a Fortune 500 corporation were selected for the investigation.

The investigation was conducted using two instruments, the Gregorc Style Delineator (GSD) and the Productivity Environmental Preference Survey (PEPS). The GSD measured four variables which were learning style channel descriptors; they were concrete/sequential (CS), abstract/sequential (AS), abstract/random (AR), and concrete/random (CR). Strength or weakness in each of these variables categorized the subjects to be assessed by learning style. The PEPS assessed degree of preference for 20 different variables from the

areas of environmental preference, emotionality, sociological needs, and physical needs.

Differences between occupation groups on each of the measures were found. People within occupational groups demonstrated common patterns of learning style and productivity preference. However, there was only very slight correlation between learning style and productivity preference.

Based upon the results of the study, there seems to be reason to believe that group analysis information could be provided which would increase effectiveness of workers through creating matches between worker learning style and occupational requirements or, at least, in providing adaptation skills for employees in unmatched situations and in providing data for training design, selection and placement criteria and strategies, and selection of organizational development activities.

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Wenham, Charlotte Louise, Ed.D.

Western Michigan University, 1987

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Charlotte Wenham

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CHAPTER I

INTRODUCTION

Businesses spend billions of dollars each year on selection and placement of personnel, on training, and on organizational development activities. Carnevale (1984) reported that training alone accounts for expenditures of \$210 billion annually; \$30 billion is spent on formal training outside of the work station while \$180 billion is spent on informal training that occurs at or near the work station. A prevailing question is whether these activities, which involve the learning processes of the individual, are being done in an efficient manner. The effectiveness of an activity is dependent upon the receptiveness of the individual learner or worker to that particular activity. For training as well as selection and placement and organizational development activities, there are theories, measurement instruments, methodologies, and strategies designed to enhance the quality of the processes used for these activities. However, what has been lacking is a way of assessing the learning characteristics of individuals in order to match persons to process and to prescribe processes based upon the learning needs of specific populations.

The fields of psychology and education can provide this valuable assessment link. Specific learning needs are described by many authorities as learning styles (Dunn, Dunn, & Price, 1979;

Gregorc, 1979c; Kolb, Rubin, & McIntyre, 1979). Learning styles are manifestations of psychological styles which serve as a basis for human behavioral characteristics. Psychologist Jung (1923) postulated the idea of duality of mind in describing the mind as having both a rational and a feeling component. Allport (1961) further developed the idea and coined the term cognitive style. Since that time research has taken two avenues: basic research of cognitive learning styles and applied learning theories (Keefe, 1979).

Learning style, according to Gregorc (1980a), is the way in which one mediates and accommodates the environment and the people in it. When style is matched with stimuli from the environment or with the style of the people providing the stimuli, learning takes place more rapidly and is retained longer (Pask, 1976). According to Gregorc (1980a) the definition of learning encompasses productivity that is used in the workplace, whether that workplace is a school, an office, a mine, or a production plant. Thus, the analysis of individual learning styles should provide data to plan for selection and placement, training, and organizational development activities in many types of organizations.

Price, Dunn, and Dunn (1982) have applied learning style research in their Productivity Environmental Preference Survey (PEPS), an instrument which identifies how adults prefer to function, learn, concentrate, and perform. Preferences are categorized along environmental, emotional, sociological, and physical dimensions. The individual profiles that result from their survey make it possible to describe comprehensively the ways in which the subjects perceive that

they learn. Learning, then, can be increased by matching learning preferences to environmental conditions. Thus, it is possible to analyze individuals and prescribe individual instructional settings, materials, methodologies and strategies which can best facilitate learning or productivity.

Learning style and productivity preference combine interpersonal factors with preferred task characteristics and preferred environmental conditions. Seers and Graen (1984) found that combining task characteristics and interpersonal factors in approaching job enrichment could increase the range of outcomes as well as the impact of job enrichment on work and personal outcomes. Thus, the question of how to assess interpersonal factors and task characteristics is important.

The Problem

Learning style research has been used in schools and has proven to increase achievement (Dunn & Dunn, 1987; Dunn, 1982). However learning style theories have not been applied to adults in work environments. In spite of this, authors frequently suggest that learning style or cognitive style is fundamental to one's occupational choice. In fact, a relationship is stated, although not documented (Holland, 1973; Keirsey & Bates, 1984). This present study assessed cognitive learning style as well as workplace preferences for the purpose of identifying the learning style and productivity preferences of people within certain occupational groups and of determining whether or not there were differences among those

groups. The research hypothesis was that occupational groups could be categorized by learning style and productivity preference and that there would be style and preference differences among groups.

Learning styles are directly related to psychological styles (Gregorc, 1980a; Guild & Garger, 1985; Kolb et al., 1979). There is broad theoretical support for linking psychological style to occupation or profession as well as to hierarchical level of achievement within organizations. However, there is very little empirical support for that linkage (Allport, 1961; Gregorc, 1980a; Herzberg, 1966; Holland, 1973; Jung, 1923). Kiersey and Bates (1984) used Jung's 16 descriptors in describing personality types and identified occupations that provide matches to each of the 16 types. They used terms such as are apt to be, gravitate toward jobs, and are drawn to occupations that fall into specific categories. Kiersey and Bates also used phraseology like the majority of members of the profession are apparently sensor judges. These generalizations resulted from logic rather than research.

Gregorc (1980a) did not name specific occupations, as did Kiersey and Bates (1984), but he did use descriptors for his four learning categories that could also be used to define particular traits of various occupations. But again, logic made the connection rather than research.

Holland (1973) postulated that there was a relationship between personality and job focus as well as between personality and placement of the job in the hierarchy of the organization. Church and Alie (1986) found that managers' personality characteristics varied

with job focus (people, data, or things). Most managers in data-focused jobs preferred methods of gathering and evaluating information that were practical and based upon rules and regulations. Upper level managers, whose jobs were people-focused, demonstrated a preference for intuition as a method of evaluating information. Church and Alie's research supported Holland's theory that personality, job focus, and hierarchical level were interrelated.

Related research addressed the issue of productivity. If a learning style and environment match increases work satisfaction, then learning style assessment and job modification could influence or increase productivity and, thus, increase satisfaction. Argyris (1971), a human relations theorist, suggested that satisfaction precedes performance; Lawler and Porter (1967), human resource theorists, found that performance precedes satisfaction. Either way, it follows that if one is increased, the other could be. Thus, if a relationship of learning style to satisfaction or performance is established, the benefit of increased productivity could occur in the work place. Quality circles, job enrichment activities and other organizational development activities have been studied in an attempt to increase productivity and/or satisfaction. Marks (1986) found that quality circles increased productivity. Hackman and Oldham (1975) indicated that job enrichment was dependent upon task variety, individual autonomy, and feedback. Each of these factors have differing values to people of differing learning styles. For example, a person of one learning style would find the sharing of information in quality circles enlightening and productive while another would

describe it as a slow, unnecessary, and minimally productive process. Thus, matching employee learning styles to organizational development activities could increase the value and effectiveness of those activities.

The business literature does not appear to include a method for matching the selection and placement or training activities to the learning styles of the individuals involved. If such a method could be provided, it could streamline and increase the efficiency of selection, placement, and training activities. Instruments for assessment of learning style characteristics are available. However, they have generally been used in educational settings. But, if the characteristics assessed could be related to selection, placement, and training characteristics, the link between individuals and selection and placement and training activities could be provided. Presently it is not practicable on a large scale because the assessments are for individuals and have not been related to group qualities or characteristics. However, if it can be shown that specific occupational groups have particular qualities, then assessment could be done on groups; and selection, placement, and training strategies could be targeted to the learning style of the specific group. If this study shows occupational groups to have particular learning style patterns, the application of learning style theory in the workplace could have practical consequences.

The Purpose

The purpose of this study was to verify if certain occupational

groups demonstrated particular learning styles and productivity preferences and to determine if there were systematic differences among the occupational groups and the magnitude of those differences. To achieve the purpose it was appropriate to identify and categorize both the learning style and the productivity preferences of the individual subjects within the occupational groups.

Employees of a Fortune 500 company in southwestern Michigan were selected for the study. Individuals were selected because of their membership in a selected occupational group. The Gregorc (1982b) Style Delineator (GSD) and the Price et al. (1982) Productivity Environmental Preference Survey (PEPS) were administered to members of nine different occupational groups. The Gregorc instrument provided for individuals to be categorized in one of four learning style categories. The Price et al. instrument specified productivity preferences in 20 different preference areas. It was more discrete than the Gregorc instrument but, on a large scale, less practical. Using both instruments would provide the additional benefit of confirming the results of this study if both showed that there were differences among groups.

To assess the learning style of individuals from nine occupational groups was the first objective of this study. These groups were chosen on the basis of occupation specification and accessibility. The occupations selected included technicians, electrical and mechanical engineers, drafters/designers, model makers, systems analysts, secretaries, accountants, and clerks.

The second objective of this study was to determine whether

persons in particular occupational groups cluster, that is show a pattern, according to learning style using Gregorc's (1984a) four categories. Individual scores on the assessment were used to determine group means for each of the four categories; using that as a basis, determination was made as to the predominance of a particular style pattern within the occupational groups.

The third objective was to determine if members of the specific occupational groups showed common strengths or weaknesses in the 20 preference areas assessed; that is, were there group commonalities for each occupational group on the Productivity Environmental Preference Survey (PEPS).

If group differences appeared on the PEPS, the next test was to determine which of the 20 categories accounted for the variance between groups. Therefore, the fourth objective was to determine preference differences between groups for each occupation. A discriminant analysis of the variables for each group determined the source of variance.

Correlating the learning style variables as determined by the Gregorc Style Delineator (GSD) with the productivity preference variables determined by the PEPS was the fifth objective of this study which contributed to the body of knowledge regarding learning style because:

1. It empirically linked learning style with occupational group.
2. The study design can be replicated in dissimilar organizations using other occupational groups.

3. The study extends the application of Gregorc's (1980a) theory and the Price et al. (1982) instrument to the field of business.

The PEPS has not been tested in a similar type of organization to the one used for this study (Price, 1986). However, its applicability is documented in learning style research. According to its author, the Gregorc Style Delineator (GSD) has not been used in a setting of the type used for this study (Gregorc, 1986).

Study Limitations

It was intended that this study would be the precursor to future studies which organize occupational groups by learning style category. The study was limited in the following ways:

1. The study showed correlations, not cause and effect. It showed a relationship between occupation and learning style and occupation and productivity preference.
2. The study included a limited number of occupational groups and a limited number of individuals within groups.
3. The satisfaction of the individuals with their occupation was not known.

It could be argued that there is limited empirical evidence to support the idea that learning styles are indicators of anything other than preference because relationships between learning styles and performance outcomes in the workplace have not been demonstrated. However, if occupational groups can be categorized by learning style, future experimental studies could be conducted to confirm or deny the premise of preference only.

Definitions

The terms relating to learning styles and productivity preferences employed in this study are generally those used by the authors of the assessment measures. Those from Gregorc's Style Delineator are:

1. Concrete/sequential (CS): The concrete/sequential learning channel is characterized by a finely tuned ability to derive information through direct, hands-on experience. This learner exhibits extraordinary development of the five senses.

2. Abstract/sequential (AS): The abstract/sequential learning channel is characterized by excellent decoding abilities in the areas of verbal and pictorial symbols. Such a learner has a wealth of conceptual pictures which are matched against what is read, heard, or seen in graphic and pictorial form. This learner has and likes to use reading skills, listening skills, and visual translation abilities; prefers a presentation that has substance, is rational, and is sequential in nature; and is able to extract main ideas from such an approach. This preference also includes deference to authority in a learning situation and a low tolerance for environmental distractions.

3. Concrete/random (CR): The concrete/random learning channel is characterized by an experimental attitude and accompanying behavior. Such learners understand ideas quickly and demonstrate the uncanny ability to make intuitive leaps in exploring unstructured problem-solving experiences. Concrete/random learners utilize the trial-and-error approach when acquiring information. They do not like restrictive procedures or intervention which denies them oppor-

tunities to independently seek answers. Like their abstract/random companions, these individuals function well in a stimulus-rich environment.

4. Abstract/random (AR): The abstract/random learner is distinguishable by attention to human behavior and an extraordinary ability to sense and interpret vibrations. This type of learner is attuned to nuances of atmosphere and mood and associates the medium with the message. The speaker's manner, delivery, and personality is tied to the message being conveyed which allows for evaluation of the learning experience as a whole. The abstract/random learner prefers to receive information in an unstructured manner and is therefore comfortable in group discussions, activities which involve multi-sensory use, and busy environments (Gregorc, 1980a).

5. Channel: For purposes of this study learning style channel means any one of the four learning style descriptors used in the GSD. A person's learning style is composed of elements from each of the four channels: CS, AS, AR, and CR. However, people generally have at least one channel which is particularly strong or particularly weak.

The terms used in the Price et al. (1982) model are defined by the authors as follows:

1. Immediate environment: sound, temperature, light and design.
2. Emotionality: motivation, responsibility, persistence, and the need for either structure or flexibility.
3. Sociological needs: self-oriented, colleague-oriented,

authority-oriented, and/or several or varied ways.

4. Physical needs: perceptual preference(s), time of day, intake, and mobility.

5. Preferences: the personally preferred traits of the work setting which contribute to greater efficiency and greater productivity.

The occupational groups used in this study are defined by specific corporation job descriptions. These descriptions are comparable to descriptions in the Dictionary of Occupational Titles (DOT) (1977).

1. Technician: conducts general instrumentation and testing programs, under the general supervision of an engineer, supervisor, or manager, to determine and report product performance and acceptance. This occupation has the same principal responsibilities as listed under "Technician" in the "Term Title and Definition" section of the DOT (1977, p. 3).

2. Engineer: performs engineering development, design, and/or testing on assigned components, features, and systems within the established objectives of time, cost, performance, and other related factors. One job description covers both electrical and mechanical engineers and is comparable to the DOT (1977) term "Test Engineer" (p. 3).

3. Drafters/designers: creates original designs, involved layouts, and complex drawings that are dimensionally accurate and easy to interpret. This, again, is a generic term used by a number of industries and recognized by the DOT (1977, p. 7).

4. Model maker: specializes in any one area of the trade, namely, machine, sheet metal, wood, and plastics or assembly and exhibits complete proficiency in the production of quality parts and assemblies through the use of machinery, equipment, and materials found in model work. "Model Maker II" is the term title used in the DOT (1977) to describe this position (p. 10).

5. Systems analyst: under general supervision, develops, designs, implements, and maintains information systems in support of the functional area(s) of specific projects as assigned. This corporate job description is equivalent to systems analyst, electronic data processing as described under DOT (1977) number 012.167-066 (p. 29).

6. Secretary: performs secretarial duties and otherwise relieves officials of clerical work and minor administrative and business detail. DOT (1977) number 201.362-030 defines the same principal objectives of this secretarial stenographer (p. 153).

7. General accountant: assists in the recording and substantiation of corporate accounting records, and prepares corporation financial statements and reports as required. DOT (1977) specifies the types of accounting to be done by each position. However, this occupation most closely approximates the budget accountant, number 160.167-014 (p.91).

8. Steno clerk: performs secretarial and clerical duties and relieves officials of minor business detail. The descriptor used in

¹

Note: These are official position descriptions from the Fortune 500 corporation where the survey for this study was conducted.

DOT (1977) for this position is stenographer or clerk-stenographer, number 202.362-014 (p. 154).

For purposes of this study one other word has been used which requires explanation.

1. Cluster: to show a common learning style pattern, that is, to have similar group channel scores on the Gregorc Style Delineator (GSD) or to show similar group scores on any of the 20 categories of the Productivity Environmental Preference Survey (PEPS).

Summary

This study examined the relationship between occupational group and learning style, occupational group and productivity preference, and between learning style and productivity preference. In order to do so, it was necessary to identify and categorize the learning style and the productivity preference of individuals within the occupational groups.

Prior to this study, learning style theory had been studied in academic settings rather than in business organizations. The field of business had postulated theories and studied the effects of various selection and placement and training models. The purpose of this study was to provide a framework for linking the educational theory with the organizational theory.

It was expected that occupational groups would cluster by learning style and productivity preference. Future studies should be able to empirically link learning style and productivity preference

to selection and placement, training, and organizational development activities.

Literature on learning style and productivity preference theory will be reviewed in the next chapter. As well, related literature on worker satisfaction and productivity, motivation, and selection, placement, and training will be reviewed. The purpose of this is to show the applicability of learning style theory in the workplace.

CHAPTER II

REVIEW OF SELECTED RELATED LITERATURE

Provided in this chapter is an historical overview of learning style and productivity preference research from its roots in the 1920s to the present. The literature reviewed explains and defines learning styles and productivity preferences. The bases for learning styles, productivity preferences, and personality types are related to job focus. This relationship is then shown to extend to the application of learning style theory and to selection and placement and training activities.

Historical Overview

Psychological Bases of Learning Styles

Jung (1923) is responsible for the first theory of learning. He postulated the idea of the duality of human mind. This duality was composed of a rational component and a feeling component which functioned in concert with one another. Thus, involved in this thought process was the intellect (rational component) and the affective or intuitive (feeling component) influence. While these two components were always present in the thought processes, the ratio of one to the other could vary depending upon the person and the situation. From this idea of duality of mind came the extreme terms sensor/

intuitor and thinker/feeler to describe the functional process of thought. Jung also developed the idea and created the words introvert and extrovert which he used to describe the method of perception and action; their meaning as Jung used them was closer to intrinsic and extrinsic than it was to the common use of introvert and extrovert. Just as the thinking process was described in oppositional terms, so was the perception and action process. Further, thought, perception, and action integrated for a more complex system. To complete his description of the complexity of the human mind, Jung added the element of reasoning. Reasoning style was labeled as judging or perceiving. This reasoning related to the use of information acquired or generated.

In the 1930s Allport (1961) further developed the ideas postulated by Jung (1923). He coined the term cognitive style. While he concurred with Jung's descriptions, he said that styles could not be analyzed.

Myers and Briggs (cited in Myers & McCaully, 1985) spent 20 years (1940-1960) analyzing style and developing an assessment instrument which provided a basis for analysis of style, the Myers-Briggs Type Indicator (MBTI) (Myers & McCaulley, 1985). This self-administered inventory became widely used and is still well-documented as both reliable and valid. The MBTI used the constructs postulated by Jung (1923). It assumed that people had strength in some categories and were weak in others and that everyone did some mediating in each of the possible modes.

While the MBTI instrument was being developed, Thelen (cited in

Gregorc 1980a) was, through research, confirming Jung (1923) and Allport's (1961) ideas. Witkin (1977) was investigating the ways in which people perceive things. As a result of his findings on the embedded figures test, he concluded that people view things in two different ways: globally, field-dependent; and analytically, field-independent. The essence of this was that one either views things in context (globally) or in relative isolation (analytically).

Cognitive psychologists expanded upon Witkin's (1977) ideas: Pask (1976) suggested that some learners learned holistically while others learned in a step-by-step fashion; Messick (1976) postulated that there were those who viewed everything as cognitively simple or cognitively complex. Hunt (1977-1978) studied educational models and related them to cognitive style and development. He believed that the developmental process, enhanced by teaching, moved one from a cognitive style of low complexity through moderate and moderately high to high complexity. Hunt also said that low complexity processing required highly structured teaching and processing and that teaching moved proportionately in opposite directions on a continuum to the point which showed low structure teaching to be appropriate for a highly complex processor. Hill (1971) divided learning into discrete categories and prescribed teaching strategies for each category. This was related to Guilford's (1959) structure of intellect which mapped the brain physiologically and mapped the constructs of learning in relationship to the brain. These theories supported the concepts that learning occurs in different ways and that matching teaching strategies to the type of learning to occur was important.

Learning Styles: Theories and Application

Research on learning style per se has developed since 1975. Keefe (1979) stated that this research had two dimensions: cognitive theories and applied learning style theories. Cognitive theories have been extended by Kiersey and Bates (1984) and developed by Kolb et al. (1979) and Gregorc (1980a). Kiersey and Bates (1984) further developed Jungian theory by adding operational definitions to the terms used and relating the various personality styles to career choices, mating patterns, and life and living patterns. Kolb et al. (1979) approached learning style in yet another way. They suggested that one processed information by first having concrete experiences which one observed and reflected upon; a person in this stage was called the diverger. Processing continued as one began to abstract from the reflections and observations; this person was called the assimilator. The next type of person, the converger, extended abstractions into new ideas. The most advanced state of processing was active experimentation and was done by the accommodator.

The model designed by Kolb et al. (1979) had been used as the basis for a teaching methodology espoused by McCarthy (1981) and used in schools which progressed from stating concrete experiences, discussing them, coaching the search for abstractions, brainstorming new ideas, monitoring the trial of those ideas; this was all followed by evaluation. McCarthy believed that this methodology would have two advantages: It was matched to all styles; and it taught an understanding of style at the same time.

Gregorc (1984b) based his theory on Jung's ideas but used dif-

ferent terminology. Again, he used the idea of dualities. However, he used dualities in each of four areas: time, sequential/random; space, concrete/abstract; reasoning, inductive/deductive; and processing, associative/separative. He used a bidimensional model for the time and space dimensions. Like Myers and Briggs (cited in Myers & McCaulley, 1985), Gregorc believed that individuals have characteristics from each learning style channel but they have strength in one or more of the style channels.

Figure 1 compares the main dimensions of the theories of Jung (1923), Gregorc (1980a), and Kolb et al. (1979).

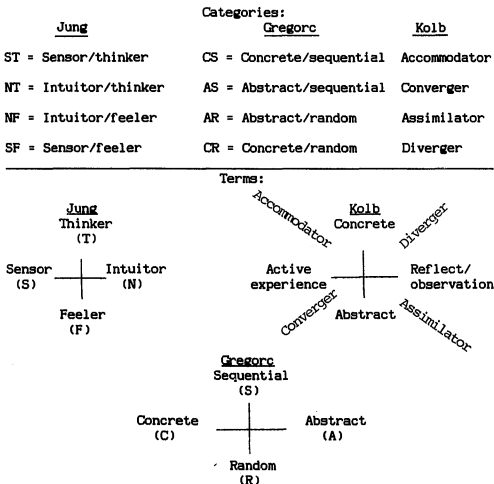


Figure 1. Comparison of Psychological and Learning Style Categories

Each of the three theories was developed for a particular purpose: Jung (1923) was attempting to describe thought processes; Gregorc (1980a) was labeling the bases for learning; and Kolb et al. (1979) were identifying a framework which could be used for assessing person-job interaction. Although the constructs were somewhat different, the definitions of terms and the application of the ideas were very similar. The comparisons in Figure 1 show the relationships of the two sets of extreme terms in each theory as well as the presence of those extremes in all three theories.

Probably the foremost researchers in applying learning style theory to teaching are Price et al. (1982). They designed and researched a Learning Style Inventory (LSI) and a Productivity Environmental Preference Survey (PEPS); the LSI was intended to be used with students in grades 3 through 12 while the PEPS was designed for use with adults. Both of these inventories assessed learning or productivity preferences from a physiological, environmental, sociological, and cognitive perspective. The Price et al. contribution to learning style theory was practical; and, they, like Myers and Briggs (cited in Myers & McCaulley, 1985) researched the same constructs and definitions and have revised them as necessary. The basic research that Kolb et al. (1979), Gregorc (1980a), and others have done was applied by McCarthy (1981), Dunn & Dunn (1987) in that they have provided the tools for assessment and made suggestions for use of the theoretical information in educational and work settings.

Research Related to Learning Style

Learning styles and productivity preferences have their theoretical basis in personality theory. Jung (1923) postulated the first theory of learning which was based upon psychological style. Thus, theory of learning from its conception has been a theory of learning style. Style differences can be categorized in four different areas: cognition, people gain and perceive knowledge differently; conceptualization, people formulate ideas and think differently; affect, people form values and feel differently; and behavior, people act differently (Guild & Garger, 1985). Perceptual differences affect how and what information is received.

According to Boles and Davenport (1975), everyone has a perceptual screen through which stimuli are filtered, and this filtering creates the uniqueness of individual perception. In other words, one's personal style influences perception. Thus, all cognition is influenced and individuals think differently. Some are convergent thinkers, searching for connections; others are divergent thinkers, making intuitive leaps from one idea to another. Divergent thinkers are described as inventive because they go outside the bounds of practicality and sequence that are applied by convergent thinkers (Gregorc, 1980a; Kolb et al., 1979).

Another aspect of style is attention to affect, that is, attention to emotions. Some people require attention and feedback from other people while others function well in relative isolation from the human touch. Need dispositions or individual personality needs relative to significant others contribute to value formation and

feelings. Behaviors are manifestations of all perceptions, thoughts, and feelings. Thus, style differences are disclosed in human behavior patterns.

Surface behaviors, mannerisms, and characteristics are manifestations of style which is superficial. "Stylistic characteristics reveal themselves to be surface indicators of two deep levels of the human mind: whole systems of thought, and peculiar qualities of the mind which an individual uses to establish links with reality" (Gregorc, 1984b, p. 51). This perspective links style to deep psychological constructs. Thus, as the search for meaning, desire to draw inferences, and need for options are psychologically rooted, so, too, are concern for detail, valuing of reward systems, and facility in the use of logic or intuition. While the bases of learning styles are psychological styles and therefore deeply rooted, surface behaviors reflect learning style. Assessment of one's actions and preference can lead to identification of learning style.

Beginning in 1970, Gregorc and his colleagues did naturalistic studies of school children. All of the subjects were academic achievers and were successful in sociocultural terms. Their behaviors were observed in and out of the classroom. The investigation found a wide range of behaviors used in the learning process. This was followed by a study of children and adults. Observations and interviews again led the researchers to a range of behaviors within which themes began to emerge. "This led to the hypothesis that common themes form an invisible abstract 'system of thought' or 'mind set.' These themes appear to guide decisions which manifest concretely in

specific mannerisms called 'style'" (Gregorc, 1984b, p. 52).

Gregorc's investigation also sought to determine the source of the systems of thought. It was concluded that some are learned and some are natural.

Like many psychological phenomena, there presently is no answer to the nature versus nurture question. It appears that both contribute to style. Gregorc (1984b) further concluded that mind sets arise from deeper driving forces and that there appear to be four of them: space, time, mental processing, and relationships.

The space qualities included concrete space and abstract space. Physical senses contributed to concrete space; whereas, intellect, emotions, imagination, and intuition were the links to abstract space. The perceptual ability of concreteness enabled one to gain knowledge through direct use and application of the physical senses. The senses served as the receptors of that which was visible in the concrete world. Abstractness permitted perception of that which was invisible and formless to the senses. In other words, this quality enabled one to learn through the faculty of reason and to emotionally and intuitively register subjective thoughts, ideas, feelings, drives, desires, and spiritual experiences.

The time dimension related to the structured ordering of realities; this was described as sequential, linear, serialized ordering, and random, nonlinear, nonserialized ordering. Sequential referred to branchlike or step-by-step ordering while random ordering was web-like, spiral, or multitiered. Sequential ordering resulted in expression in a progressive, logical, systematic manner; information was

organized in a methodical, predetermined order. Information storage and retrieval had no obvious pattern in random ordering. Therefore, expression took form in an active, multifaceted, and unconventional manner (Gregorc, 1982a).

All subjects in the Gregorc studies were found to have leanings toward one type of space and time. The final inference from the Gregorc (1984b) studies was that individuals related best to conditions which matched their preferred style and that they grew and developed most effectively in those matched conditions.

The dual terms concrete and abstract space and sequential and random order interacted to create four different learning styles. The two sets of dualities, concrete and abstract, and sequential and random, were found to be apparent in the information acquisition phase of learning (Gregorc & Ward, 1977). All persons possessed qualities of all four of the learning styles; however, 95% expressed definite preference for one or two of the styles (Gregorc, 1979a). The four learning styles were: concrete/sequential (CS); abstract/sequential (AS); abstract/random (AR); and concrete/random (CR).

1. Concrete/sequential learner (CS): This type of learner learns best from examples and real life objects or actual experiences. Structure and order are important; in the teaching and learning process, information should be arranged so that the CS learner can see the successive parts. Because of extraordinary development of senses, this learner has a low tolerance for distraction. A high regard for authority along with a clear sense of subordinate-superordinate relationships is important. Precision, exactness, and per-

fection are the bywords of this learner who requires a tangible reward but little in the way of encouragement. This learner reads very little but literally interprets and recalls information given.

2. Abstract/sequential learner (AS): Characteristic of this learner is the appreciation for abstractions, ideas, and concepts. Sequence and structure are important as this learner fits information into a big picture of connectedness. Information is analyzed and evaluated in terms of the connectedness as well as the authority from which it came. Intellectualism colors the perspective of this learner who is bothered by limitations on concepts or ideas but who requires sequence and orderliness of the thought process. This learner has high expectations, requires tangible reward, reads profusely, links information together, and uses figurative language, especially metaphor.

3. Abstract/random learner (AR): The AR learner describes abstractions in metaphorical terms, must see and be given options, and have minimal structure applied to the learning environment. This learner appreciates collegial relationships and is a highly empathic and highly subjective person. Although motivation is internal, this learner requires subjective approval from other people. Intuition guides this person who has a high tolerance for distraction, reads profusely, and sprinkles conversation with superlatives.

4. Concrete/random learner (CR): This learner makes concrete application of ideas and uses options and alternatives in experimentation. The CR is concerned with both the cognitive and affective dimensions of situations, data, and people. The thought process of

this style is characterized by intuitive leaps which occur in place of linear sequencing. Both internal and external rewards are important. Variety and a stimulus-rich environment are necessary and moderate distraction is acceptable to the CR (Gregorc, 1980a).

Table 1 contains brief synopses of the style characteristics of the four dominant channels.

Table 1
Learning Style Channel Comparison

Category	CS Concrete/ sequential	AS Abstract/ sequential	AR Abstract/ random	CR Concrete/ random
WORLD OF REALITY	Concrete world of the physical senses	Abstract world of the intellect based upon concrete world	Abstract world of feeling and emotion	Concrete world of activity and abstract world of intuition
ORDERING ABILITY	Sequential step-by-step linear progression	Sequential and two-dimensional; tree-like	Random non-linear and multi-dimensional	Random three-dimensional patterns
VIEW OF TIME	Discrete units of past, present, future	The present, historical past, and projected future	The moment: time is artificial and restrictive	Now: total of the past, interactive present, and seed for the future
THINKING PROCESS	Instinctive, methodical, deliberate, structured	Intellectual, logical, analytical, rational	Emotional, psychic, perceptive, critical	Intuitive, instinctive, impulsive, independent
VALIDATION PROCESS	Personal proof via the senses; accredited experts	Personal intellectual formulae; conventionally accredited experts	Inner guidance system	Practical demonstration; personal proof; rarely accepting of outside authority

Table 1--Continued

Category	CS Concrete/ sequential	AS Abstract/ sequential	AR Abstract/ random	CR Concrete/ random
FOCUS OF ATTENTION	Material reality; objects of value	Knowledge facts, documenta- tion	Emotional attachments, relation- ships, and memories	Applications, methods, pro- cesses and ideals
CREATIVI- TY	Product, pro- totype, re- finement, duplication	Synthesis, theories, models and matrices	Imagination, the arts, refinement, relation- ships	Intuition, originality, inventive, and futuristic
APPROACH TO CHANGE	Slightly adverse; speculative, hesitant and slow	Notoriously indecisive, cross- checks, de- liberation, fence- straddler	Subject to emotions, level of interest; critical or impression- able	Open and amen- able, often in- stigator, 'rolling stone,' 'trouble shooter'
APPROACH TO LIFE	Realist, patient, con- servative, and per- fection oriented	Realist; serious, determined, logical, and intel- lectual	Idealist; emotional, exuberant, transcendent, and intense	Realist/idealist; telescopic attitud- inal, inquisitive, and independent
ENVIRON- MENTAL PRE- FERENCE	Ordered, practical quiet, stable	Mentally stimulating, ordered and quiet, non- authoritative	Emotional and physical freedom; rich; active and colorful	Stimulus-rich, competitive, free from restriction, amenable
USE OF LANGUAGE	Literal meaning and labels; succinct, logical	Polysyllabic words, pre- cise, rational; highly verbal	Metaphoric, uses gestures and body language; colorful	Informative, likely, colorful; 'words do not convey true meaning'

Table 1--Continued

Category	CS Concrete/ sequential	AS Abstract/ sequential	AR Abstract/ random	CR Concrete/ random
PRIMARY EVALU- ATIVE WORD(S)	Good	Excellent	Super, fantastic, out-of- sight, dynamite	Superior, great"

Note: From An Adult's Guide to Style (p. 39) by A. F. Gregorc, 1982, Maynard, MA: Gabriel Systems.

Instrument for Assessing Learning Style

Based upon the concrete/sequential (CS), abstract/sequential (AS), abstract/random (AR), and concrete/random (CR) learning styles, Gregorc (1982b) designed the Gregorc Style Delineator (GSD) which surveys the strength of each learning style channel. This study used the GSD, a self-analysis instrument by which adults can identify their learning style.

Research Related to Productivity Preference

Beginning in the late 1960s, Dunn (cited in Dunn et al., 1979) worked in projects to facilitate learning for students who had difficulties in traditional teaching situations. She inferred that some youngsters learned under selected teaching methods but failed to show success in others. From this grew investigations into how children and adults learn. Dunn et al. (1979) found in their review of literature that learners are affected by four types of

stimuli producing 20 different elements of productivity or learning preference.

1. Environmental stimuli: The first type of stimuli is from the learner's immediate environment. Sound affects learning. Some learners block out sound and others cannot. Likewise there are some people who cannot work effectively in silence, while others require silence. Light is another environmental factor. Light sensitivity varies from individual to individual. Those who prefer subdued light often grow tense when lighting is too bright. Others who prefer bright light are energized by it and become apathetic and weary without it. Individuals also react to the environmental element of temperature differently. Preferences range on a continuum from cold to hot. Tenseness, weariness, and general discomfort may occur when room temperature and personal preference do not match. Environmental design affects learning. Some learners prefer a straight chair in a row while others seek a comfortable chair, a lounge, or a spot on the floor, if given the opportunity. Again, formal design is comfortable for some learners and constraining to others (Dunn et al., 1979).

2. Emotionality: Productivity preference includes emotional elements of motivation, persistence, responsibility, and structure. Motivated learners are those who are eager to learn. Others get discouraged easily if tasks seem to be too long or too difficult. Because they are unenthusiastic about learning, individualization may be the key to participation in learning. Persistent learners will work at a task until it is complete. Some learners are responsible and complete a task without supervision, but those with short atten-

tion spans lose interest as soon as difficulty arises; thus, frequent and direct supervision is necessary to keep them on task. Structure is the establishment of rules and procedures for accomplishing a task. Some learners function well with precise structure and others find structure confining and prefer options and personally chosen strategies.

3. Sociological stimuli: There are sociological elements of learning style which fall into this same category. Preferences of learning include a penchant for learning alone, with one other person, with several others, with an authority figure nearby, or a combination of all of these (Dunn et al., 1979).

4. Physical stimuli: There are also physical elements of learning style. The first of these is perceptual preference, or sensory preference for learning stimuli. Learners have a preference for either the visual, auditory, tactile, or kinesthetic mode of learning. Some learners prefer to receive stimuli from a combination of all of these modalities. Physical needs of intake and mobility should also be satisfied for individuals to learn effectively. Some people require breaks which provide an opportunity to get food or drink for replacement of energy; others do not. Likewise, some learners need to move about during the learning process. Not all learners can sit still while learning occurs. Time is also a physical element of learning style. Learners learn best at various times of the day. Some perform well at any time; others have a preference for morning, afternoon, or evening (Dunn et al., 1979).

Instrument for Assessing Productivity Preference

All of these elements of learning style are assessed on the Productivity Environmental Preference Survey (PEPS), a self-assessment instrument for adults which measures different aspects of learning style identified as productivity preferences. This instrument was designed by Dunn et al. (1986). These preferences, when matched to the work environment, can influence productivity. In thinking about various occupational settings and traits of various jobs, one can speculate that certain occupations might be more compatible with certain learning styles or productivity preferences than with others.

Research Related to Personality and Occupation

The independent variable for this study was occupational group. Subjects were selected because of their membership in particular occupational groups within the organization. Under the conditions that learning style is a function of personality style and productivity preference is also a function of personality style, the literature suggests but does not demonstrate a relationship of personality style to occupation. Therefore, it is appropriate to expect to find a relationship between occupation and learning style.

Leary (1957) stated that "persons who work regularly together inevitably develop patterns of interaction which can make for a comfortable and productive job situation or which can lead to pain, anxiety and disorganization" (p. 403). He further said that personality characteristics play a vital role in job satisfaction and productivity.

According to Holland (1966) members of a vocational group have similar personalities and similar histories of personal development. This leads to a cluster of personal attributes which create predispositions or preferences for a particular class of vocations. He postulated that vocational choice is a function of interest and interest is an inventory of personality. Thus, the congruency between personality and work environment contributes to satisfaction, stability, and achievement.

Holland (1973) described both personality and environment with six descriptors: realistic, investigative, artistic, social, enterprising, and conventional. He believed that people of each personality type search for compatible environments and that behavior is determined by the interaction of the two. He stated that "what we have called 'vocational interest' is simply another aspect of personality" (p. 7).

Holland's (1973) theory was supported by a study done by Church and Alie (1986) which showed a relationship between personality characteristics and the principal focus, data, people or things, of organizational positions. Their study demonstrated that personality characteristics vary with job focus. They found that most managers in data-focused jobs preferred sensing and thinking to gather and evaluate information. People who fit the descriptor sensor-thinker were rule-oriented, practical, and guided by traditional logic.

The Myers-Briggs Type Inventory (MBTI) (cited in Myers & McCaulley, 1985) was designed to assess personality type. The purpose of the MBTI was to make Jung's (1923) theory of personality

types useful in everyday life. It has been used as a basis for various types of counseling including career counseling. According to Myers and McCaulley (1985), occupations attract particular personality types and similar occupations have similar type distributions. In their data all reported occupations had individuals from each of the 16 Jungian types. However, each occupation attracted some types more than others.

Myers and McCaulley (1985) recognized that people select occupations for a variety of extrinsic reasons. But, their premise that the MBTI is useful in career counseling is predicated on the assumption that one of the most important motivations for career choice is a desire to find work which is intrinsically satisfying and interesting and that allows for use of preferred functions and attitudes. While acknowledging that there is no such thing as a perfect match, they indicate the theoretical supposition that mismatch is detrimental to productivity. Because it is theoretically less tiring to use preferred processes, it is believed that mismatch causes fatigue. Since preferred processes require less effort for better performance, greater satisfaction comes from performing tasks that call upon those preferences. Myers and McCaulley (1985) asserted that individuals should never be discouraged from entering an occupation because it is not a match. But, they indicated a clear difference between conscious choosing of a difference in fit versus the expectation of fit and subsequent lack of fulfillment of that expectation.

Keirsey and Bates (1984) further elaborated upon Jung's (1923)

theory. They described four primary temperaments being the sensor/perceivers (SP), sensor/judges (SJ), intuitor/thinkers (NT), and intuitor/feelers (NF). For each of these temperaments, they listed occupations that seemed to match best the temperament type. According to these authors, the sensor/perceiver (SP) type is process-oriented rather than product-oriented. The SP prefers action and jobs which pit human force against nature and works well against pressure and responds well to demands of the moment. They choose construction work, detective jobs, bellhopping, rescue jobs, and careers in athletics. The sensor/judge (SJ) prefers jobs which provide the opportunity to be a conservator. People fitting this description are drawn to teaching, preaching, banking, accounting, selling, and rehabilitating. The SJ type is dedicated to established norms and institutions and has a service orientation. Intuitor/thinkers (NT) have a passion for knowing; they are academically-oriented. This type is drawn to occupations that apply scientific principles such as mathematicians, philosophers, scientists, and engineers. The intuitor/feeler (NF) focuses on the abstract and the verbal; selected occupations are frequently in the communication areas. Examples of these would be writers, psychologists, teachers, and advertisers. Those occupations which are altruistic in nature attract the NF.

Myers and McCaulley (1985) list occupations coded in a modified system from the Dictionary of Occupational Titles (1977) according to the empirical attractiveness to the Jungian types. They then report nearly 15 years of collected data which contribute to percent-

ages of each personality type within each occupation. Table 2 shows the percentage of occupational choice made by the four general types in Jung's (1923) theory on the Myers and McCaully (1985) study for seven of the nine occupational categories used in this present study.

Table 2
Occupational Choices of Psychological Types

	Sensor/ thinker (ST)	Sensor/ feeler (SF)	Intuitior/ feeler (NF)	Intuitior/ thinker (NT)
Technician	36.84	19.30	12.28	31.58
Engineer				
Electrical	35.19	16.67	16.67	31.48
Mechanical	48.05	10.39	19.48	22.08
Drafter/designer	20.00	21.82	34.55	23.64
Model maker	N/A	N/A	N/A	N/A
Systems analyst	34.88	11.63	11.63	41.86
Secretary	28.53	27.03	29.13	15.32

Note. The numbers are percentages.

From Manual: A Guide to the Development and Use of the Myers Briggs Type Indicator (pp. 253-260) by I. B. Myers and M. H. McCaulley, 1985, Palo Alto, CA: Consulting Psychologists Press.

Relating Gregorc's (1980a) learning style terms to Jung's (1923) psychological style terms, there is a parallel between the four categories used by both theoreticians. A sensor/thinker shares common characteristics with a concrete/sequential; a sensor/feeler with a concrete/random; an intuitior/feeler is similar to an

abstract/random; and, an intuitor/thinker shares characteristics with an abstract/sequential. Thus, it is appropriate to expect that people with particular learning styles will cluster by occupational group.

Research on the Application of Learning Style Theory to Adults in the Workplace

Dunn et al. (1981) state that students learn differently, student performances in different academic areas are related to how they learn, and students learn more effectively when taught in a manner which is compatible with their preferred method of learning.

Research suggests some of the same results when adult learning style is assessed. In a study of the relationship between teachers' individual time preferences and in-service workshop schedules, Freeley (1984) found that workshop schedules which were matched with individuals' preferred learning times resulted in significantly increased implementation scores. This supported the idea that learners instructed at their preferred time will have increased achievement.

Another study that indicated a usefulness of learning style theory in job training is one which found that learning preference and style assessment information could be used by the adult learner in planning and structuring individual learning experiences. In adult learning situations, the instructor is largely a facilitator whose role is to arrange appropriate opportunities for learning. Rusin (1983) assessed 32 adult learners in an upper division program of nursing using the Productivity Environmental Preference Survey (PEPS). Her study supported the idea that this preference survey could be an important and useful step toward analyzing the conditions

under which an adult is most likely to produce, achieve, create, problem-solve, and learn. The subject pool indicated that they were better able to use time efficiently and, as a result, improve grade achievement.

In a study of the learning styles of exemplary superintendents which used the Gregorc Style Delineator (GSD), Haggard (1984) found that the dominant thinking style of the respondents was the concrete/sequential. However, the respondents with the concrete/random style were measured as slightly more proficient in the decision-making process. Although Haggard did not attempt to prove that the dominant learning style was the most effective in a superintendency, he suggested that the GSD could be used to screen potential administrators as the concrete/sequential learning style was dominant. In other words, the GSD could be used in the selection or training process to identify concrete/sequential candidates; further, those with secondary strength in the concrete/random channel might be identified because of their proficiency in decision making. Haggard further suggested that those whose style was variant could be counseled and more thoroughly screened prior to admission in a graduate program for administrators or prior to being selected to fill an administrative position.

The ability to match personal learning style with the requirements of a job could be provided by learning style assessment of individuals and categorization of occupations by learning style. The present study has shown some correlation between learning style and occupation. "If an organization decides to fill its positions by

matching the characteristics of a person and the requirements of a job, organizational effectiveness should increase as a result of greater personal satisfaction and improved job performance" (Sims, 1983, p. 501). The job context is viewed as a learning environment; either a match of person to position could be facilitated or design changes and training programs could be set up to develop the strengths or preferences needed to perform the job more efficiently.

Summary

This chapter included a review of the literature on learning style and productivity preference from its basis in the study of psychological styles in the 1920s to its current state. As well, the relationships between style and preference and job focus have been explored. The research on those relationships provided justification for the research hypotheses of this study. The information from the literature review further served as a basis for extending learning style theory to include the feasibility of applying learning style theory to the processes of selection, placement, and training. In order to utilize learning style theory in this way it was necessary to answer the question of whether occupational groups could be categorized by learning style and productivity preference and if there would be style and preference differences among groups.

Chapter III describes the research setting, design, instrumentation, and data collection and analysis procedures for this investigation of the relationship between learning style, productivity preference, and occupational group.

CHAPTER III

METHODOLOGY

The relationships between learning style and occupational group, between productivity preference and occupational group, and between learning style and productivity preference were investigated in this study. It could be replicated in dissimilar organizations using other occupational groups. This chapter describes the research setting, the design and instrumentation of the study, the population sampled, the data collection procedures, and the data analysis procedures.

Research Setting

The investigation was conducted in a branch of the administration center of the corporate headquarters of a Fortune 500 company located in southwestern Michigan. The branch facility was in the same community as the corporate headquarters and it housed the support personnel for the research and administrative function of the organization. Its focus was on design and support and practicable, market-ready engineering rather than strategic long-term future corporate planning. There were 415 employees in the facility, 140 of whom participated in the investigation, and each worked in one of the nine occupational categories used in this study.

Because the facility focused on present needs of the company,

there may have been an influence of this perspective on the learning style and the productivity preference of the persons who chose to be in this environment. On the other hand, assignment to this facility was a regular step in the career path of those who were upwardly mobile within the corporate structure; this too could have contributed to learning style bias.

Research Design

The purpose of the investigation was to examine the relationship between occupation and learning style, occupation and productivity preference, and between learning style and productivity preference. Because learning and productivity preference style are part of personality, an ex post facto design was appropriate.

The strength of ex post facto design was in its applicability to research problems in the social sciences where experimental inquiry was not practicable. The three major weaknesses of ex post facto research were the inability to manipulate variables, the absence of randomization, and the risk of faulty interpretation (Kerlinger, 1973).

The investigation was conducted using two instruments, the Gregorc Style Delineator (GSD) and the Productivity Environmental Preference Survey (PEPS). The GSD measured four variables which were learning style channel descriptors; they were concrete/sequential (CS), abstract/sequential (AS), abstract/random (AR), and concrete/random (CR). Strength or weakness in each of these variables categorized the subjects to be assessed by learning style.

The PEPS assessed "patterns through which the highest levels of productivity occur" (Price et al., 1982, p. 2). Degree of preference was measured on 20 productivity preference variables. The variables were categorized by stimuli and they were as follows:

Environmental preferences

1. Sound
2. Light
3. Temperature
4. Formal design

Emotionality

5. Motivated/unmotivated
6. Persistent
7. Responsible
8. Structure

Sociological needs

9. Learning alone/peer oriented
10. Authority oriented
11. Learn in several ways

Physical needs

12. Auditory preferences
13. Visual preferences
14. Tactile preferences
15. Kinesthetic preferences
16. Requires intake (food)
17. Evening/morning
18. Late morning

19. Afternoon

20. Mobility

Tests of the hypotheses were applied to the results of both the Gregorc Style Delineator (GSD) and the Productivity Environmental Preference Survey (PEPS) to determine if occupational groups cluster by learning style and/or productivity preference and if common learning patterns exist within groups.

The Population and Sample

This study was an investigation of members of nine occupational groups working in a corporate support facility near the corporate headquarters. Occupational groups were selected both for their similarities and for their discreteness. Employees in the setting whose job titles were selected for study were asked to volunteer to be assessed for purposes of assisting in the investigation. The employer did not deem it appropriate to require personnel to participate in the study; therefore, volunteers were used because of their availability.

The facility employs 415 people working in the nine occupational categories used for this research; 140 subjects participated. Results of the research are reported for only seven occupational groups because the cell sizes in two groups, accountants and clerks, were too small to be included, 4 and 2, respectively. The other group sizes were: technicians, 31; mechanical engineers, 29; drafters/designers, 24; model makers, 14; systems analysts, 15; electrical engineers, 12; and secretaries, 9.

The fact that subjects volunteered to participate in the study decreased the generalizability to the population at large (Hoaglin, Light, McPeck, Mosteller, & Stoto, 1982). However, an attempt was made to compensate for this weakness by analyzing the data according to age, educational level, and gender. For this purpose the total sample of 140 subjects was used. A factor within the stratified sample was self-selection into comparison groups. The problem with this process was that those who chose to participate may have had characteristics which make them different from those who did not choose to participate. Another factor to consider was the situation that the subjects within the occupational groups may have possessed traits or characteristics that were integral to the variables of the research as well as traits or characteristics that were extraneous to the research problem (Kerlinger, 1973). Because this was a sociological study, it was not possible to isolate those traits related to learning style and preference; thus, other traits may have influenced the results of the assessment.

Each occupation assessed had a specific job description within the organization. As reported in the definitions section of Chapter I, these job descriptions are compatible to those in the Dictionary of Occupational Titles (DOT) (1977).

1. Technician: Conducts general instrumentation and testing programs, under the general supervision of an engineer, supervisor or manager, to determine and report product performance and acceptance.
2. Engineer: Performs engineering development, design and/or testing on assigned components, features and systems within the estab-

lished objectives of time, cost, performance, and other related factors.

3. Drafters/designers: Creates original designs, involved layouts, and complex drawings that are dimensionally accurate and easy to interpret.

4. Model maker: Specializes in any one area of the trade, namely machine, sheet metal, wood, and plastics or assembly exhibits complete proficiency in the production of quality parts and assemblies through the use of machinery, equipment, and materials found in model work.

5. Systems analyst: Under general supervision; develops, designs, implements, and maintains information systems in support of the functional area(s) of specific projects as assigned.

6. Secretary: Performs secretarial duties and otherwise relieves officials of clerical work and minor administrative and business detail.

Instrumentation

For this study it was necessary to identify the learning style of subjects within particular occupational groups; the Gregorc (1980b) Style Delineator (GSD) was used for this purpose. Additionally, subjects were given the Price et al. (1982) Productivity Environmental Preference Survey (PEPS) which showed patterns of learning preference. The following sections describe the variables measured and the instruments used for data collection.

Learning Style Variables

The dependent variables, as measured by the Gregorc Style Delin-eator (GSD) instrument, were learning style channels. Gregorc (1982a) defined style as the outward appearance of an individual's mediation abilities. He theorized that the human mind has channels through which it most productively receives and expresses informa-tion; the power, capacity, and dexterity to use these channels are called mediation abilities. The GSD was designed to identify two types of mediation ability, perception and ordering.

Perceptual abilities were identified as abstract and concrete. Abstractness allows one to deal with ideas and concepts and to con-ceive and visualize data through reason, emotional and intuitive processing. Concreteness requires perception of data through the senses of sight, touch, sound, smell, and taste.

The ordering abilities were sequence and randomness. Sequence disposes the mind to order data in a step-by-step manner and link it together categorically or in some other ordered arrangement. Sequen-tial learners are precise, logical, and systematic. Randomness is just the opposite. Data are recorded in the mind and retrieved at any time; intuitive leaps are characteristic of randoms. This quali-ty of randomness provides for multifaceted, unconventional proces-sing.

The coupling of perception and ordering provides the four channels of style of the GSD. They are: concrete/sequential (CS), abstract/sequential (AS), abstract/random (AR), and concrete/random (CR).

On each of the four channels the respondents scored in a range of 10 to 40. The higher the score, the greater the preference for that particular processing channel. Gregorc (1984a) conducted reliability studies which showed correlation coefficients for each of the four channels greater than .83. Validity studies were also conducted and the results were found to be satisfactory, all correlations were significant at the $p < .001$ level.

Productivity Preference Variables

The Productivity Environmental Preference Survey (PEPS) was used in this study to analyze the conditions in which the subjects were "most likely to produce, achieve, create, solve problems, make decisions, or learn" (Price et al., 1982, p. 1). It did not measure psychological underpinnings of productivity; it was intended to prescribe how a person prefers to produce rather than why. The PEPS was a 100-item questionnaire which was answered on a 5-point Likert scale; strongly agree was a 5 and strongly disagree was a 1. The survey was completed in less than 30 minutes. For each subject an individual profile was given which showed the subject to be in a strong, weak, or normal range for each of the 20 assessed variables.

Analysis of each person's profile data gathered from the PEPS identified those elements that were critical to his/her productivity preference. For each individual, a computerized profile was prepared; this included a diagnosis of each person's productivity preferences. The profile contained individual identification data, group identification, raw score and standard score, and a graph of the

relative location of the standard score in each of the 20 areas. The standard score scale on each of the 20 variables ranged from 20 to 80 with a mean of 50 and a standard deviation of 10.

The PEPS is a normed instrument. Individuals having a standard score of 60 or more on any one variable strongly prefer that area as a factor when they study or work. Individuals having a standard score of 40 or less on a variable do not prefer that factor when they study or work. Individuals having scores that fall between 40 and 60 have no strong preference with respect to how much that area is important to them.

According to Price (1986), Hoyt reliabilities for the 20 variables assessed on the PEPS are greater than .67 except in three categories. Authority figures (.51) and tactile (.59) are less than .67. The category several ways (.16) is difficult to measure as it combines several different areas of the sociological preferences. Validity was assessed by an intercorrelation coefficient (Price et al., 1982, p. 22).

Pilot Test

In the summer of 1985 the writer conducted a pilot test of the PEPS, at the same Fortune 500 corporation, which served as the impetus for the topic of the present research. The respondents were grouped according to their work relationship with the corporation, into four groups: instructors, builder territory managers, dealer territory managers, and technicians. Groups were profiled according to those group members who were more than one standard deviation from the

mean; in other words, summaries of those group members with scores below 40 and those above 60 on each preference variable were given. This enabled the researcher to quickly recognize commonalities within the various groups.

The Wilks lambda criterion, was used to test the null hypothesis that there were no differences between groups. This statistical procedure included analysis of all 20 variables. This was followed by a discriminant analysis procedure. At Step 1 it identified the one variable which most discriminated among the four groups. When the variance associated with that variable was removed, it then proceeded to the next step and identified which variable next most discriminated and it continued with these step-by-step analyses until it reached a point at which none of the variables significantly discriminated between groups. For this particular analysis there were 14 of the 20 variables that significantly discriminated between groups. The variables, in the order in which they entered the discriminant equation, were: tactile, evening/morning, temperature, mobility, sound, learning alone/peer-oriented, learn in several ways, intake, authority-oriented, design, responsible, persistent, visual, and structure.

As shown in Table 3, pair-wise comparisons were made among groups. The correlation coefficients show statistical differences between groups.

Generalizations

The discriminant analysis showed that the instructors and the

Table 3
Results of Between-Group Pair-Wise Comparisons
of Productivity Preferences

^a Group	1-2	1-3	1-4	2-3	2-4	3-4
Variable						
Tactile			.0405		.0001	
Evening/morning			.0041		.000	
Temperature		.0374	.0009		.0000	
Mobility		.0010	.0016	.0019	.0000	.0084
Sound		.0009	.0021	.0005	.0000	.0135
Alone/peer		.0017	.0003	.0012	.0000	.0144
Several ways		.0011	.0007	.0014	.0000	.0021
Intake		.0012	.0003	.0029	.0000	.0043
Authority		.0022	.0001	.0055	.0000	.0048
Design		.0040	.0001	.0066	.0000	.0077
Responsible		.0074	.0000	.0109	.0000	.0057
Persistent		.0067	.0000	.0141	.0000	.0100
Visual		.0115	.0000	.0232	.0000	.0085
Structure		.0132	.0000	.0236	.0000	.0052

Note. Comparisons between Groups 1-2, 1-4 and 2-4 provide the most important statistics; the sample size of Group 3 was too small to be used for comparison. The blanks indicate no significant difference. All comparisons were tested at the $p < .05$ level.

^a

Group 1 = Instructors. Group 2 = Builder territory managers.
Group 3 = Dealer territory managers. Group 4 = Technicians.

builder territory managers were not significantly different statistically from each other on any of the 14 dependent variables specified.

Dealer territory managers were shown to be different from all groups but they were too small a group from which to generalize. The analysis indicated that there were statistically significant differences between instructors and technicians and between builder territory managers and technicians on the 14 specified variables.

Because of the cell size of Group 3, it was omitted from further analysis. Instructors and builder territory managers were generally contrasted to technicians, with whom they showed statistically significant variance on the 14 productivity preference variables. Each variable was distinguished by the group differences:

1. Tactile: Technicians showed a very strong preference for tactile learning.
2. Evening/morning: Instructors and territory managers had strong morning preferences, while technicians showed an evening preference.
3. Temperature: Instructors and territory managers both showed preference for cooler temperatures in the productivity environment.
4. Mobility: Technicians showed a high need for mobility.
5. Sound: Technicians preferred to have sound present in the work environment, whereas instructors and territory managers preferred quiet.
6. Alone/peer oriented: Technicians preferred to work alone rather than with peers.
7. Several ways: In this area, there was no predominant mode shown although there was significant variance between groups.

8. Intake: Technicians were strong in requiring intake, having a need for food or drink, while the other groups were not.

9. Authority figures present: Instructors and territory managers showed no particular strength in this area, but presence of authority figures was an important preference to technicians.

10. Design: This preference refers to the physical setting of the work environment, the layout of the room. Preference for formal physical design was higher among territory managers than among technicians.

11. Responsible: Technicians showed low preference for responsibility; this is not true for instructors or territory managers.

12. Persistent: Technicians stood out as being high in persistence.

13. Visual: Not one individual among the technicians showed a preference in visual learning, while it was present in individuals in the other groups.

14. Structure: Although there was variance between groups, all groups showed low need for structure.

These results of the analyses of the variables suggested that differences among the four occupational groups tested did occur and could be measured on the PEPS.

Data Collection Procedures

Survey responses were collected from members of various occupational groups in one branch of a corporation. Permission was obtained from the Human Resources Department of the Fortune 500 Company

as well as the Western Michigan University Human Subjects Institutional Review Board to administer the assessment instruments. Both the Gregorc Style Delineator (GSD) and the Productivity Environmental Preference Survey (PEPS) were shown to the corporate officials so that management was completely aware of the process and the intended product of the research. Occupational groups for assessment were selected by the researcher in concert with corporation representatives. Members were asked to participate in the assessment. The two surveys were given at a specified time to all group members who volunteered to be assessed.

Prior to assessment, the focus of the research was explained to the subjects and it was made clear that the results were not to be used in any way to evaluate job performance. Participants were assured that (a) participation was approved by the corporation, (b) group results only would be shared with the education director for purposes of assessing staff development programs, and (c) any individual who requested his/her own individual results or general results of the study would be provided with them.

Several testing periods were set up on a specified day. Participants were able to select the time most convenient for them. The surveys were administered in a large conference room with the administrator following a written protocol of testing procedures. The Gregorc Style Delineator (GSD) was distributed first, and the subjects had 4 minutes to complete it. Then the Productivity Environmental Preference Survey (PEPS) was distributed with a 30-minute allowance for completion.

The researcher tabulated the results of the Gregorc Style Delin-eator (GSD) according to standard directions. The Productivity Environmental Preference Surveys (PEPS) were sent to Price Systems, Inc. for tabulation and preparation of individual and group profiles.

Statistical Procedures

Based upon the Review of Related Literature, the first research hypothesis was: There will be a direct relationship between occupa-tional group and learning style.

Null Hypothesis: There will be no difference in the group mean scores on the scale of style by occupational group. The null hypoth-esis was tested using a one-way analysis of variance at the .05 level of significance against the alternate hypothesis that there were differences in the group mean scores on the scale of style.

For each occupational group, as well as for the total number of respondents, mean scores for concrete/sequential (CS), abstract/sequential (AS), abstract/random (AR), and concrete/random (CR) were computed. Mean scores were also computed for gender groups, age groups, and educational groups. Analysis of variance (ANOVA) was used to measure independent means; a repeated measures ANOVA was used to identify the predominant style for each group. Post hoc testing using both the Tukey and the Bonferroni t methods was completed to determine where group differences occurred.

The second research hypothesis was: There will be a direct relationship between occupational group and productivity preference.

Null Hypothesis: There will be no differences in the group mean scores on the productivity preference variables. This was also tested at the .05 level of significance. The alternative hypothesis was that there would be differences in the mean scores on the preference variables. The Wilks lambda criterion was used to test the null hypothesis that there were no differences between groups. The specific differences between groups were analyzed using the discriminant analysis procedure.

The third research hypothesis was: There will be a direct relationship between learning style and productivity preference.

Null Hypothesis: There will be no relationship between learning style and productivity preference. The alternative hypothesis was that there would be a relationship between learning style and productivity preference.

A Pearson correlation of the scores from the GSD and the PEPS was completed. The biserial correlation coefficient was used as the test statistic with the alpha level set at .05. Canonical correlation coefficients were then computed to determine the maximum predicted relationship between constructs.

Summary

This research examined the relationship between occupational group and learning style, between occupational group and productivity preference, and between learning style and productivity preference. The investigation involved 140 persons and compared seven occupational groups.

Assessment of the subjects was completed using the Gregorc Style Delineator (GSD) to measure learning style and the Productivity Environmental Preference Survey (PEPS) to measure preference. The GSD yielded scores in four learning style channels: concrete/sequential (CS), abstract/sequential (AS), abstract/random (AR), and concrete/random (CR). The PEPS provided an individual and group profile showing strength or weakness in 20 productivity preference variables.

The data obtained from the GSD were analyzed by means of a one-way ANOVA followed by post hoc comparisons. A multivariate analysis of variance (MANOVA) and a discriminant analysis were completed for the PEPS. The relationship between learning style and productivity preference was computed using the Pearson correlation coefficient. An alpha level of .05 was used to determine differences in learning style and productivity preference between groups and to determine the relationship between the two. Chapter IV is a presentation of the results of the statistical analysis.

CHAPTER IV

RESEARCH FINDINGS

This chapter presents information pertinent to sample respondents and the results of hypothesis testing. The principal hypotheses were tested using the one-way analysis of variance (ANOVA). Hypotheses related to post hoc analyses were tested using the Bonferroni t, the Tukey, and the Wilks lambda methods. All hypotheses were tested at the .05 level of significance.

Tests of the Hypotheses

Relationship of Occupation to Learning Style

The first research question dealt with the issue of whether there was a relationship between occupational group and learning style. The null hypothesis tested was that of no differences in the group mean scores on the Gregorc Style Delineator (GSD) scale of style. Two additional analyses were completed to determine where the statistically significant differences occurred.

The first analysis completed was an analysis of variance (ANOVA) of the four channel scores of learning style with occupation. There were statistically significant differences found among five of the seven groups. The null hypothesis was rejected and the alternate hypothesis accepted; there were statistically significant differences in the group mean scores on the GSD scale of style. Table 4 shows

the mean and the standard deviation score on each channel for each occupational group tested.

Table 4
Mean and Standard Deviation Scores by Channel by
Occupation on the Gregorc Style Delineator

Occupation	n		Channel			
			CS	AS	AR	CR
Technicians	31	M	26.84	26.13	22.16	24.87
		SD	5.84	5.84	6.63	4.83
Mechanical engineers	29	M	31.55	26.34	18.76	23.31
		SD	4.24	2.84	4.10	4.68
Drafters/designers	24	M	30.50	23.87	20.96	24.25
		SD	5.22	2.72	4.89	6.14
Model makers	14	M	31.50	25.79	20.36	22.36
		SD	3.55	3.17	3.32	2.59
Systems analysts	15	M	30.60	27.47	17.67	24.27
		SD	4.15	3.58	2.87	5.12
Electrical engineers	12	M	29.75	27.25	19.25	23.75
		SD	3.33	3.17	4.79	4.07
Secretaries	9	M	32.22	22.67	24.89	20.11
		SD	4.15	2.83	4.11	4.34

Note. CS = concrete/sequential. AS = abstract/sequential.
AR = abstract/random. CR = concrete/random.

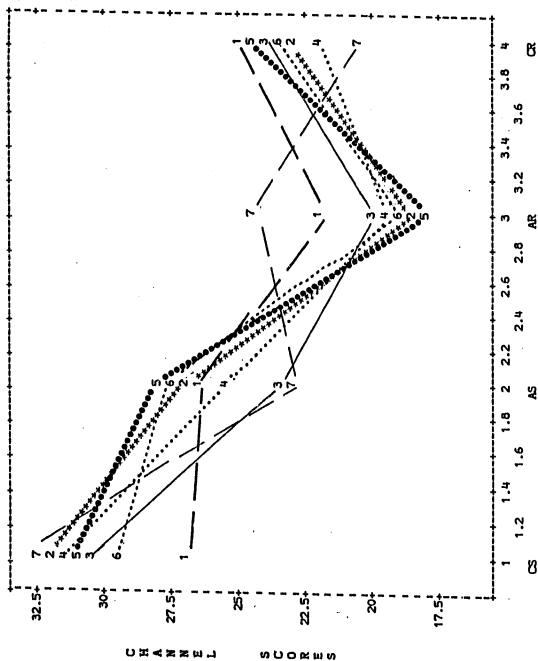


Figure 2. Plot of Mean Scores by Occupation.

A profile of the mean scores in each channel for each occupation shows graphically the difference between groups. This is shown in Figure 2.

The ANOVA dictated rejection of the null hypothesis at the .05 level. In five of seven groups tested, there were significant differences within the channels of learning style between the groups. Again, the alternate hypothesis that there were statistically significant differences in the group mean scores on the GSD scale of scores was accepted. Differences were found in the occupational groups of technicians, mechanical engineers, model makers, systems analysts, and electrical engineers.

A post hoc analysis using Tukey's Studentized Range (HSD) Test was completed to determine where the variance occurred. There was a statistically significant variance within each of the occupations in one, two, or three of the four channels of learning style. In the concrete/sequential (CS) channel, technicians differed from mechanical engineers, model makers, and secretaries. The abstract/sequential (AS) channel accounted for variance between mechanical engineers and secretaries, between drafters/designers and systems analysts and electrical engineers, between systems analysts and secretaries, and between electrical engineers and secretaries. The abstract/random (AR) channel accounted for differences between mechanical engineers and secretaries and between systems analysts and secretaries.

A second post hoc test completed was the Bonferroni (Dunn) t Test to determine how the difference between groups was accounted for. This analysis was completed because the Bonferroni t Test is expected

to be more sensitive than the Tukey. As well, it was a way of cross-validating the results on the Tukey.

The Bonferroni t Test for difference between means was used to analyze the variance by channel of learning style; the channels are concrete/sequential (CS), abstract/sequential (AS), abstract/random (AR), and concrete/random (CR). The data in Table 5 show that technicians were found to be different from the total group; the significant mean score differences were in the CS and AS channels. Mechanical engineers were different from the total group; the difference was accounted for by a low mean in AR and a high mean in CS. Drafters/designers were not significantly different from the total group. Model makers varied from the total group; the difference was in a higher mean for CS and similar means in AS and CR and AR and CR. The variance within the systems analysts group was found in the low mean of the AR channel and a high mean in CS. Electrical engineers varied from the overall with differences appearing due to low means of AR and CR and higher means of CS, AS, and CR. Secretaries did not show statistically significant difference from the total group. The two occupations, mechanical engineers and systems analysts, showed the same pattern of means.

In an attempt to control for the extraneous variables of gender, age, and educational level, three additional hypotheses were tested. The first hypothesis tested whether there were differences in learning style which were accounted for by gender. A one-way analysis of variance (ANOVA) was completed. The null hypothesis that there were no differences in mean scores of men and women in the

Table 5
Bonferroni t Test Comparison of Mean
Scores by Channel by Occupation

	CS	AS	AR	CR
Technicians ^a	26.84 A	26.13 B	22.16 A B	24.87 A B
Mechanical engineers ^a	31.55 A	26.34 A B	18.76 C	23.31 A B
Drafters/designers	30.50 A	23.87 A B	20.96 B	24.25 A B
Model makers ^a	31.50 A	25.79 A B	20.36 C	22.36 B C
Systems analysts ^a	30.60 A	27.47 A B	17.67 C	24.27 A B
Electrical engineers ^a	29.75 A	27.25 A B	19.25 C	23.75 A B C
Secretaries	32.22 A	22.67 A B	24.89 A B	20.11 B

Note. The letters A, B, & C represent similarity of mean scores; those mean scores in one row which share a letter are not significantly different from each other.

^a

The group is statistically significantly different from the total group.

learning style channels was rejected because there were differences found in the abstract/sequential (AS), abstract/random (AR), and con-

crete/random (CR) channels. However, only 22 of 140 subjects were females, so the sample size and proportionate distribution could have skewed the results.

Table 6 shows the relationship of gender to channel of learning style. In the concrete/sequential (CS) channel, the dominant channel for all subjects, there was no significant difference between genders. A lower mean for females in the abstract/sequential (AS) channel accounted for the difference in that channel. A higher mean for females in the abstract/random (AR) channel accounted for the difference in that channel. Females were significantly lower in mean score than males in the concrete/random (CR) channel. Disproportionate distribution of males to females may have accounted for this variance, however.

Table 6
Relationship of Gender to Learning Style Channel

	PR > F	Overall mean (N = 140)	Females (n = 22)	Males (n = 118)
Concrete/sequential	.0739	30.18	31.91	29.86
Abstract/sequential	.0044	25.73	23.86	26.08
Abstract/random	.0131	20.46	22.95	20.00
Concrete/random	.0173	23.54	21.23	23.97

Another variable tested was whether there were differences in learning style which could be accounted for by age. The ages of

subjects ranged from 22 to 64 years of age. The null hypothesis that there were no differences in learning style channel scores by age was supported. A regression analysis of channel scores with age yielded no significant differences accounted for by age when all occupations were combined.

The last variable tested was educational level. Subjects ranged from having completed high school to having completed 1 year or more beyond a bachelor's degree. The null hypothesis that there were no differences in learning style channel mean scores accounted for by educational level was supported. An ANOVA of the learning style channel score with education by occupation and channel was completed. No statistically significant differences were found.

Gender, age, and educational level appear to account for little, if any, of the variance in learning style channel scores. Thus, the statistically significant differences found between occupations appear to be of more practical significance than if the extraneous variables of gender, age, and education had not been tested.

Relationship of Occupation to Productivity Preference

The second research question was whether there was a relationship between occupational group and productivity preference. The null hypothesis, tested against the Wilks lambda criterion, was that there were no differences in the group mean scores on the scale of productivity preference using the Productivity Environmental Preference Survey (PEPS).

On the follow-up discriminant analysis, there were 7 variables

that significantly entered the discriminant equation in the following order: tactile; kinesthetic; light; structure; learning alone/peer-oriented; auditory; and, noise level. Table 7 shows the mean scores for the occupational groups on each of the 7 variables.

Table 7
Group Mean Scores of Variables Appearing
in the Discriminant Analysis

	Group Means						
Group Number =	1	2	3	4	5	6	7
n =	31	29	24	14	15	12	9
Variable Name							
Tactile	15.5	15.5	15.2	15.0	14.3	15.4	12.1
Kinesthetic	16.7	15.3	16.3	16.4	15.4	15.8	17.6
Light	22.1	21.5	17.9	21.1	21.7	20.5	21.7
Structure	8.9	7.5	8.3	7.1	8.1	6.8	9.5
Learning alone/ peer-oriented	23.5	21.6	21.5	20.1	23.1	21.4	17.1
Auditory	11.7	10.9	11.7	10.1	11.3	9.3	12.4
Noise level	15.5	15.2	16.3	17.0	16.3	16.3	19.4

Note. Group 1 = technicians. Group 2 = mechanical engineers. Group 3 = drafters/designers. Group 4 = model makers. Group 5 = systems analysts. Group 6 = electrical engineers. Group 7 = secretaries.

Technicians and systems analysts and technicians and secretaries were significantly different from each other and mechanical

engineers were significantly different from systems analysts and secretaries and mechanical engineers, drafters/designers, model makers, systems analysts, and electrical engineers were all significantly different from secretaries.

The next variable to enter the discriminant equation was kinesthetic. On this variable technicians were significantly different from mechanical engineers and secretaries. Mechanical engineers, drafters/designers, model makers, systems analysts, and electrical engineers were significantly different from secretaries but not significantly different from each other.

Light was the next variable to enter the discriminant equation. On this variable technicians were significantly different from drafters/designers and secretaries. Mechanical engineers were significantly different from drafters/designers and secretaries. Drafters/designers were significantly different from systems analysts and secretaries and model makers, systems analysts, and electrical engineers were significantly different from secretaries.

On the structure variable technicians were significantly different from mechanical engineers, drafters/designers, electrical engineers, and secretaries. Mechanical engineers were significantly different from drafters/designers and secretaries. Drafters/designers were significantly different from systems analysts and secretaries and model makers, systems analysts, and electrical engineers were significantly different from secretaries.

The next variable to enter the discriminant equation was learning alone-peer oriented. On this variable technicians were

significantly different from mechanical engineers, drafters/designers, model makers, electrical engineers, and secretaries. Mechanical engineers were significantly different from drafters/designers and secretaries. Drafters/designers were significantly different from systems analysts and secretaries. Model makers, systems analysts, and electrical engineers were significantly different from secretaries.

On the auditory variable technicians were significantly different from mechanical engineers, drafters/designers, model makers, electrical engineers, and secretaries. Mechanical eningeers were significantly different from drafters/designers and secretaries. Drafters/designers were significantly different from systems analysts, electrical engineers, and secretaries. Model makers, systems analysts, and electrical engineers were significantly different from secretaries.

The last variable to enter the discriminant equation was noise level. On this variable, technicians were significantly different from mechanical engineers, drafters/designers, model makers, electrical engineers, and secretaries. Mechanical engineers were significantly different from drafters/designers and secretaries. Drafters/designers were significantly different from electrical engineers and secretaries. Model makers, systems analysts, and electrical engineers were significantly different from secretaries.

The sample size for secretaries was only nine. This may have accounted for some of the variance between that group and others. However, the three largest groups, technicians (31), mechanical

engineers (29), and drafters/designers (24) were different from other groups on every variable.

Relationship of Learning Style and Productivity Preferences

The third and final research question for this study was whether there was a relationship between learning style as defined by Gregorc (1982) and productivity preferences as defined by Dunn et al. (1986). The null hypothesis was that there was no relationship between the Gregorc Style Delineator (GSD) scores and the Productivity Environmental Preference Survey (PEPS) scores.

A Pearson correlation between learning style channels and PEPS scores indicated no correlations greater than .25. Thus, the null hypothesis was supported; there was no relationship shown between learning style variables and productivity preference variables in this study.

However, the canonical correlation analysis showed that there was a maximum possible correlation of .53 between learning style channels and productivity preferences. Table 8 shows the canonical correlation analysis.

The first canonical correlation seemed to be related to noise level and motivation in the productivity preferences and to having low scores in abstract/sequential (AS) and abstract/random (AR) on the learning style assessment. The second canonical correlation appeared to be related to a high score in kinesthetic and an evening preference which is indicated by a negative number as well as high

AR and CR scores. The third canonical correlation appears in a high afternoon preference combined with very high AS and CR scores.

Table 8
Canonical Correlation Analysis for the Gregorc
Learning Style Channels and the Productivity
Environmental Preference Variables

Productivity Preference Variables						
Canonical correlation		Noise level	Motivation	Kines-thetic	Evening/morning	Afternoon
1st	.53	0.6127	0.6831	0.2812	-0.1618	-0.4214
2nd	.47	0.3114	-0.3905	0.8372	-0.5472	-0.4061
3rd	.32	-0.0645	0.3971	0.0641	0.1-62	0.6611
Learning Style Channels						
		AS		AR		CR
1st		-0.5827		-0.8665		0.3675
2nd		-0.3381		0.6962		0.5373
3rd		1.0658		0.6225		0.9393

Summary

The purpose of this study was to determine whether there were learning style and productivity preference differences between the occupational groups measured. For two separate hypotheses tested, the null hypotheses were rejected at the .05 level.

While the variance between groups was different for each measure, differences were apparent on both the Gregorc Style Delineator (GSD) and the Productivity Environmental Preference Survey (PEPS). Table 9 shows a generalization of those group differences that occurred.

Table 9
Summary of Group Variance

Group		Groups Which Show Variance						
1. Technicians	GSD	2		4				7
	PEPS	2	3	4	5	6		7
2. Mechanical engineers	GSD	1						7
	PEPS		3		5			7
3. Drafters/designers	GSD				5	6		
	PEPS			4	5	6		7
4. Model makers	GSD	1						
	PEPS							7
5. System analysts	GSD		3					7
	PEPS							7
6. Electrical engineers	GSD		3					7
	PEPS							7
7. Secretaries	GSD	1	2			5	6	
	PEPS	1	2	3	4	5	6	7

CHAPTER V

DISCUSSION AND IMPLICATIONS

This chapter is a summary of the investigation of the relationship between learning style and occupation, productivity preference and occupation, and between learning style and productivity preference. Conclusions drawn from the results of the investigation are presented. These conclusions are then interpreted into practical implications for use in the work setting.

Summary of Procedures and Results

This study investigated the learning style and productivity preference of subjects employed in seven different occupational categories working in one branch of a Fortune 500 company in southwestern Michigan. Each of the 140 subjects in the study was assessed using the Gregorc Style Delineator (GSD) and the Productivity Environmental Preference Survey (PEPS). The GSD categorized learning style in four different channels: concrete/sequential (CS), abstract/sequential (AS), abstract random (AR), and concrete/random (CR). The PEPS identified productivity preference in 20 different categories. For the GSD, an ANOVA was completed to determine whether there were differences between occupational groups. Then post hoc analysis was completed to determine what those differences were. A multivariate analysis of variances (MANOVA) followed by a discriminant analysis

was completed to determine whether there were differences between occupational groups on the PEPS. A Pearson correlation coefficient and a canonical correlation were computed to determine whether there was a relationship between learning style and productivity preference.

The focus of this study was on three theoretical hypotheses. They were:

1. People in different occupational groups will cluster according to learning style channel strengths on the Gregorc Style Delineator (GSD).

2. People in different occupations will show group variance according to productivity preference on the Productivity Environmental Preference Survey (PEPS).

3. There will be some relationship between learning style and productivity preference as measured by the GSD and the PEPS.

The test of the first hypothesis indicates that there are learning style differences among occupational groups. Technicians show significantly different concrete/sequential (CS) channel mean scores than mechanical engineers, model makers, and secretaries. Mechanical engineers are different from technicians and secretaries; they are higher in CS than technicians and higher in abstract/sequential (AS) and lower in abstract/random (AR) than secretaries. Drafters/designers show variance by a smaller mean score in the abstract/sequential (AS) channel than systems analysts and electrical engineers. Model makers are stronger in CS than technicians. Systems analysts show variant channel mean scores from drafters/designers

and secretaries; they are higher in AS than both but lower in AR than secretaries. Electrical engineers are stronger in AS than drafters/designers and secretaries. Secretaries differ in channel mean scores from technicians, mechanical engineers, systems analysts, and electrical engineers; the secretaries are higher in CS than technicians, lower in AS than both mechanical and electrical engineers and systems analysts, and higher in AR than mechanical engineers and systems analysts.

Three other relationships were tested for purposes of increasing validity by reducing the potential for bias. The first test was to determine whether there were learning style differences accounted for by gender. There are gender differences in three channels of learning style, abstract/sequential (AS), abstract/random (AR), and concrete/random (CR). This sample was small, 22 of 140 were female, and 9 of those 22 were in one occupational category. This was too small a group from which to generalize; however, it appears that gender may be a factor in learning style channel dominance.

Another test for bias was whether there were differences accounted for by age. The range of the 140 subjects was from 22 to 64 years of age. No differences are found to be accounted for by age.

The same is true for educational level. There appear to be no learning style differences accounted for by educational level which ranged from high school completion to one or more years beyond the bachelor's degree.

The test of the second hypothesis again indicates a difference

among occupational groups. This difference is in productivity preference. Of the 20 variables measured, statistically significant variance occurs in the categories of preference labeled tactile, kinesthetic, light, structure, learning alone/peer-oriented, auditory, and noise level. Technicians differ significantly from all other groups. Mechanical engineers differ from drafters/designers, systems analysts, and secretaries. Drafters/designers show differences from model makers, systems analysts, electrical engineers, and secretaries. Model makers, systems analysts, and electrical engineers differ significantly only from secretaries. Secretaries differ from all groups.

The third hypothesis was not supported by the research. There is only very weak (.25) correlation between channels of the Gregorc Style Delineator (GSD) and the variables of the Productivity Environmental Preference Survey (PEPS). Although the canonical correlation shows a potential for moderate (.53) correlation, a clear relationship does not appear in this study.

Interpretation of the Results

This study identifies a relationship between learning style and occupation and between productivity preference and occupation. This relationship has not been shown in previous studies of learning style or productivity preference. Thus, this finding should be of considerable interest in further studies of occupational choices or learning styles or productivity preferences. This study extends the work of Gregorc (1980a) on learning styles and Dunn et al. (1979) on

productivity preferences as well as Holland's (1973) theory that served as a basis for the premises of this research.

Holland (1973) postulated that there was congruence between personality and occupational choice. Gregorc (1985) stated that:

Style consists of outer behavior, characteristics, and mannerisms which are symptomatic of the psyche and of particular mental qualities. Specifically, an individual's outer, visible style characteristics provide clues as to the inner invisible nature and capacity of his psychological and mental makeup. (p. 7)

Thus, he is saying that learning style is a manifestation of personality. If Holland and Gregorc are correct, there should also be a congruence between learning style and occupational choice. This study confirms that there are differences between occupational groups that may be accounted for by learning style variance.

The Productivity Environmental Preference Survey (PEPS) was included as a measure in this study as a way of validating the results of the testing of the first hypothesis and because it was designed with a different focus than the Gregorc Style Delineator (GSD). The GSD assesses style characteristics which are clues to personality. The PEPS provides information about patterns through which the greatest productivity is likely to occur; thus, this instrument is concerned with surface patterns rather than personality. This study identifies occupational group differences in productivity preferences.

The GSD and the PEPS both measure learning style, using the term generically. These measures are designed for two different purposes and seek to identify different traits; however, the general concepts

of each are congruent, if not the same. Thus, a part of this study was to determine if there was a relationship between the two. While there is very little correlation between the GSD and the PEPS, each shows differences between occupational groups. So, the two different measures of various traits of learning style confirm the overall results of the other. That is, there are learning style differences among the occupational groups tested in this study.

This study varies from other related studies because it establishes an empirical link using occupation as the independent variable and a specific component of personality, learning style, as the dependent variable. Previous studies have assessed personality type and then surveyed occupational choice. Myers and McCaulley (1985) have collected data on occupational choice from those whose type has been assessed using the Myers-Briggs Type Inventory (MBTI). Kiersey and Bates (1984) speculate job preferences but no evidence is presented to support the speculation other than logic.

To generalize the findings of this study it would be important to assess persons in a variety of employment settings ranging from large corporations such as the one used in this research to small or independent operations. Extending the number and variety of occupations to be assessed is also important to future research. This study, apparently being the first to show a relationship between learning style and occupation, does provide a basis for studies to confirm the results and increase the generalizability of these results.

Limitations of this study are the similarity of the occupations

selected for this study and the common employment setting for all of the groups participating in this study. More divergent occupational groups than those selected might have shown even greater variance between groups than those studied. For example, had musicians, ministers, research scientists, poets, and morticians been assessed, variance might have been greater than it is between the seven groups used in this study. While the common setting of the groups tested eliminates potential variance because of setting, conversely it may reduce normal variance because of the focus of the particular branch of the organization in which the measurement was taken.

Another limitation of this study is the limited number of female participants which rendered the results of the test of the relationship between gender and learning style inconclusive. Future studies should test for gender differences in general as well as gender differences within occupational groups.

Implications of the Study

The fact that learning style and productivity preference differences appear to be present between occupational groups has some implications for training, selection, placement, and other organizational development activities. The results of learning style analysis could provide the information needed to increase effectiveness of workers through creating matches between worker learning style and occupational requirements or, at least, in providing adaptation skills for employees in unmatched situations and in providing data for training design, selection criteria, placement criteria and strat-

egies, and selection of organizational development activities.

Research in school settings and in occupational settings has shown that productivity and effectiveness can be increased by matching learning style to teaching style or to the demands of the task (Dunn, 1982; Dunn & Dunn, 1987; Freeley, 1984; Rusin, 1983; Sims, 1983).

An understanding of learning styles and an analysis of group learning styles could provide trainers with the information needed to select methods and materials for training. Analysis of learners could provide the trainers with the criteria for effectively individualizing instruction and with group style data for targeting audiences. Matching teaching style, methods, and materials to learning style characteristics should increase the effectiveness of learning and decrease the time it takes to learn.

Further study of the learning style of particular occupational groups should provide information which could increase the effectiveness of employee selection processes, particularly if further research shows that the most productive employees in a group have a common learning style pattern. Should this be confirmed, the selection process theoretically should be made more effective by inclusion of a learning style analysis into the process of selection.

Additionally, if there is a match between task and employee learning style, productivity should increase as a result of better selection. This could occur with new employees. Seasoned employees could be assessed, particularly if productivity is less than expected, and be considered for reassignment based upon learning style

criteria. Thus, learning style data could be used for employee placement purposes.

A relationship between motivating forces and learning styles certainly seems to exist. Management should be able to use style theory practicably in organizational development activities. There are, however, some factors that must be given consideration. Managers should engage in self-analysis in order to understand interactions with others. The first responsibility of good managers is to determine their own style and to assess the behaviors and consequence of those behaviors that result from personal style. Then, and only then, should an assessment of employee styles take place. An understanding of styles provides a framework within which to operate in establishing jobs and rewards which will complement individual styles and ultimately aid in developing human resources. Research on styles and its application is not at all complete. But supervisors of people can begin to apply the theoretical concepts and, by doing so, add the variables of reality to the style theories.

Recommendations For Future Research

The present study demonstrates the usefulness of investigating occupational groups in relationship to learning styles. The need for this type of study has been shown in the literature as a need for refinement of training, selection, placement, and organizational development needs and strategies. Future studies can extend this study's findings; the results should then be useful in designing training methods, determining criteria for selection and placement, and estab-

lishing organizational development activities. The approach used in this study can be used; however, some refinements are recommended.

Sampling

Assessment of total populations or random selection of subjects within occupational groups within employment settings would provide for generalizability of the study. Perhaps with this study as a basis, organizations will be more willing to commit the time of an entire staff to the assessment process.

Diversifying the occupational groups to be assessed could improve the results in two ways. First, variation between groups may be enhanced by this diversification. Secondly, it is important to have sufficient numbers of both males and females in the sample to support or reject the result of this study that there are learning style differences between genders.

The GSD and PEPS Instruments

The Gregorc Style Delineator (GSD) is a more expedient measure than the Productivity Environmental Preference Survey (PEPS). The GSD takes only 4 minutes to complete and it can be scored as quickly as the eight rows of five numbers are added to form four columns of two numbers each, which are then totaled. Immediately the results can be interpreted. The concepts underlying the GSD are more complex than those for the PEPS. However, these can be simplified into stylistic characteristics which are easily listed and are very understandable. Thus, for group use, the GSD is the more

expedient instrument.

The PEPS is very useful for individual assessment; the disadvantage is that it must be scored by a scoring service. For group use, the results are complicated but generalizations result which can be useful in planning for group activities.

Summary

The above suggestions for refinement could improve future studies of the relationship between occupational group and learning style. The results of the present study will need to be considered in future studies and in dissimilar organizations with different occupational groups before the implications can be extended. Whatever the results, this and subsequent studies should provide learning style information critical to the improvement of training, selection, placement, and organizational development activities.

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