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The study used the Oddi Continuing Learning Inventory to measure self-directedness as a personality construct and the refined Wagner Preference Inventory to measure hemisphericity. To round out the test packet, a demographic questionnaire was included. There were 390 participants in the study. The study was designed to be a technical variation of Torrance and Mourad's correlational study (1978) using different instruments, a more diverse population and more comprehensive data analysis.

The study found positive correlation between high degrees of self-directedness and left hemisphericity. It also found correlations between high scores in self-directedness and age, and left hemisphericity and age. It is concluded that this study supports the notion that adult learning theory should be considered separately from childhood learning theory.

The results of this study conflict with the findings of Torrance and Mourad (1978) and it is recommended that replications of this study be conducted to verify the direction of the link between self-directedness and hemisphere dominance.
SELF-DIRECTEDNESS AND HEMISPHERICITY
OVER THE ADULT LIFE SPAN

by
Constance Christensen Blackwood

A thesis submitted in partial fulfillment
of the requirements for the degree
of
Doctor of Education

MONTANA STATE UNIVERSITY
Bozeman, Montana
July 1988
APPROVAL

of a thesis submitted by

Constance Christensen Blackwood

This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citation, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

Date Chairperson, Graduate Committee

Approved for the Major Department

Date Head, Major Department

Approved for the College of Graduate Studies

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Date  7/19/83
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ABSTRACT

The purpose of the study was to add empirical evidence to the argument that adult learning theory has a definite and specific place on the general learning theory continuum. To do this the study sought to clarify the role of self-directedness as a personality construct in adult education. In addition, it sought to solidify the role of hemisphericity as an important concept of adult learning.

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The results of this study conflict with the findings of Torrance and Mourad (1978) and it is recommended that replications of this study be conducted to verify the direction of the link between self-directedness and hemisphere dominance.
CHAPTER 1

INTRODUCTION

An ongoing debate in the adult education literature has to do with separating adult learning theory from childhood learning theory. Some theorists (McKenzie, 1977; Knowles, 1970) believe that adults are intrinsically different from children, and therefore the underlying assumptions that determine how they learn must also be different. On the other side of the argument, there are those (Houle, 1972; Elias, 1979) who believe that adults are intrinsically the same as children and that there should be only one theory of learning irrespective of age.

One response to this learning theory debate has been that if adults do learn differently than children, they should therefore be taught differently than children. As a result, entire curricula are being designed around the specific learning needs and learning styles of adults.

This debate regarding adult learning as well as the response regarding the teaching of adults continues with little resolution. The lack of resolve exists because there has been little in the way of empirical research to
either confirm or deny the underlying assumptions upon which adult learning theory is built. Knowles (1970) proffered four assumptions about learners. The assumptions are that as a person matures, 1) self-concept moves from one of dependency to one of self-directedness, 2) accumulated experiences become a useful learning reservoir, 3) readiness to learn becomes dependent on social roles, and 4) learning shifts from being subject-centered to being performance-centered. It is Knowles' first assumption that forms a fundamental basis for the current research.

Self-directedness as perceived by Knowles (1973), is definitive of adulthood. Knowles suggested that the first dimension of the maturing process is that the self-concept moves from dependency to autonomy (or self-directedness). Later, referring to adults with this ideal of autonomy, Knowles (1980) stated that "one of the central quests of their lives is for increasing self-direction" (p. 30). A manifestation of this quest is the influx of adults who are pursuing all types of continuing education. In 1981 there were 25 million adults participating in informal and formal education (Queeney, 1988).

In order to better understand this growing adult learning population, attempts have been made to theoretically link self-directedness to both adult
development (Caffarella & O'Donnell, 1987) and cognitive structure (Torrance & Mourad, 1978). By using chronological age as a generic approximation of maturation level and brain hemisphere dominance (hemisphericity) as a measure of cognitive learning style, it should be possible to gain empirical support for this link.

Left brain/right brain theory, or hemisphericity, has been accepted for some time in the adult education literature as a valid theory of information processing and cognitive learning style. Torrance (1977), for example, developed an instrument to measure hemispheric cognition. Keefe (1979) discussed several different instruments used to measure many different kinds of cognitive learning style including hemisphericity. Cross (1981) mentioned the importance of understanding how cognitive learning patterns change over the adult life span. Cornett (1983) discussed student learning styles at all age levels and included a listing of hemisphericity tests in the cognitive domain.

Although an occasional article by an expert in another field will surface in an education journal (e.g. Levy, 1983), critical review of hemisphericity by adult educators has yet to be conducted. In particular, few attempts have been made to determine whether general information processing tasks assumed by each hemisphere are related to
other concepts of importance in the study of adult education. To the extent that hemisphericity is a relevant concept, it is important for adult educators to have a useful working knowledge of how the concept fits into the adult education paradigm. It is important to keep a concept as significant and potentially useful as hemisphericity in the proper perspective. The role that hemisphericity plays in adult education depends on how well we understand it. The purpose of the current research is to explore the relationship between self-directedness and the specific educational concept of brain hemisphericity. In this study, hemisphericity is considered a cognitive learning style, and self-directedness is viewed as a personality-based affective measure of learning style. This contrasts with the biologically-based cognitive learning style inherent in hemisphericity. This study then evaluates the relationship between these two methods of classifying learning style.

It has been proposed that both the individual's degree of self-directedness (Knowles, 1980) and hemisphere asymmetry (Springer & Deutsch, 1985) may change over the adult life span. These age-specific differences in hemisphericity and self-directedness were also examined.
Establishing a Conceptual Base

One way of conceptualizing how we learn is to consider learning style. For adults, learning style varies not only among individuals but also within each individual. Although part of an individual learner's style is experientially based, an individual selects his/her choice of learning style to fit the situation. That is, variation in use of learning styles in adults is primarily a contextual and situation specific response (Vacc & Vacc, 1973). Despite this variation, broad similarities between individuals exist in that they share a common repertoire of preferred learning styles from which to draw. The development of this repertoire occurs primarily in childhood, but continues to develop throughout adulthood. This study identifies and explores two different types of learning style, cognitive style and affective style. Cognitive style is the way in which we think, or how we process and conceptualize information. Affective style, as referenced here, has to do with the amount and location of control and school authority that exists in the adults choice of learning experience. How much control of the learning transaction that is retained by the learner can be translated into the degree of self-directedness that the learner exhibits.
Self-Directedness as a Personality Construct

The notion of self-directed learning (which implies a necessary degree of self-directedness) has been a critical part of adult education literature for almost two decades. However, there remains disagreement among adult educators as to the actual role that self-directedness plays in adult learning. It has been identified as a variable in the definition of adulthood (Knowles, 1973), an instructional method (Tough, 1979), a personality construct (Oddi 1984), and as an active change in consciousness and motivation (Brookfield, 1985c; Mezirow, 1985). Most authors would agree that adults who possess self-directedness appear to experience a greater degree of success in learning situations, on the job and in an ever changing society (Houle, 1980).

To look at self-directedness as a learning style as well as a personality construct adds another dimension to the perspectives that currently define self-directedness. Self-directedness has been used in many ways within the area of adult learning. From a personality trait base, it can be viewed as a classification scheme for describing an affective learning style, specifically taking primary responsibility in a learning transaction. It is therefore,
consistent to look at self-directedness as both a personality construct and possibly as a learning style.

**Hemisphericity as a Learning Style**

The way we receive, sort out, store, and retrieve information constitutes the cognitive aspect of our learning style. Research shows that information is stored in different ways in each of the two hemispheres of the brain (Springer & Deutsch, 1985). Hemisphere dominance is manifest in the observed problem-solving behavior of the individual. For example, if presented with a problem, a left hemisphere dominant subject will define the problem verbally, using an analytical-type approach. The right hemisphere dominant subject may approach the same problem in a more holistic manner by visualizing the "big picture." The right hemisphere stores information globally and the left hemisphere stores information in a linear fashion. Retrieval of the stored knowledge occurs in a similar manner. Where and how the original input was stored determines how it is retrieved for the required output in specific learning tasks.

**Linking Self-directedness and Hemisphericity**

There has been a recent increase in references in the adult education literature that link self-directedness to
right hemisphere dominance. Perhaps most referenced is Torrance and Mourad's correlational study (1978). In studying various correlates of creativity, Torrance and Mourad found that self-directedness had a high positive correlation with right hemisphere dominance. Based on these findings, adult educators have begun to interpret self-directedness as a specific function of the right hemisphere of the brain (Brockett, 1987; Caffarella & O'Donnell, 1987). However, because of the small number of participants in Torrance and Mourad's study and the high probability of sample bias, their findings are suspect.

Studies using behavioral characteristics to describe self-directed learners have identified characteristics that can also be found in left as well as in right hemisphere dominant individuals. This supports the possibility that self-directedness might be linked with the left as well as the right hemisphere.

Stylistically speaking, cognitive style is a biologically-bound, natural style of learning; it is what children inherit from parents genetically. Affective learning style, on the other hand, is more dependent on experience and the nurturing process. This suggests that as one develops and matures, affective style tends to modify cognitive style. In terms of the variables chosen
to operationalize these concepts in this study, hemisphericity is biological and self-directedness is experiential. This would imply that as one develops and matures, self-directedness modifies hemisphere dominance.

**Statement of the Problem**

Self-directedness and hemisphericity have been established as important concepts related to adult learning. Some empirical evidence (Torrance & Mourad 1978) exists to support a relationship between the concepts. However, because such a limited and perhaps biased study sample was used, a more comprehensive study is needed to verify and more clearly define the relationship between self-directedness and hemisphericity. In particular, age needs to be considered as a moderating variable because there is reason to believe that the degree of lateralization and/or the degree of self-directedness may vary over the life span.

**Rationale and Purpose**

The need to continue research on self-directedness, particularly from a personality perspective, has been expressed several times in recent literature. Brockett, Hiemstra and Penland (1982) suggested that future research
needs to continue to examine the relationships between self-directedness and other personological variables. Additionally, one of the six recommendations for future research posed by Caffarella and O'Donnell (1987) is that "nature of the individual studies are a fertile area... and viewing the concept of self-directed learning as a personality construct is an especially exciting idea" (p. 209).

Regarding the further study of hemisphericity in adult education, Springer and Deutsch (1985) stated that "It would also be valuable to investigate hemispheric asymmetries over the entire life span to see if the aging process differentially affects the hemispheres. This is an area in which very little work has been done" (p. 198).

If a relationship is found between hemisphericity and self-directedness this research will not only provide an empirical base for these elements of adult learning theory but could also help educators better assess adult students. Knowledge of an adult student's degree of self-directedness and his or her hemisphericity could enhance the educator's ability to better assess the students' specific learning style and therefore be used as an aid in helping the student select the most effective learning experience from a variety of settings.
The purpose of this study is multifaceted: 1) to test empirically for a relationship between self-directedness and hemisphere dominance, 2) to test empirically for a relationship between self-directedness and age, 3) to test empirically for a relationship between hemisphericity and age, 4) to test empirically for a relationship between self-directedness and the variables health, educational attainment, mental exercise, and gender, 5) to test empirically for a relationship between hemisphericity and the variables health, educational attainment, mental exercise, and gender, 6) to determine whether self-directedness can be predicted from the variables hemisphericity, age, health, educational attainment, mental exercise, and gender, and 7) to determine whether hemisphericity can be predicted from a combination of the variables self-directedness, age, health, educational attainment, mental exercise, and gender.

It is felt that self-directedness is positively related to hemisphericity among adult learners. However, the hemispheric direction of the relationship is difficult to predict for several reasons. As noted earlier, Torrance and Mourad (1978) found a right hemisphere correlation but the finding begs replication because of methodological flaws. If an attempt were made to predict hemisphere
direction based on observed behavior alone, both right and left hemisphere characteristics would be found among self-directedness characteristics. Evidence based on observed characteristics, therefore, was equivocal regarding the prediction of right or left dominance.

Investigation of the character of the relationship between hemisphericity and self-directedness in the sample is also performed in this study. The character is defined by looking closely at the possible relationships between each major variable and age. It is also hypothesized that relationships would be found between hemisphericity and self-direction and the following variables: gender, perceived health, amount of mental exercise, and number of years in school. Additionally, it is expected that a combination of the variables tested will make unique and significant contributions to self-directedness and hemisphericity. The variables used in the tests are perceived health, number of years in school, age, gender, and the amount of mental exercise performed daily.

**Significance of the Study**

There are several significant contributions that this study can make to the adult education literature. One is to clarify the distinction between self-directedness and
self-directed learning in the adult education literature. Self-directedness is a part of the personality that expresses action upon one's own course in life. It is measured by the degree to which this trait is demonstrated through behavior in a given situation (from dependency to increasing autonomy). On the other hand, self-directed learning "represents the ultimate state of learning autonomy" (Mocker & Spear, 1982, p. 11). It is within this state that the learner activates his or her degree of self-directedness by exercising control over, and taking major responsibility for, choosing both the goals and the means of learning. It is "measured" by noting the way in which the individual chooses to learn.

A second contribution would be to discover new tools used to identify students who are at risk of failing as a result of selecting inappropriate learning situations. Houle (1980) suggests that the degree to which adults are self-directed affects the success they experience in an adult education setting. In light of the autonomous nature of highly self-directed learner, this implies that there is an optimal degree of self-direction required for structured or semi-structured learning. For example, if adult educators mistakenly assume that all adults have a high degree of self-directedness, merely because they are
adults, they may place a highly self-directed student at risk for success in a learning situation specifically designed for lower levels of self-directedness as are found in formal settings. To help identify students at risk, Oddi (1984) developed an easy-to-administer and score inventory to measure the level of self-directedness in adult students to aid in understanding the adult learner.

Third, if establishing a significant relationship between self-directedness and hemisphere preference identifies hemisphericity as an important variable in the definition of self-directedness, and if a high degree of self-directedness serves as an identifier of the adult learner, then hemisphericity scores can be used as an additional measure of the student profile. Therefore, knowing the student's cognitive learning style in terms of hemisphere dominance may further aid in reducing failure of adults in formal learning situations.

Finally, the study will add useful information to aid in the understanding of the importance of left brain/right brain theory in education. Hines (1982) warned educators not to base practice on unsupported findings of vast differences in style between hemispheres. This study will help clarify the role of hemisphericity in the practice of
adult education by testing for the contribution of age to hemisphere preference and self-directedness.

If a relationship does exist, the role that hemisphericity plays in adult learning may become more clear. In addition, knowledge that hemisphere dominance may be distinguishably different in young adults than in old adults may allow us to begin to discriminate between the adult as learner from the child as learner. This would take us one step further toward defining the differences between adult learning and childhood learning.

Assumptions and Limitations

For the purposes of this study, the following assumptions regarding the study instruments were made:

1) The Refined Wagner Preference Inventory is a valid and reliable measure of hemisphericity.
2) The Oddi Continuing Learning Inventory is a valid and reliable measure of self-directedness as a personality construct.

The statistical reliability and validity information found on both of these instruments is discussed in Chapter 3.

This study is limited by two factors. First, the sample, though representative of the desired population, was not obtained by random selection. The importance of
selecting groups that represented the desired characteristics of the population to be studied (persons of ages that include all of the adult life span, and adults in structured or semi-structured learning settings) precluded an independent random sampling scheme. There is no theoretical basis to assume that respondents in this study, as a group, have other than normally distributed hemisphere dominance. However, some evidence suggests that the degree of self-directedness could be culturally or socio-economically related. Therefore, for white, middle class residents of the western United States, the trends observed in the results may be generalizable.

Second, the study is cross-sectional in nature. The potential delimiter here is that time does not allow for a longitudinal study to test for changes in personality or learning style due to the aging process. The deficiencies of substituting a cross-sectional for a longitudinal design are well known (Botwinick, 1973). For example, in cross-sectional studies it is difficult to tell if one is observing actual changes in the variable or if one is observing generational differences due to historical events, social mores, or general trends. Because of the genetic and biological binding of hemisphericity, it is difficult to imagine that socioeconomic changes could be
observed. However, the exploratory results from this cross-sectional study should give future researchers a base upon which to justify a more definitive longitudinal study. Tentative conclusions can still be made about any relationships or differences in the two primary variables and in the attribute variables.

Definition of Terms

Definitions of the terms used in this study are offered here to establish an equal ground between reader and researcher. Adult, hemisphericity, learning style, personological, self-directedness are defined below, relative to their use in this investigation.

Adult

An adult in this study is defined from several different perspectives. Chronologically, in this study, the adult life span begins at the age of 18. In behavioral terms, an adult learner is a person who is 18 or older and is involved in a structured or semi-structured learning transaction.

Hemisphericity

The working definition of hemisphericity for this study is that, the brain has two hemispheres that each
process information differently but work together. The individual usually relies more on one hemisphere than the other to solve problems. An individual's preferred approach to problem solving is then called their cognitive learning style. It is available to the learner along with other cognitive styles as a result of developmental information processing techniques. Incoming information is processed globally in the right hemisphere and in a linear fashion in the left hemisphere. In this study, hemisphericity is measured by the participants preference for performing certain tasks and problem solving techniques as determined by the Refined Wagner Preference Inventory.

**Learning Style**

For the purpose of this study, Keefe's (1979) definition of learning style was used. He defined learning style as "...cognitive, affective, and physiological behaviors that serve as relatively stable indicators of how learners perceive, interact with, and respond to the learning environment" (p. 4).

**Personological**

Personology is the study of the personality. When referring to traits that make up the personality, the term personological is used.
Self-directedness

Self-directedness is the hypothetical construct used to identify the inherent personality traits of the adult, particularly as they pertain to the amount of control of, and responsibility taken for, his or her own learning. When viewed from this perspective, it might also be defined as a learning style. In this study, self-directedness is measured by the participants need for outside approval of his/her actions and ability to function independently in a learning setting. It is measured using the Oddi Continuing Learning Inventory (OCLI).

Recent research, although incomplete, appears to provide preliminary justification for believing that there is a relationship between hemisphericity and self-directedness. An in depth review of the literature will provide the necessary basis for this research.
REVIEW OF THE LITERATURE

This chapter is designed to present the current literature on one concept from two very different perspectives. The concept is learning and the perspectives are cognitive and educational. A paradigm of both perspectives was drawn from the literature to give a foundation to the two approaches (Figure 1).

The educational perspective draws information from the philosophies underlying pedagogy and andragogy. Andragogy is discussed in terms of its four underlying assumptions; the one of major interest in this study being that, in the adult, the self-concept moves from that of dependency to that of self-direction. Self-direction is reviewed from three viewpoints, as a method of instruction, as a set of skills, and as a personality construct. Self-directedness as a personality construct is further defined by behavioral characteristics found in other studies and by correlates empirically verified in this study, one of which is hemisphere dominance.
Figure 1. Schematic used in constructing the literature review.
The cognitive perspective draws information from four major fields: neurophysiology, neurolinguistics, cognitive psychology, and education. Each of these four fields makes a major contribution to the foundation and validity of the left brain/right brain theory. This theory suggests that there are two separate hemispheres that make up the organ of thought that we know as the brain. They have different physical and operational characteristics but are linked to each other. The dominant role that each hemisphere plays in how we think is called hemisphericity. Hemisphericity is further defined by behavioral characteristics identified in other studies and by correlates of hemisphericity found in this study, one of which is self-directedness.

**Self-Directedness In Adult Learning**

To clarify how self-directedness became an important concept in learning, it is appropriate to begin with its relationship to andragogy and then to education in general. In his search for an adult learning theory, Knowles (1970) popularized the term "andragogy". Through many revisions and much controversy his definition of the concept evolved from literally "adult leader" into "another model of assumptions about learners to be used alongside the pedagogical model of assumptions" (1980, p. 43). Knowles'
four assumptions of andragogy are: 1) self-concept moves from being a dependent personality to being self-directed, 2) adults accumulate experiences that are incorporated in their future learning experiences, 3) adult readiness to learn is increasingly dependent on social roles, and 4) the application of the learning experience is immediate as opposed to postponed.

There has been extensive controversy regarding learning theory in the adult education literature, as is healthy during the discussion of any new theory. Strong opposition regarding the dichotomization of child and adult learning theories caused opponents (Houle, 1972; London, 1973; Elias, 1979; Davenport & Davenport, 1985) to proffer a single human learning theory. However, no single theory of learning that covers birth to death has been agreed upon.

Amid the controversy, many that prefer the dual theory perspective believe andragogy to be the cornerstone of a philosophy of adult education. As mentioned previously, the first assumption of andragogy is that the learner's self-concept moves from one of dependency to one of self-direction. As a result of this inextricable relationship, the concept of self-directedness has become a dominant
theme in the adult education literature, particularly since the early 1970's.

Self-directed learning finds its foundation in both the behavioral and humanistic philosophies. Behaviorists believe that whether self-planned or not, tasks such as goal setting and obtaining feedback are ultimately designed to modify behavior (Herman, 1977). As Elias and Merriam (1980) pointed out, mainstays of adult education such as learning contracts and active learner participation are also behaviorist in nature. However, the most influential philosophical roots of self-directedness can be traced to the existential humanist movement in adult education. Humanism is based on the autonomy of humans. Elias and Merriam (1980) paraphrased the 1973 Humanist Manifesto I by observing that "the person is not ready-made but is rather the designer of his own being" (p. 111). In other words, human beings are responsible for their own destiny. Davenport and Davenport (1985) emphasized the existential perspective when citing McKenzie (1977) who defined adults as being basically different from children and that this basic difference demands an alternate teaching approach. In the 1960's Rogers (1969) related his humanistic philosophy of education to adult education by suggesting that self-
initiated learning that is relevant to the learner be set up as a model for adult learning.

The term "self-planned" learning was first used by Tough (1967, 1971) to describe the behavior of individuals involved in learning projects. Tough believed that most learning by adults was done informally. In his seminal work Tough made several profound observations. He found that adults participated in an average of eight learning projects a year, and that they initiated and designed 68% of the learning projects themselves. Even though a "helper" was sought at some point in each learning project, Tough maintained that most learning done by adults is self-directed in nature. Only about 10% of the learning observed took place in a higher education setting. It was through Tough's work and a plethora of replications of his study, that self-planned learning came to be known as the "preferred" way in which adults learn. The ability of adults to conduct self-planned learning projects has been shown. However, as Fellenz (1985) pointed out, to assume that self-planned learning is the preferred method of learning by adults is an assumption seldom subjected to critical review. Even without critical analysis and empirical verification it has assumed factual status in the adult education literature.
The difficult process of defining terms to establish a common understanding among all who discuss them is currently predominant in the adult education literature. The terms self-directedness and self-directed learning have not been bypassed by the scrutiny of definition. The work of Tough and his adherents has defined the self-planned method of learning. It soon became popular to discuss learning from a self-planned (Tough, 1967), self-initiated (Rogers, 1969), or self-directed (Knowles, 1970) perspective. However, because each of these perspectives carried with it its own set of assumptions, the need for clarification became evident.

Schuttenberg and Tracy (1987) classified the diverse definitions of self-directed learning into three conceptual categories: skills, processes, and philosophies. The category of skills or behaviors includes Bruner's (1985) suggestion that self-directed learning is related to decision-making skills. It also includes the notions that self-directed learning is a method of instruction (Brockett & Hiemstra, 1985) and that self-directed learning is a set of skills to be mastered (Knowles, 1975). Self-directed learning as an instructional process, such as Brookfield's (1986) model of the teaching/learning transaction, is categorized as processes or interactions. The third of
Schuttenberg and Tracy's categories, philosophies or values, finds examples in Brookfield's (1985c) conclusion that self-directed learning is an active individual change in philosophy. Further support is noted in self-directed learning as a selective choice of learning method in adulthood (Long, 1976; Kulich, 1970). Most radical is Mezirow's conviction that the purpose of self-directed learning is to affect societal change (1985), and radical behavior change (1981). In his theory on perspective transformation, Mezirow stated his belief that self-directedness is the goal and not the means of education.

Not necessarily mutually exclusive, the above three conceptions of self-directed learning each confirm Brockett and Hiemstra's (1985) understanding that self-directed learning is not an all or nothing concept but rather exists on a continuum, and that there exists a varying amount of self-directedness within each learner. It is this degree of self-directedness within the individual that determines the ability to acquire the skills, the willingness to interact in a teaching-learning process, and the personal speculation on how to go about undertaking a learning experience.

Brockett, Hiemstra, and Penland (1982) suggested that there are three general ways that self-directed learning
has been studied: 1) through descriptive studies of self-directed learning projects; 2) through qualitative measures such as content analysis; and 3) through empirical studies that explore the relationships between self-directedness and various personological variables. Brockett (1985c) more definitively discussed these techniques in response to Brookfield's (1985c) admonishment that research regarding self-directed learning has been parochial in scope and quantitative in approach. The methods and instruments used to study self-directedness by these three methods is reviewed later in this chapter when measurement of self-directedness is discussed.

Oddi (1984) has broken the literature on the study of self-directed learning into two viable categories: self-directed learning as a set of activities in a learning process, and self-directedness as the personality attribute that determines whether or not an individual adult engages in learning. She developed the Oddi Continuing Learning Inventory (OCLI) in order to measure self-directedness as a personality construct. It is this separation of the extrinsic action of self-directed learning from the intrinsic quality that is self-direction that makes the understanding of self-directedness as a personality trait possible.
Self-Directedness as a Personality Construct

As previously noted, self-directedness as a dynamic personality construct is perhaps one of the most salient directions for the notion of self-directed learning to take in the adult education literature. The origins of studying self-directedness as a personality construct evolved through the writings of Knowles (1970). He listed self-directedness as the first of four major dichotomous assumptions between andragogy and pedagogy. Later, he restated the assumption in developmental terms when he said that "andragogy assumes that the point at which an individual achieves a self-concept of essential self-direction is the point at which he psychologically becomes an adult" (1980, p. 45). Even (1982) attempted to lend support to this view by arguing that self-directedness is a dichotomous trait that adults either possess or do not possess. However, the use of Guglielmino's (1977) Self-Directed Learning Readiness Scale (SDLRS) has verified that adult individuals vary considerably on a self-directed readiness scale. Knowles (1980) himself admitted that, spurred on by the debate in the literature, his own thoughts on self-directedness had gone through an evolutionary change. He suggested that his model of andragogy is more useful when the assumptions are viewed as
two ends of a continuous spectrum rather than as a
dichotomy. His revised theory suggested that through the
process of maturation, the learner moves from possessing a
dependent personality toward being a self-directed human
being. Davenport and Davenport (1985) recounted the
historical events that stimulated Knowles' rethinking of
his theory. They suggested that the change came about, in
part, as a result of Houle's (1972) criticism that learning
should be a single human learning theory, not dual adult
learning versus child learning theories.

The debate continues in the adult education literature.
However, in this research learning will be viewed from a
personality construct perspective. When viewed in this
manner, self-directedness might also be defined and
measured as one component of learning style similar to
other personality traits. Such traits include motivation,
and locus of control, all considered to be affective
learning styles. For example, Fellenz (1985) pointed out
that self-directed learners possess an internal locus of
control, suggesting a possible relationship to an affective
style of learning.

Other references in the literature relate self-
directedness to a cognitive style of learning. Brookfield
(1985a) for example, suggested that it is possible to
relate the notion of self-directed learning to field-independent cognitive styles. Field-independent/field dependent theory is the dichotomous construct developed by Witkin (1949) to explain different types of learners. Field-independent learners are autonomous and exhibit self-control where field-dependent learners prefer highly structured settings that are externally controlled.

Fellenz (1985) supported the link between self-directedness and cognitive structure when he suggests that self-direction is one of the psychological states attained by an individual in personal development. Fellenz goes on to indicate that one popular view was to equate the self-directed learner with the field-independent learner. Although Fellenz rejected this view as inaccurate, Chickering (1976) supported it by suggesting that the field dependent learner is limited in the capacity to be self-referent.

Brookfield (1986) suggested that self-directed learners are field-dependent. He described the self-directed learner as depending on peers and instructors as resources and placing their learning activities in a social context. Even (1982) suggested that the successful self-directed learner could be both field-dependent or field-independent, depending on the situation. This discussion was designed
to point out the apparent polarization that exists in the current literature on the cognitive nature of the self-directed learner. It seems that the underlying assumptions that are used to define the self-directed learner also determine the learner's relationship to field-dependency/independency.

The debate regarding field-dependency parallels the growing interest in hemisphericity and its role in adult learning. Researchers have proposed lists of behaviors that define both right and left hemisphere dominant individuals. Some of the characteristics from both these lists can also be identified as defining the self-directed learner. This suggests that successful self-directed learners can be either left or right hemisphere dominant, or can use both left and right hemispheres equally.

In light of the above evidence self-directedness can be viewed as a dimension of cognitive learning style. It may also be reasonable to say that the individual's degree of self-directedness makes up at least one component of that individual's cognitive framework.

**Self-Directedness and Age**

Knowles (1980) defined adulthood as that time when an individual demonstrates the social responsibilities
normally associated with adulthood. As noted earlier in this chapter, Knowles also suggests that self-directedness is developmental and indicative of adulthood. However, there is no empirical evidence to support that claim. Developmentalists suggest that there exists emotional and developmental milestones that identify phases and stages of adulthood. These are loosely connected with age ranges that although not exact, are quite consistent. Many researchers studying adult developmental stages begin adulthood chronologically between ages 30 and 35 (Jung, 1957; Erickson, 1950; Peck, 1960). Others start adulthood at around age 20 (Havighurst, 1956; Levinson et al., 1976). They all seem to agree that at least by the early to middle thirties, adulthood has been reached in the developmentally normal individual.

One purpose of this study is to empirically support the theoretical assumption that a relationship exists between self-directedness and age. Some studies have found positive correlations with self-directedness and both age and motivation (motivation has been identified as an intrinsic characteristic in self-direction). For example, Johnstone and Rivera (1965) found age to be a corollary of motivation. Sabbaghian (1979) using Guglielmino's Self-Directed Learning Readiness Scale to study self-directed
learners' readiness to learn found high correlations between age and self-directed readiness. Oddi (1984) also reported age as a factor in both motivation for, and participation in, continuing learning. However, at least two studies (Brockett, 1982; Shaw, 1987) found no significant correlation between age and self-directedness. While studying elderly individuals for life satisfaction, Brockett found no significant correlation between age and readiness for self-directed learning as measured with Guglielmino's SDLRS. Shaw, using Oddi's scale found no significant difference in self-directedness scores on the OCLI between young adults (under 25 years) and older adults (above 25 years).

Research Approaches to Self-Directedness

The instruments and methods used to research self-directedness generally reflect the underlying assumptions upon which the concept is defined and studied. As discussed earlier, there are at least three ways of studying self-directedness: 1) through descriptive studies of self-planned learning projects, 2) through content analysis and qualitative theory building, and 3) through correlational studies that explore the relationships between self-directedness and other personality constructs.
The Structured Interview

The structured interview is a type of inquiry designed to understand nature. Influenced in part by the findings of Johnstone and Rivera (1965) on the learning patterns of adults in the United States, Tough (1967) employed the structured interview technique to study how adults involve themselves in learning projects. As noted earlier, among Tough's major findings are that adults participate in an average of eight learning projects a year. Of these projects 68% were initiated and conducted by the student. Tough's technique was to have a set of written questions that each interviewer followed systematically. The questions were then followed up with prompting and probing to help the interviewee understand what was meant by a learning project and in order to recall learning projects they had undertaken. Data were presented in quantified descriptive form. Adherents of Tough, continued to use the structured interview style to confirm, classify, and extend to other populations, the findings regarding learning projects identified by Tough. Mocker
and Spear (1982) summarized three major reviews of self-directed learning studies. Coolican (1974) identified seven major studies between 1971 and 1974 that used the Tough approach. Tough (1978) analyzed over 20 studies that replicated his research. Finally, Cross (1981) used both Coolican's and Tough's review along with Penland's (1979) national study to develop her review. All three of these reviews, according to Mocker and Spear, found consistent evidence that Tough's original findings were supported, but little in the way of new findings or questions were identified.

These extensive reviews of the various replications of Tough's study essentially support his findings regarding the ability of adults to do self-planning in learning. One conclusion of significance in these later studies was that adults engage in learning projects on a pragmatic basis. In other words, the adult learner perceived a need to solve a problem in their every day life and proceeded to find a solution through a self-directed learning project. In fact, Penland suggested that 75% of all adult voluntary learning was on practical topics (Penland, 1979). A second finding of interest was made by Hiemstra (1976). He used the structured interview technique developed by Tough to study self-directed learning in older adults. Hiemstra
found that while the older adults in his sample participated in fewer projects, they were much more active in learning than has generally been found in studies of formal participation.

Content Analysis and Qualitative Design

Content analysis is a method of inquiry employed in the social sciences when the variables or characteristics of interest are of someone who is deceased or are intangibles only identified over long periods of time. In content analysis of biographies and autobiographies the characteristics are determined by reported behavior. In adult education, content analysis is a qualitative method of research used to analyze and categorize the behaviors of individuals felt to be self-directed in their lifelong learning. The objective in this type of analysis is to record and tabulate observed behavior in those individuals studied and then consider the most frequently observed characteristics to be self-directed characteristics (Gibbons, et al., 1980). In Gibbon's study, the researchers identified 20 self-directed individuals all of whom were considered to be experts in their field. They were studied by analyzing the contents of their biographies. In a qualitative study, Brookfield (1981)
interviewed 25 adults in a semi-structured interview and found several consistent characteristics to occur. The findings in these studies are discussed in more detail later in this chapter when characteristics linking hemisphericity and self-directedness are discussed.

Other qualitative designs have been used in a variety of inquiries. Qualitative design comes from the social sciences and has been referred to as grounded theory (Glaser & Strauss, 1967), naturalistic inquiry (Leean & Sisco, 1981), or qualitative research (Spear & Mocker, 1981). The purpose of qualitative inquiry is to understand natural phenomenon by observing it in a natural setting and through in-depth questioning. It is different from conventional methods of inquiry in that it does not formulate or test hypotheses. Because of human diversity, and the complex nature of adult education, this form of inquiry has been recently employed quite successfully. Arlene Fingeret (1983) used this type of inquiry to explore independence in illiterate adults and found that as their ability to read increases, they must also separate themselves from their current social networks in order to form new ones. Spear and Mocker (1981) used naturalistic methods to verify their concept of "organizing circumstance." They empirically concluded that self-
directed learning is stimulated by circumstances that occur in daily life.

Quantitative Measures

A third way to study self-directedness is to identify measurable traits demonstrated by self-directed individuals and analyze them in a statistical framework. To do this, Guglielmino (1977) developed a scale to measure readiness for self-directed learning and Oddi (1984) developed an inventory to identify self-directed persons based on their personality traits.

The Self-Directed Learning Readiness Scale. Based on the assumption that self-directed learning is a method of instruction, Guglielmino (1977) developed the Self-Directed Learning Readiness Scale. The scale was designed to determine if an adult is ready to assume the responsibilities necessary to engage in secondary or post secondary self-directed learning projects. The SDLRS is a 58-item self-reporting instrument. It is scored on a 5-point Likert-type scale. An underlying assumption of Guglielmino's scale is that it is intended to measure an adult's "readiness" for learning. Guglielmino identified eight major factors that affect an adult's readiness for self-directed learning: 1) openness to learning
opportunities, 2) Self-concept as an effective learner, 3) initiative and independence in learning, 4) informed acceptance of responsibility for one's own learning, 5) love of learning, 6) creativity, 7) future orientation, and 8) ability to use basic study skills and problem solving skills. She suggested that the scale be used as a screening tool for programs involving self-directed study as well as in research projects. The scale has been used successfully in several studies. For example, Sabbaghian (1979) studied 77 adult students and found a positive correlation with the participants positive self-concept. Savoie (1979) found a relationship between SDLRS scores and success in self-directed learning encounters among 152 nurses. While reliability was statistically high in these studies, internal consistency was low. When used in conjunction with qualitative follow up interviews it has been noted that certain adult sub-populations have difficulty responding to the scale. For example, when correlating self-directed learning with life satisfaction in aged adults Brockett (1985b) found the SDLRS a questionable measure. He found that in his sample of elderly persons, that those with low educational achievement were confused by the school-based perspective and double negative nature of many of the questions. Leeb
(1983) basically supported this finding with a more highly educated sample. In her review of the SDLRS, Oddi (1984) agreed that the scale is closely associated with self-directed learning as a method of instruction and goes on to say,

The close association between the SDLRS and instruction is further illustrated by findings that difficulties are encountered when attempting to administer the instrument to adults with relatively little schooling. (p. 41)

The Oddi Continuing Learning Inventory. Concluding that the SDLRS is not a best-fit general measure for continuing learners, Oddi (1984) developed a scale that measures self-directedness as a personality construct. She developed this measure of self-directedness based on the idea that self-direction is a personality construct of degree and that it is not an all or nothing phenomenon. She confirms this idea with the statement that "ongoing involvement in learning activities lies in the personality of the learner" (p. 43). The Oddi Continuing Learning Inventory is a 24-item, self-reporting instrument. It is scored on a 7-point Likert-type scale with five reversed items. Content validity of the items used in Oddi's scale was established by a panel of experts in the field. The reliability test conducted during the instrument's
development was administered to 271 graduate students.

Oddi developed what she called three overlapping dimensions of the self-directed learner. Each of the three dimensions was set on a continuum. The first dimension she termed proactive drive versus reactive drive. The poles of the continuum here are low versus high self-confidence, extrinsic versus intrinsic forces to stimulate learning, and low versus high self-esteem. Dimension two is cognitive openness versus defensiveness. The poles here are openness to new ideas versus rigidity, ability to change versus fear of failure, and tolerance of ambiguity versus avoidance of new ideas. Dimension three is a commitment to learning versus apathy or aversion to learning. Oddi polarized this dimension from a positive versus hostile attitude on learning, and thought-provoking leisure pursuits versus less thought-provoking ones. Oddi did not recommend use of the three dimensions until further validation studies could be conducted. Six and Hiemstra (1987) reported that Oddi discouraged the use of the OCLI in practice settings without further study. However, they, along with Shaw (1987), both found validation scores within an acceptable range. (Statistical validation is discussed in Chapter 3.) Although the factor analysis did not confirm reliability of the three dimensions of the self-directed
learner as perceived by Oddi, the overall reliability of the instrument has been established. The decision to use the OCLI in this study was encouraged by the unique personological perspective used in the instrument.

The research to date in self-directed learning reveals that the concept is still in a theory building stage. Self-directedness, the parent theory upon which self-directed learning theory was built, has a much longer history. Defining self-directedness as a personality construct is only one of several ways of studying it. However, there seems to be sufficient evidence to support further study of self-directedness as a personality construct. An adequate scale has been developed to measure the phenomenon of self-directedness as a personality construct. There is the necessary research duty to continue to examine the constructs of self-directedness, what its correlates are, and how it affects the adult learner.

Hemisphericity in Adult Learning

Hemisphericity is the notion that through the developmental process we learn to store specific information in different parts of our brain thereby forming a unique thinking process framework. All learning is
stored in the 1/8 inch thick covering of the brain called the cortex. Which part of the cortex specific information is stored in determines how it is retrieved and how future information is sorted. The right hemisphere of the brain stores information in a global fashion. It is generally considered to be the more creative, intuitive, and automatic hemisphere in the brain. The left hemisphere stores and retrieves information in a structured and linear fashion. It is considered the logical, analytic, and attentive hemisphere.

This storage process builds the framework upon which we evaluate new information. When this information is processed and permanently stored, it is known as semantic memory. Semantic memory, according to Tulving (1972), is the means by which we think. Because it is built from individual experience, it is this kind of memory that Cattell (1963) identified as "crystallized" intelligence. Crystallized intelligence is that which we know from our own experience, as opposed to that which we inherit genetically.

As individuals age, their experiences multiply, and brain functions continue to develop, the selective storage and retrieval of information is believed to become more automatic (Shiffrin & Schneider, 1977). This means that
those skills the brain must at first expend effort to control, such as the rules of language, eventually become more effortless and automatic. Of interest here is that the left hemisphere is generally considered the conscious hemisphere, while the right hemisphere is considered the unconscious or automatic half. In other words, over time certain tasks originally delegated to the left side move to the right side, leaving the left side free to process new information. This phenomenon may make it appear that the left hemisphere does all of the new information processing in adults. Collins and Quillian (1969) first explored this phenomenon, and called this conservation of mental effort "cognitive economy".

As incidents of human experience increase and become less and less novel, learners develop a "preference" for the hemisphere of the brain in which new information is repeatedly processed (Springer & Deutsch, 1985). Irrespective of an individual's hemisphere preference, the two hemispheres of the brain act in harmony in storing and recalling memory, and are manifest in a single specific cognitive learning style.
In 1864, Broca (Critchley, 1970) discovered that the left side of the brain contains two areas physically different from the surrounding brain tissue. They are the Wernicke's area and the Broca's area. These two areas in the left hemisphere are known to control speech. This finding was instrumental in formulating the assumption that the left hemisphere is the dominant hemisphere. In 1868 Jackson (Springer & Deutsch, 1981) declared the left hemisphere of the brain dominant because it controlled both verbal and logical thought. He based his conclusion on his observation that left-hemisphere stroke victims lost their ability to speak when right-hemisphere stroke victims did not. The right hemisphere was later identified as containing cognitive processing related to creative and intuitive thought.

The notion of hemisphericity evolved through the study of split-brain patients (Sperry, 1966). Sperry found that patients who had an operative procedure that physically cut the connective tissue between the two halves of the brain demonstrated subtle differences in cognition. When tested, patients demonstrated that the left side of the brain reported stimulation in verbal terms while the right side of the brain reported stimulation in visual terms. In
other words, the left hemisphere of the brain responds through a language ability acquired from its superior analytical skills. The right hemisphere however, responds positively to patterns interpreted from a visuospatial perspective. Sperry felt that the findings showed that each brain hemisphere possesses a different cognitive mode and therefore a different approach to learning.

While the tremendous contributions that the Nobel prize winning research of Sperry has made to our understanding of learning cannot be ignored, it is wise to remember that virtually all of the research was conducted on "split-brain" patients. Split-brain patients are those who suffer from debilitating epilepsy and have undergone a surgical procedure, called radical commissurotomy, separating the two hemispheres. No major change in personality occurs in these patients. However, subtle differences in cognitive processing have been detected through extensive testing.

It was through the exploration of these subtle differences that researchers were better able to describe the cognitive differences in each hemisphere. For example, Levy and Trevarthen (1976) found that upon viewing a picture of a needle and thread, the left brain identified what it saw by describing how a needle and thread function.
The right hemisphere, on the other hand identified the needle and thread based on appearance alone. Witelson (1977) found similar results and hypothesized that the difference in hemispheres is not so much in the type of information processed but the way in which it is processed. He felt that the left hemisphere processed information in a linear fashion while the right hemisphere processed the same information in a global manner. Witelson (1977) also found that the left hemisphere is related to controlled (conscious) information processing and the right is related to automatic (unconscious) information processing.

More recent work of Gazzaniga (1983) and others concluded from the work of Sperry that instead of possessing separate modes of cognitive structure, in the healthy human subject the two halves of the brain work in a more integrated manner. Springer and Deutsch (1985) also suggested that each hemisphere does not necessarily possess its own independent cognitive style, rather the one cognitive style demonstrated at any given time by the learner is a combination of both hemispheres.

These descriptions of dominant hemisphere functions should not imply that each half of the brain functions independently of the other. Psychologist Robert Ornstein (1977) made a distinction between Western (left hemisphere)
thought and Eastern (right hemisphere) thought and felt that American schools trained children in left hemisphere skills only. As a result, it became popular in the education literature to state the belief that we teach to only the left side of the brain and that we ignore the right side (Edwards, 1979). Others have gone so far as to suggest that entire curricula be developed for "right sided" learners and "left sided" learners (Dahlberg, 1981; Grady & Luecke, 1978).

A variety of observations can be made in view of the above evidence. One is that the processing and retrieval of information occurs more predominantly in some learners in the left hemisphere, and in other learners in the right hemisphere. Another is based on Gazzaniga's findings suggesting that as our brain becomes more "sophisticated" (i.e. mature) we "learn" to effectively utilize both the hemispheres together. Finally, Witelson's findings suggest that it is possible to assume that as the brain ages, some of the processing tasks move into the right (automatic) hemisphere leaving immediate processing (attention) to the left hemisphere.

These observations offer three possible predictions regarding hemisphere preference. First, they suggest that left and right hemispheres operate independently and that
learners are either right or left dominant. Second, information processing is integrated between both hemispheres, and third is that in adults, the left hemisphere is more often used for the processing of new information, since the right hemisphere is occupied with taking on additional automatic processing.

Hemisphericity As a Cognitive Learning Style

The poorly understood group of events that occur between the initial input of information and eventual retrieval of that information has been commonly referred to by cognitive psychologists as a black box. This means that for years, what happened inside the mind was a mystery. Only recently have scientists begun to have insight into how we process information. Recent attempts by educators to explain the cognitive process include the term cognitive style. "Cognitive style is a hypothetical construct that has been developed to explain the process of mediation between stimuli and responses" (Goldstein & Blackman, 1978, p. 46). For educators, there are many dimensions on which to classify the concept of cognition. The most popular to date has been cognitive learning style, and several instruments have been developed to measure some of the styles (Chei, 1984). For example, Witkin's (1949)
Embedded Figures Test measures what he termed field-dependent and field-independent styles of learning and Kolb's (1975) Learning Styles Instrument measures the adaptation of experience to learning. However, as Cornett (1983) points out "much of a person's cognitive learning style can be related to hemispheric brain functioning with the processes falling to either the right or the left hemisphere" (p. 9). Supported by the literature, hemisphericity will be pursued in this research effort as a valid cognitive learning style in adult education.

Hemisphericity and Age

With few exceptions, the age-related studies in hemisphericity have not tested beyond puberty. Kinsbourne (1975) thought that much of the hemispheric specialization function of the brain is present at birth. In early childhood, the brain is extremely flexible and in certain instances (e.g., if trauma occurs to the speech center before the age of five), the brain's plasticity will allow the right side of the brain to take over the speaking tasks normally found in the left hemisphere. However, after approximately age five, the language center is confirmed and plasticity can no longer relocate speaking tasks to the
right side (Lenneberg, 1967). The significance of this finding is that under certain conditions, the right hemisphere is capable of assuming the tasks normally assigned to the left hemisphere. Although the brain cannot completely accommodate for trauma after a certain age, the specializing process of right and left hemisphere may continue to be somewhat flexible over time.

In 1863 Broca conducted autopsies on patients who suffered from brain injury and stroke. He discovered the brain's language center in the left hemisphere of the brain. This discovery caused many people to label the left side of the brain dominant (Joynt, 1964). It was because of this physical evidence that much of what we know about hemisphere development has been studied through linguistics or language development.

While studying language, Brown and Jaffe (1975) found that both the responsibility for language and the organization of language within the left and right hemispheres may change with age. Wood (1983) suggested that language becomes more automatic with use. As this physical nature of the evolution of language within the brain over the life span is becoming increasingly better understood, and knowing that hemisphere preference and language are linked, attempts to look at hemisphericity as
an intrinsic part of adult development and adult learning have become more valid.

Thorndike's (1932) classic study on learning ability and aging was the base for the work of Macht and Buschke (1984) who found that adults show an actual increase in certain verbal skills as they age. We also know that in approximately 80% of the general population, the left hemisphere controls language. Therefore, Macht and Buschke's findings lend additional support to Johnson's (1979) conclusions that there is increased left lateralization with age.

In addition, Macht and Buschke's findings corroborate with those of Cattell (1963). Cattell believed that certain brain functions actually increase while others decrease with age. He explained this phenomenon by making a distinction between biologically-based, fluid intelligence and environmentally-based, crystallized intelligence. Fluid intelligence, according to Cattell, is independent of experience and education. Crystallized intelligence, on the other hand, is dependent on experience and education. Crystallized intelligence is manifested in verbal comprehension, numerical skills, and inductive reasoning all of which have been identified by Kane and Kane (1979) as left hemisphere functions. Cattell suggested
that in view of these basic assumptions, biologically-based fluid intelligence would deteriorate with age and crystallized intelligence, based in experience and education, would increase with age. Baltes and Shale (1976) also showed in longitudinal testing that crystallized intelligence indeed increases with age at least into the seventh decade. These findings are significant because they give further evidence that intelligence does not necessarily decline as a function of age alone. The findings also suggest that intelligence is not a single function. Part of our intelligence is biologically-based, and part is learned.

Cognitive learning style, as measured by cognitive complexity (Vacc & Vacc, 1973), is developmental in children but is individually variable in adults. Turner (1984) suggested that this finding means that "the culmination of cognitive development is therefore the attainment of a stage in which individuals are able to use their powers of thought to further their personal interests and concerns" (p. 148). In other words, adults select their cognitive thinking style depending on the situation or the problem needed to be solved.

Finally, in her work with Elderhostel participants, Davenport (1986) pointed out that age is indeed a factor in
learning style. She indicated that older learners prefer "traditional class organization, qualitative emphasis, detail, . . . and listening and reading activities" (p. 208). Using the Gregoric Style Delineator, Davenport discovered that most of her Elderhostel participants, irrespective of age or gender, scored highest on the concrete/sequential channel. Respondents who scored dominant in the concrete/sequential channel on the Gregoric scale preferred their learning to contain logical and ordered material, and kinesthetic experience. These characteristics were similar to those students who are left hemisphere dominant.

Research Approaches to Hemisphericity

Hemisphericity has been studied predominantly by scientific methods in fields outside of education. The purpose of the scientific research was to understand how the anatomy and physiology of the brain impacts the mind. Making this mind/brain connection has come of age in adult education (Long, 1983) as well as in neurophysiology.

Physical Methods

In the fields of neurophysiology and cognitive psychology there are a variety of physical tests. Those tests include methods such as Kimura's (1967) dichotic
listening test which tests auditory preference, and a visual method using a tachistoscope. In a dichotic listening test, subjects are given a separate list of words in each ear and then asked to record what they heard, the resulting calculation is the degree of hemisphere dominance. Use of the dichotic listening test of hemisphere asymmetry was ruled out as useful in this study because, as Bryden (1982) pointed out, ear-asymmetry scores have not proven to be reliable tests of hemisphere dominance. In addition, it is a difficult test to interpret without first determining possible unilateral hearing deficit.

Eye-field dominance testing using a tachistoscope is a technique where a physical barrier was placed between the left and right eye. The subject was then shown two pictures on a split screen for a very short period of time (microsecond). They were then asked to point to which picture they saw (right hemisphere recording) or to say which picture they saw (left hemisphere recording). This method was ruled out for use in this study, because of the inability to obtain equipment and appropriate timing devices. In addition, it is time consuming to administer and requires training to interpret.
Heuristic Methods

During the last decade or two, adult educators have moved from primarily studying methods of teaching to studying learning itself. This shift in research efforts to understand learning has emphasized the mind/brain connection and the study of cognition has become more and more evident on research agendas in adult learning.

In adult education there are no known qualitative, naturalistic, or grounded theory studies of hemisphere dominance. Many quantitative studies however, have involved the development of tests to measure hemisphericity. Hemisphericity has been studied primarily from the perspective that a greater understanding of how students learn, will produce more insight on how to teach them. Most of the studies result in suggestions for changes in curriculum design and instructional practice. Even (1982), for example, suggested that her findings were opposite of that which occurs in nature and that institutional and instructional practices based on nature should be reassessed and redesigned. Lux (1983) suggested that using information gathered through hemisphericity testing should be used to plan programs, instruction, counseling, and administration. Shaw (1986) proposed that hemisphericity research can optimize the learning
process by proper redesign of educational materials. Other studies have reserved making suggestions that are too radical in nature. Garvin (1986) for example, suggested that learning through brain research should continue to be explored. However, caution should be used when defining the actual role of a process (such as hemisphericity) in education, specifically in educational policy making.

Two major paper and pencil instruments designed to measure hemisphericity include Torrance's *Your Style of Learning and Thinking* (Torrance, Reynolds, Ball, & Riegel, 1978) and the *Refined Wagner Preference Inventory* (Wagner & Wells, 1985). Torrance's instrument (Form A) is a 36-item multiple choice self-report measure of cognitive learning style associated with brain hemispheres. The items have three possible responses. One represents a right hemisphere choice, one a left hemisphere choice, and one an integrated brain function choice. The reliability studies reported in the preface of the scale by Torrance list a reliability range from .65 to .80. Validity testing found correlations with creativity instruments only. One shortcoming of this instrument is that there is no attention paid to any degree of lateralization. By using categorical responses, the ability to analyze the data by degree is lost.
The **Refined Wagner Preference Inventory** was chosen as the instrument to be used in this study for three major reasons:

1. The inventory has an underlying assumption that hemisphere dominance is measurable by assessing behavioral choices.
2. The inventory has the ability to reveal degree of hemisphericity.
3. The instrument is brief and can be easily administered and self-scored.

This instrument will be discussed in greater detail in the section on study instrumentation in Chapter 3.

Adult education has recognized the importance of hemisphericity in learning. However, it is necessary to continue research as to its constructs, correlates and importance to practice. Proceeding with caution as to how we apply our understanding of hemisphericity is essential to avoid making practical application without adequate empirical evidence.

**The Link Between Self-Directedness and Hemisphericity**

The following paragraphs reflect a review of the literature identifying similarities between characteristics demonstrated by self-directed individuals and the
characteristics of people with established hemisphere preference. By examining these characteristics, the basis for a theoretical argument for a relationship between hemisphericity and self-directedness can be formulated.

Characteristics Related to Self-Directedness

For almost 50 years, adult education researchers have identified adult learners by a variety of behavioral characteristics. A selected overview of some of these characteristics will lend some historical credibility to the definition of a self-directed adult learner. Overstreet (1949) defined the self-directed adult as a maturing person who is constantly growing. He went on to describe the self-directed adult as a person who knows how to use knowledge, a concept similar to Flavell's (1977) metacognition, and a person who has successfully mastered survival in his/her environment. Houle (1964) described characteristics of continuing learners as persons who recognize they have the ability to learn, have realistic goals, learn new concepts from past personal experience, seek outside support when needed, learn in depth, and use logic. Tough (1979) reported characteristics of self-directed individuals to include curiosity, accepting-of-self, confidence, intrinsic motivation, goal-oriented, productive, and successful.
Some additional characteristics of persons defined as self-directed learners were identified by Gibbons, Bailey, Comeau, Schmuck, Seymour, and Wallace, (1980). This qualitative study focused on 20 self-directed individuals, all of whom were considered to be experts in their profession. They were studied by analyzing the content of their biographies. Some of the characteristics that Gibbons and his colleagues observed are listed in Table 1.

Table 1. Characteristics of 20 Self-Directed Learners, reported by Gibbons, et al., 1980.

<table>
<thead>
<tr>
<th>Perseverance</th>
<th>Self-disciplined study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curiosity</td>
<td>Single-minded pursuit</td>
</tr>
<tr>
<td>Creativity</td>
<td>Ingenuity</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>Natural ability</td>
</tr>
<tr>
<td>Assertiveness</td>
<td>Intellectual</td>
</tr>
<tr>
<td>Independent exploration</td>
<td>Integrity</td>
</tr>
<tr>
<td>Nonconformity</td>
<td>Industriousness</td>
</tr>
</tbody>
</table>

In another study, Brookfield (1981) interviewed 25 adults using a semi-structured interview. Consistent characteristics of self-directed learners observed in that study were: 1) individuals were concomitantly competitive and cooperative, 2) learning was ongoing (no beginning or end), and 3) the individuals did not limit their interests to their expert field.
In a discriminant analysis of student's choice for independent study, Devitt's (1979) research results showed some surprising characteristics. He found that students choosing independent study were assertive, adventurous, apprehensive, reserved, sober, obedient, uncompromising, and introspective. Devitt also reported no significant relationship between the independent student and intelligence.

The development and subsequent use of instruments that measure self-directedness has added another group of characteristics to the list. Although Guglielmino did not define her scale in personological terms, she suggested eight factors that contributed to an individual's readiness for self-directed learning. Her original eight factors included: openness to learning opportunities, self-concept as an effective learner, initiative and independence in learning, informed acceptance of responsibility, love of learning, creativity, a future orientation, and the ability to use basic study and problem solving skills. Studies using the Self-Directed Learning Readiness Scale discussed these factors in a slightly different way. Using Guglielmino's scale to examine elderly individuals, Brockett (1982) found that high life satisfaction, love of learning, and self-concept of being an effective learner
were positive correlates of readiness for self-directed learning. Using Oddi's scale, Shaw (1987) found that self-directedness and intellectual development show a positive correlation. However, this does not conflict with the lack of evidence for correlation between self-direction and intelligence.

**Characteristics Related to Hemisphere Dominance**

Questions that are asked in the hemisphericity literature are strikingly similar to those asked in the adult education literature regarding self-directedness. Is there a true dichotomy? Is the phenomenon all or none, or is it continuous? Most of the literature on hemisphericity depends on listing behaviors observed in the testing of split-brain patients and assigning them to either the right or left hemisphere. The behaviors have been dichotomized to fit the known characteristics of each hemisphere. Springer and Deutsch (1985) listed these dichotomies of mental organization within the hemispheres, a partial listing is shown in Table 2.

Identification of the characteristics associated with specialization in the cerebral hemispheres have been made by several other researchers outside of the neuro-physiological field. For example, in their research involving gifted children, educational researchers Torrance
Table 2. Hemispheric Dichotomies in Mental Organization as Identified by Springer and Deutsch (1985).

<table>
<thead>
<tr>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intuitive</td>
<td>Rational</td>
</tr>
<tr>
<td>Implicit</td>
<td>Explicit</td>
</tr>
<tr>
<td>Synthetic</td>
<td>Analytical</td>
</tr>
<tr>
<td>Continuous</td>
<td>Discrete</td>
</tr>
<tr>
<td>Divergent</td>
<td>Convergent</td>
</tr>
<tr>
<td>Free</td>
<td>Directed</td>
</tr>
<tr>
<td>Impulsive</td>
<td>Realistic</td>
</tr>
<tr>
<td>Multiple</td>
<td>Sequential</td>
</tr>
<tr>
<td>Subjective</td>
<td>Objective</td>
</tr>
<tr>
<td>Simultaneous</td>
<td>Successive</td>
</tr>
</tbody>
</table>

and Mourad (1978), observed the characteristics in Table 3. They believed these characteristics are associated with specialized cerebral hemisphere functions as they relate to cognitive style of learning.

Table 3. Torrance and Mourad's (1978) Characteristics of Specialized Cerebral Function.

<table>
<thead>
<tr>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong emotional response</td>
<td>Produces logical ideas</td>
</tr>
<tr>
<td>Produces humorous ideas</td>
<td>Processes info. sequentially</td>
</tr>
<tr>
<td>Self acting, initiates</td>
<td>Serious/systematic</td>
</tr>
<tr>
<td>Improvisational</td>
<td>Has definite plan</td>
</tr>
<tr>
<td>Synthesizing</td>
<td>Critical, analytical</td>
</tr>
<tr>
<td>Intuitive problem solving</td>
<td>Logical problem solving</td>
</tr>
<tr>
<td>Creative</td>
<td>Intellectual</td>
</tr>
</tbody>
</table>
The previous paragraphs emphasize the similarities between the personality characteristics associated with both hemisphere preference and self-directedness. To see how the characteristics identified with self-directedness fit with hemispheric characteristics, a schematic composite was developed. Table 4 lists, by author, characteristics and behaviors derived from selected adult and general education literature that have been identified as self-directed in nature by the respective authors.

Table 4. Characteristics Identified by Selected Authors as Self-Directed and Categorized in Right and Left Hemisphere Domains.

<table>
<thead>
<tr>
<th>Source</th>
<th>Left</th>
<th>Right</th>
</tr>
</thead>
<tbody>
<tr>
<td>Devitt (1979)</td>
<td>Sober, Uncompromising, Single-minded</td>
<td>Adventurous</td>
</tr>
<tr>
<td>Brookfield (1981)</td>
<td>Competitive</td>
<td>Diverse</td>
</tr>
<tr>
<td>Overstreet (1949)</td>
<td>Knowing how to know</td>
<td></td>
</tr>
<tr>
<td>Houle (1964)</td>
<td>Realistic, Logical</td>
<td></td>
</tr>
<tr>
<td>Tough (1979)</td>
<td>Goal-oriented</td>
<td>Confident, Curiosity, Intrinsic motivation</td>
</tr>
</tbody>
</table>
Using a "two shape test" over a period of five years, Even (1981) tested 1,239 adult college students between the ages of 21-73. Even concluded from this study that 75% of adult participants in her study showed a right hemisphere preference. The test that Even used, however, was less definitive than Torrance's inventory as it completely dichotomized hemisphere preference and has never been tested for validity or reliability.

The only study to date that quantitatively attempts to identify a relationship between hemisphericity and self-directedness is that by Torrance and Mourad (1978). Torrance and Mourad felt that self-directed adult learners and the gifted children that they studied had something in common. As a test for construct validity, they compared Guglielmino's (1977) SDLRS with eight instruments designed to measure creativity and other criteria. One of the eight instruments that they used was Torrance's Your Style of Learning and Thinking Instrument, which measures the style of learning associated with the specialized cerebral hemisphere functions. They expected to find that self-directedness would correlate with the creative right hemisphere.

The sample in their study consisted of 41 graduate students in Torrance's creative thinking class. Torrance
and Mourad found a significant positive relationship ($r = .43$) between right hemisphere preference and self-directedness. In addition, they found a significant negative relationship ($r = -.34$) between left hemisphere preference and self-directedness. (Torrance & Mourad, 1978).

Evidence suggests that a relationship exists between self-directedness and hemisphericity. There is also reason to believe that each of these major variables may be affected by age. Similarities among the characteristics of both self-directedness and hemisphericity place the relationship between the two concepts into a behavioral context. Empirical verification of these relationships as presented in the literature, is necessary to give them the further credibility.
CHAPTER 3

METHODOLOGY

To clarify the role of self-directedness in the adult learner, and to justify the role of hemisphericity in adult education a study was designed to empirically test for relationships between: 1) self-directedness and hemisphericity, 2) self-directedness and age, 3) hemisphericity and age, and 4) to determine if self-directedness could be predicted from a combination of variables. In this chapter a discussion of the methodology used to explore the suggested relationships is presented. It includes sections on population and sample, variables and instrumentation, data collection technique, statistical hypotheses, and the data analysis.

The general method employed to study whether a relationship exists between the two primary variables was a correlational research design. None of the variables were manipulated because of their pre-existing nature, therefore, it was also an ex-post facto study (Kerlinger, 1973).
Population and Sample

The population for this study had two major identifying characteristics. It consisted of adults currently involved in a learning situation, and whose ages ranged across the entire adult life span.

Accessible groups of persons representative of this population were identified. The entire sample consisted of 392 adult learners. Two of the respondents did not fill out the Oddi Continuing Learning Inventory (OCLI) and were dropped from the study. Of the 390 remaining, 362 were students at Montana State University, 238 of which were undergraduate students enrolled in large survey-type core courses. The lower division core courses were chosen to control for the bias of a declared academic major or special interest. Sixty-four individuals were enrolled in an upper division sociology class, 15 in an adult education graduate course, and 45 in an MSU sponsored Elderhostel program. The other 28 individuals were participating in an Elderhostel program in eastern Montana sponsored by a rural community college.

Instrumentation and Scoring

Three instruments were employed to study the variables of interest. One was a demographic questionnaire. The
other instruments were used to measure the variables of self-directedness and hemisphericity.

Self-Directedness

Self-directedness was measured by the Oddi Continuing Learning Inventory (OCLI) (Appendix A). This summated rating scale was developed by Lorys Oddi in 1984 and is a self-reporting inventory designed to collect information on how adults approach learning. Each of the 24 items of the instrument measures self-directedness on a one through seven Likert-type scale. Because a summated rating scale allows for measuring the intensity of expressed attitude (Kerlinger, 1973), the higher the score, the greater the degree of self-directedness.

The OCLI was selected as the measure of self-directedness for several reasons. The conceptualization that underpins the design of this instrument views self-directedness as an internally generated characteristic as opposed to an extrinsically imposed one. Additionally, it can be administered in group settings and is easily understood by the subjects. A non-royalty license agreement is required by Oddi to use the inventory (Appendix B). Use of the inventory is limited to research only.
In order to place a high degree of confidence in the observations made in this study, it is important to know that the instruments used are reliable. A reliability measure of internal consistency tells the researcher that the individual items on the test are consistent with the test as a whole. The closer the coefficient is to 1.00, the lower the error variance in the measurement. It is commonly accepted that a reliability coefficient of .70 is well within the acceptable range, especially when working with short instruments (Nunnally, 1982). During the development of her scale, with 271 individuals, Oddi (1985) tested the reliability of the OCLI and reported a standardized coefficient alpha of .87. Her test/retest stability measure showed a correlation coefficient of .89. Using Cronbach's alpha on a sample of 36 subjects, Six and Hiemstra (1987) reported a reliability coefficient of .66. The study sample used in this research produced a reliability coefficient of .73.

Oddi (1985) reported three factors in her scale: 1) proactive vs. reactive drive, 2) commitment to learning vs. apathy/aversion to learning, and 3) cognitive openness vs. defensiveness. Oddi believes that these factors are not reliable enough to be useful at the present time. However, she cites several studies in progress that may
show the factors she suggested to be relatively stable (personal communication, April 8, 1987). In addition, she reports a positive correlation with Guglielmino's scale (Landers, in press). The purpose of measuring self-directedness in this study, however, is not to inspect or compare the factors but to look at the total score as an overall measure of an individual's degree of self-directedness. Therefore, the OCLI was used as a unidimensional measure of self-directedness.

**Hemisphericity**

The instrument used to measure hemisphere preference was the Refined Wagner Preference Inventory (WAPI II) (Appendix A). The inventory is of forced-choice design, which contains 12 sets of four items each. From each set of four items, the respondent must indicate the one that he or she finds most appealing. It was developed in 1985 by Wagner and Wells to meet the need to measure hemisphericity not as an absolute dichotomy, but on a scale that contains multiple subcategories capable of being measured by degree. Measurement in this manner can reflect the bimodal nature of the brain when that nature is viewed as a learning style.

The WAPI II measures the characteristics related to each hemisphere in two subcategories. The left hemisphere
demonstrates logical and verbal characteristics while the right hemisphere manifests in manipulative-spatial and creative characteristics. Scoring is done by first adding the two left subcategories, to give the total left preference, and the two right subcategories, to give the total right preference. A difference of at least three points between left and right hemisphere dominance is needed to show a significant preference. If the difference is less than three points left and right dominance, the style is considered to be "balanced". This means that the respondent is neither left or right hemisphere dominant but rather utilizes both hemispheres nearly equally to process information.

The WAPI II inventory was chosen over others that identify hemisphere preference because the questions were constructed to parallel the theoretical assumptions that hemisphericity, as a learning style, is measured in degrees on a continuum, not as a true dichotomy. It attempts to measure not just the dichotomy of left or right but moves toward measuring the more integrated nature of brain function so that degree of preference or integration can be measured. Also, for the purpose of analyzing the data, the WAPI II was chosen for this study because with it, hemisphericity can be measured in both a categorical and
continuous manner. Additional appeal of this instrument was its brevity, and ease with which it could be administered and scored.

A possible limitation of the instrument is that it is relatively new and the validation and reliability studies are scarce. However, because of the newness of the concept of hemisphericity, all of the available inventories designed to measure it are relatively untested.

Reliability is a test for consistency of outcome for the construct that the instrument is supposed to measure. One way to test for this stability is to do a test-retest. A test instrument is administered twice with at least a two week time period between administrations. A high correlation between the two test scores indicates that the test is reliable. Wagner tested his scale for reliability using a test-retest design. For a sample of 51 students, he found stability at alpha = .05 between the first and second tests administered two weeks apart.

The most extensive validity testing of the WAPI II is the continual testing by the instrument's author and his students on the Valdosta State College campus. Wagner and Wells (1985) have been able to successfully validate the predictive value by using criterion-referenced groups. Wagner and his students select groups of subjects that
demonstrate behaviors identified as generically right or left hemisphere dominant, predict the group outcome, and then confirm the prediction with the WAPI II scale. For example, Wagner selected a group of six visual artists, and based of their creative characteristics and the creative nature of right hemisphere processing, predicted that they would score high in the right hemisphere on his scale. All six of the artists tested were right hemisphere dominant. Wagner and his students have repeated this criterion test for validity many times using different types of people and in both large and small groups. In all cases, the direction of the prediction was confirmed.

Another widely used statistical method for measuring reliability is Cronbach's alpha. As reported earlier, the most commonly used criterion level of reliability is .70 for this analysis method. The scores reported by the participants in this study (n=390) on the WAPI II revealed an overall reliability coefficient of the 12 item scale of .66. Although low, Nunnally states that it is not uncommon in education research for this number to be considered within an acceptable range of reliability. Table 3.1 shows the results of the Cronbach's alpha test.
Table 5. Test Reliability Using Cronbach's Alpha.

<table>
<thead>
<tr>
<th>Test</th>
<th>Standardized Item Alpha</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCLI</td>
<td>.7719</td>
<td>.7342</td>
</tr>
<tr>
<td>WAPI II</td>
<td>.6619</td>
<td>.6665</td>
</tr>
</tbody>
</table>

Selected Attribute Variables

The third instrument used in this study was a brief demographic and personal characteristics questionnaire (Appendix A). The questionnaire asked participants to list their age, gender, number of years in school, amount of time spent reading or doing other mentally challenging activity, and perceived general health.

Chronological age was asked of participants because three of the hypotheses included relationships involving age. It was essential to the study to know if age was related to self-directedness and/or hemisphericity, and if age was a predictor of self-directedness.

Gender has been included because it has produced controversial findings in other studies. Gender has been found to be related to both hemisphere dominance (Springer & Deutsch, 1985) and self-directedness (Sabbaghian, 1980). However, in a stratified random sample of 100 college students, Shaw (1987) found no significant relationship
between scores on the OCLI and gender. These findings prompted the use of gender as a variable.

Number of years in school has been related to other developmentally linked personality traits such as moral development (Rest, 1986). Virtually all of the self-directed learning studies that used Guglielmino's Self-Directed Learning Readiness Scale supported this link between number of years in school and self-directedness. The findings using Oddi's scale are limited to date; however, Shaw (1987) reported a positive correlation between educational attainment and the scores on the OCLI.

Mentally challenging activities such as working crossword puzzles, reading, playing word games, if done regularly, establish the amount of "brain exercise" participants get. The stability of learning ability across the life span has been linked with the amount of stimulation the brain experiences through such activities (Cross, 1981). Cross mentions the "activity theory" that suggests the more practice in thinking the brain gets, the more "fit" the brain becomes in various mental exercises such as problem solving.

General health was asked in order to determine self-assessment of physical well-being. It has been established that mental ability is affected by the preoccupation of
coping with illness, especially in older adults (Henig, 1981). Participants were asked to check if they felt that they were in either excellent, good, or poor health. The question was originally asked in order to eliminate persons who consider themselves to be in poor health from the study.

Data Collection Technique

Approval for using students as test subjects was obtained through the Human Subjects Committee at Montana State University (Appendix B). Test packets were assembled prior to administration and contained the demographic questionnaire, the WAPI II, and the OCLI.

A brief overview of the study and instructions for completing the test packets were read from a written script so that administration was consistent during each session. The instruments were administered in group settings by this investigator whenever possible. In some Elderhostel settings, a data collection assistant gave out the packets and read the instructions. The packets and written instructions were given to and collected from the assistant by this investigator. The WAPI II was self-scored by each individual participant for immediate feedback and rescored when the data were entered into the computer for analysis.
The OCLI was scored by the investigator. All of the data were collected during a six-week period in May and June, 1987.

Final computerized scoring of the OCLI and the WAPI II was done using the SAS statistical package (SAS Institute Inc., 1985). On the OCLI, adjustment was made for the five reverse items and the scores then added together. The minimum possible score of the OCLI is 24 and maximum is 168. To score the WAPI II the program recorded and summed all of the left dominant responses together, and all of the right hemisphere responses together. The scores ranged from plus 12 to minus 12.

Statistical Hypotheses Tested

The conceptual hypothesis introduced in Chapter 1 that a relationship exists between self-directedness and hemisphericity was established to define the scope of this study. The following specific statistical null hypothesis was used to test empirically for a possible relationship.

$H_{01}$: There is no statistically significant relationship between scores on the OCLI and scores on the WAPI II.

The conceptual development of the relationship between self-directedness and hemisphericity bases its contribution...
to adult learning on establishing the possibility that the relationship may change throughout the adult life span. The following hypotheses were used to test whether the suspected relationships existed.

Ho₂: There is no statistically significant relationship between scores on the OCLI and age.

Ho₃: There is no statistically significant relationship between scores on the WAPI II and age.

As has been discussed, there are attribute variables that may be intervening or contributing variables in this relationship. The following hypotheses considered the relationship between scores on the Oddi Continuing Learning Inventory and the four attribute variables.

Ho₄: There is no statistically significant relationship between scores on the OCLI and gender.

Ho₅: There is no statistically significant relationship between scores on the OCLI and perceived health.

Ho₆: There is no statistically significant relationship between scores on the OCLI and amount of mental exercise.
$H_{07}$: There is no statistically significant relationship between scores on the OCLI and number of years in school.

Four additional hypotheses considered the relationship between scores on the Refined Wagner Preference Inventory for hemisphericity and the four attribute variables.

$H_{08}$: There is no statistically significant relationship between scores on the WAPI II and gender.

$H_{09}$: There is no statistically significant relationship between scores on the WAPI II and perceived health.

$H_{10}$: There is no statistically significant relationship between scores on the WAPI II and amount of mental exercise.

$H_{11}$: There is no statistically significant relationship between scores on the WAPI II and number of years in school.

Finally, the question of whether it was possible to predict self-directedness or hemisphericity from the established variables was asked in the following null hypotheses:

$H_{12}$: The squared multiple correlation coefficient between the dependent variable self-
directedness (OCLI) and a combination of the independent variables WAPI, age, gender, years in school, health, and mental exercise is equal to zero.

$H_{o13}$: The squared multiple correlation coefficient between the dependent variable hemisphericity (WAPI) and the combination of the independent variables OCLI, age, gender, years in school, health, and mental exercise is equal to zero.

These 13 hypotheses were designed to answer the questions addressed in this study.

Method of Data Analysis

Descriptive statistics were computed from the information received on the attribute variable questionnaire using means when appropriate. Those attribute variables included self-directedness, age, years in school, and perceived general health. Descriptive statistics were also generated relative to attributes of hemisphericity, perceived general health, mental exercise, and gender.

Bivariate regression with Pearson product moment correlation coefficient was used to measure the first 10 hypotheses. These included the relationships between self-
directedness and hemisphericity, hemisphericity and age, and self-directedness and age. It was used to test for a relationship between self-directedness and age, mental exercise, education, and health. Pearson's $r$ was also used to test for a relationship between hemisphericity and age, mental exercise, education, and health. Stepwise multiple regression was used to test for the prediction of self-directedness and hemisphericity from a combination of independent variables as in hypotheses 12 and 13. A simple $t$-test was used to compare OCLI and WAPI scores among the Elderhostel groups and participants in the same age groups who were in the higher education group.

All hypotheses were tested at the .05 level of significance. This level of significance was chosen to guard against Type I error or rejection of a true null. To put this in a "social consequence" perspective, if a true null is rejected, an incorrect decision about nature is made and a relationship is said to exist when it does not (Ferguson, 1981). The alpha level was chosen so that a high level of confidence can be used to recognize a relationship between self-directedness and hemisphericity as well as the other relationships found.
CHAPTER 4

ANALYSIS OF DATA

This chapter presents the statistical findings from the data collected from the 390 participants. The findings are divided into four separate areas for discussion purposes. The first area is an overview of the characteristics of the participants. This discussion includes summary and descriptive statistics including means and standard deviations. The second area contains information regarding the instruments used in the study. The third area of discussion presents statistics relevant to testing the hypotheses. Correlations and regression analyses are presented in the hypotheses testing section.

The Study Sample

Understanding the characteristics of the respondents in a study is an important way to more accurately assess the findings in the statistical analysis. This section describes the study participants with regard to the following variables: age, gender, number of years in school, mental exercise, and health. The frequency
distribution, means, standard deviations, minimums and maximums are given in Table 6.

Table 6. Profile of the Study Participants.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-30</td>
<td>290</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>31-50</td>
<td>29</td>
<td>12</td>
<td>82</td>
</tr>
<tr>
<td>51-78</td>
<td>70</td>
<td>18</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>389</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Minimum = 18</td>
<td>Maximum = 78</td>
<td>Mean = 30.5</td>
<td>S.D. = 18.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>167</td>
<td>44</td>
</tr>
<tr>
<td>Female</td>
<td>223</td>
<td>56</td>
</tr>
<tr>
<td>Total</td>
<td>390</td>
<td>100%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education (Years in school)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4-11</td>
<td>6</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>12-14</td>
<td>216</td>
<td>66.6</td>
<td>68.1</td>
</tr>
<tr>
<td>15-18</td>
<td>148</td>
<td>27.0</td>
<td>95.0</td>
</tr>
<tr>
<td>19-23</td>
<td>19</td>
<td>5.0</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>389</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Minimum = 4</td>
<td>Maximum = 23</td>
<td>Mean = 14.8</td>
<td>S.D. = 2.1</td>
</tr>
</tbody>
</table>
Table 6.—Continued

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental Exercise (Hours Per Day)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1</td>
<td>1</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>1-2</td>
<td>144</td>
<td>37.4</td>
<td>37.7</td>
</tr>
<tr>
<td>2-3</td>
<td>128</td>
<td>33.2</td>
<td>70.9</td>
</tr>
<tr>
<td>&gt;3</td>
<td>112</td>
<td>29.1</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>385</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

| Health | | | |
| Excellent | 178 | 45.6 | 45.6 |
| Good | 208 | 53.3 | 98.9 |
| Poor | 4 | 1.0 | -- |
| Total | 390 | 100% | 100% |

Note: Due to rounding, some percentages may not add to exactly 100%. Not all frequency totals equal 390 as some respondents did not report all information.

**Age and Gender**

Consistent with the targeted population, the study participants ranged in age from 18 to 78 years. The mean age was 30.50 with a standard deviation of 18.10. In the study sample 56% (233) were female, while 167 males represented the remaining 43%. This ratio between males and females is similar to that found in the general American population of adults which is 53.1% female and 46.7% male (U.S. Bureau of the Census, 1986).
Number of Years in School

The amount of formal education accumulated by an individual participant was represented as actual number of years of schooling completed. This way of measuring educational level was chosen for several reasons: 1) A variety of personality traits and developmental patterns have been positively correlated with number of years actually spent in school but not necessarily to number or level of degrees attained. 2) All of the subjects in this study were still actively participating in a formal or semiformal educational situation, but not necessarily degree oriented. 3) Finally, this method was selected as the most efficient measurement of educational level because it can be represented as continuous data on an interval scale.

The mean number of years in school was 14.8 with a minimum of four years and a maximum of 23 years, each of which were reported by a single subject. A standard deviation of 2.14 was found. The study participants represent a more highly educated group than the United States adult population for whom the mean educational attainment is 11.4 years (American Association of Retired Persons, 1987). However, it is felt to be representative
of the target population of adults currently involved in
formal or semiformal educational efforts.

Mental Exercise and Health

The study participants were asked to identify the
number of hours per day that they did crossword puzzles,
worked logic games, read, or performed other mentally
challenging activity. They could answer in any one of four
ways: by writing in less than 1 hour, or by checking 1-2
hours, 2-3 hours, or more than three hours per day.

Only one of the 385 participants responding to the
question regarding mental exercise reported engaging in
mental exercise for less than one hour a day. One hundred
and forty-four, or 37.7%, responded as participating in
these activities one to two hours per day, 128 (33.2%)
reportedly experienced two to three hours per day, and 112
(29.1%) reported more than three hours a day.

Perceived status of personal health was established by
having the participant check one of three choices: 1) poor,
2) good, or 3) excellent. As noted earlier, four
respondents self-reported that they were in poor health.
Two hundred and eight or 53.3% reported good health and 178
(45.6%) of the respondents felt that they were in excellent
health. Therefore, almost 99% percent of the people in the
study perceived themselves as being in good or excellent
health. In view of these findings, it is felt that the scores obtained on the instruments given can be interpreted with a high degree of confidence as being those of participants without preoccupying health concerns.

Summary of Study Sample Characteristics

In summary, participants in the study had a mean age of about 30.5 years. There were slightly more female than male participants. Those participating in the study had attained an average of 14 years of education, which is slightly higher than the average for United States adults. Virtually all of the participants perceived themselves to be in physically good health, and nearly two-thirds reported two or more hours a day were spent in mental exercise.

The Study Instruments

Mean scores on the two study instruments were generated as well as minimum score, maximum score, and standard deviations. Each instrument was individually investigated in terms of the demographic variables. A t-test was done that compared the OCLI and WAPI II scores of the Elderhostel participants to other participants in the same age range and no statistically significant difference
was found. Table 7 exhibits the overall mean scores and scores for males and females on the OCLI and the WAPI II.

Table 7. Maximum and Minimum Test Scores Overall and by Gender.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Variable</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>OCLI</td>
<td>160</td>
<td>67.00</td>
<td>157.00</td>
<td>115.78</td>
<td>16.36</td>
</tr>
<tr>
<td></td>
<td>WAPI</td>
<td>167</td>
<td>-12.00</td>
<td>12.00</td>
<td>-0.96</td>
<td>5.51</td>
</tr>
<tr>
<td>Female</td>
<td>OCLI</td>
<td>215</td>
<td>69.00</td>
<td>160.00</td>
<td>119.35</td>
<td>14.33</td>
</tr>
<tr>
<td></td>
<td>WAPI</td>
<td>223</td>
<td>-12.00</td>
<td>12.00</td>
<td>-0.72</td>
<td>5.00</td>
</tr>
<tr>
<td>Overall</td>
<td>OCLI</td>
<td>375</td>
<td>67.00</td>
<td>160.00</td>
<td>117.80</td>
<td>15.30</td>
</tr>
<tr>
<td></td>
<td>WAPI</td>
<td>390</td>
<td>-12.00</td>
<td>12.00</td>
<td>-0.82</td>
<td>5.20</td>
</tr>
</tbody>
</table>

Table 7 shows that the mean score on the OCLI was slightly lower for males than for females. A t-test showed that this difference is not statistically significant.

The mean for the WAPI was lower for females than males, but again the difference was not statistically significant. The mean score of the WAPI suggests that the average participant has a balanced hemisphere dominance irrespective of gender.

The OCLI

Since its development in 1984, at least three studies have been conducted that reported findings based on the
Oddi Continuing Learning Inventory. This section examines the OCLI scores from the current study, and compare the findings with other studies that have used the scale.

Self-directedness, when referenced as OCLI, represents the summated scores on the Oddi Continuing Learning Inventory. The five reverse items were accounted for by inserting a mathematical equation in the analysis program to subtract the recorded score from eight. In other words, since the Likert-type answers on the OCLI range from seven to one, (seven being high) the answer of one in a reverse item question would be calculated as eight minus one or seven \((8 - 1 = 7)\), an answer of two would be calculated as eight minus two, or six \((8 - 2 = 6)\) etc.

The overall mean score on the OCLI was 117.8, with a minimum of 67, a maximum of 160 and a standard deviation of 15.3. Shaw (1987) determined the mean of OCLI in a normal distribution as 72. Ninety-eight percent of the study participants in the current research scored better than 72. Using that criterion, the mean score achieved in this study is well above the normal distribution and thus suggests that the average participant is self-directed in nature.

However, the scores in this study are slightly below the mean of the subjects that Oddi (1984) tested. Participants in this study sample did not score, on the
average, as high as any of Oddi's original three subgroups nor did they score as high as the mean found by Shaw (1987). The only study that reported a lower OCLI score than the present study was by Six (1987). Six studied 328 Business College students with a reported mean of 112.8. Details of how the scores generated by this study sample compare with Oddi's as well as Shaw and Six other studies using the Oddi Continuing Learning Inventory are shown in Table 8.

Table 8. Comparison of Findings on the OCLI With Other Studies.

<table>
<thead>
<tr>
<th>Study (date)</th>
<th>N</th>
<th>Study Sample</th>
<th>Mean</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackwood</td>
<td>375</td>
<td>Adult Learners</td>
<td>117.8</td>
<td>67</td>
<td>160</td>
</tr>
<tr>
<td>(1988)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oddi</td>
<td>a. 110</td>
<td>Law Students</td>
<td>119.0</td>
<td>44</td>
<td>161</td>
</tr>
<tr>
<td>(1984)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. 83</td>
<td>Adult Ed. Students</td>
<td>125.4</td>
<td>56</td>
<td>161</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. 78</td>
<td>Nursing Students</td>
<td>128.2</td>
<td>54</td>
<td>153</td>
</tr>
<tr>
<td>Six</td>
<td>328</td>
<td>Business College Students</td>
<td>112.8</td>
<td>57</td>
<td>157</td>
</tr>
<tr>
<td>(1987)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaw</td>
<td>100</td>
<td>Undergraduates (Random Sample)</td>
<td>121.0</td>
<td>54</td>
<td>157</td>
</tr>
<tr>
<td>(1987)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As an additional aid to assessing the OCLI scale in the current study, Pearson's $r$ was used to calculate item-to-
total correlations. Testing internal consistency is especially important with a new instrument in order to cross-validate the scores. The results are presented in Table 9. All of the item-to-total correlations for the OCLI scale were positive and significant at the .05 level. The magnitude of the correlations ranged from .16 to .56 with over 80% falling between .30 and .55.

Table 9. Item-To-Total Correlations of the OCLI Using Pearson's r.

<table>
<thead>
<tr>
<th>Item</th>
<th>Correlation</th>
<th>Item</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.52</td>
<td>13</td>
<td>.45</td>
</tr>
<tr>
<td>2</td>
<td>.56</td>
<td>14</td>
<td>.33</td>
</tr>
<tr>
<td>3</td>
<td>.41</td>
<td>15</td>
<td>.48</td>
</tr>
<tr>
<td>4</td>
<td>.51</td>
<td>16</td>
<td>.44</td>
</tr>
<tr>
<td>5</td>
<td>.55</td>
<td>17</td>
<td>.37</td>
</tr>
<tr>
<td>6</td>
<td>.41</td>
<td>18</td>
<td>.46</td>
</tr>
<tr>
<td>7</td>
<td>.45</td>
<td>19</td>
<td>.37</td>
</tr>
<tr>
<td>8</td>
<td>.38</td>
<td>20</td>
<td>.32</td>
</tr>
<tr>
<td>9</td>
<td>.50</td>
<td>21</td>
<td>.16</td>
</tr>
<tr>
<td>10</td>
<td>.49</td>
<td>22</td>
<td>.36</td>
</tr>
<tr>
<td>11</td>
<td>.51</td>
<td>23</td>
<td>.34</td>
</tr>
<tr>
<td>12</td>
<td>.19</td>
<td>24</td>
<td>.26</td>
</tr>
</tbody>
</table>

In summary, the major findings relevant to the OCLI are that first, except for Six's study, the mean score in this study is the lowest of all studies using this scale. Second, the data give support to the findings of Oddi,
Shaw, and Six regarding the internal consistency of the scale.

The WAPI II

Hemisphere dominance was analyzed using three different methods to measure and interpret the WAPI II scores. The first and predominant scoring method used in this study is referred to simply as WAPI. WAPI reflects in a direct manner the scores on the WAPI II. It was obtained by inserting an equation in the analysis program that subtracts the right hemisphere score from the left hemisphere score on the WAPI II. Since the sum of both hemisphere scores is always equal to 12, the possible scores are 12 - 0 or 12, 11 - 1 or 10, 10 - 2 or 8, and so on to 0 - 12 or -12. Thirteen possible scores are obtained by this function, 12, 10, 8, 6, 4, 2, 0, -2, -4, -6, -8, -10, and -12.

The second method used to tabulate the scores from the WAPI II was used early in the statistical analysis when a variable was created to measure absolute distance from the center or balance (irrespective of left or right direction). The test scores were examined in this manner to test the hypothesis that, regardless of the direction of dominance, cognitive brain functions become more balanced (or less lateralized) between the hemispheres as we age.
This interpretation of the variable was referred to as balance.

Finally, the variable dominance was created from the WAPI scores in order to categorize subjects into three groups: left hemisphere dominant, right hemisphere dominant, and balanced. Using the scoring ranges that Wagner (Wagner & Wells, 1985) suggested, scores between -3 to +3 were considered to be in the balanced brain category, scores of less than -3 were placed in the right hemisphere category, and those greater than +3 were placed in the left hemisphere category. This categorization into three groups was created in order to test for interaction among the variables using categorical data.

All of the 390 participants completed the WAPI II test items. As measured by the variable dominance, 87 (22.3%) exhibited left hemisphere dominant learning characteristics, 177 (45.3%) exhibited right hemisphere dominant learning characteristics, and 126 (32.3%) demonstrated scores that were in the balanced range. Table 10 shows how these scores from the current study compare with Wagner and Wells' (1985) study.

Because the study of hemisphericity is relatively new, instruments used to measure it such as the WAPI II are also relatively new and therefore lack sufficient data to
Table 10. Comparison of Current Study with Wagner and Wells' 1985 Study on Hemisphere Dominance.

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Left  %</th>
<th>Right %</th>
<th>Both  %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackwood (1988)</td>
<td>375</td>
<td>82 (21.8%)</td>
<td>123 (32.8%)</td>
<td>170 (45.3%)</td>
</tr>
<tr>
<td>Wagner &amp; Wells (1985)</td>
<td>211</td>
<td>56 (26.5%)</td>
<td>75 (35.5%)</td>
<td>80 (37.9%)</td>
</tr>
</tbody>
</table>

unequivocally support reliability and validity. However, it is important to use the tools available to build up a supporting data base in order to refine an instrument further and make its use in the future more appropriate. Wagner and Wells (1985) used criterion referenced groups to validate their scale and therefore these figures cannot be compared with their findings for validation purposes.

**Testing the Hypotheses**

In Chapter 3, several hypotheses were presented. These hypotheses were postulated in order to adequately explore the relationship between self-directedness and hemisphericity and how that relationship affects the adult learner. Each hypothesis was tested and the findings are discussed in this section.

To study relationships between the variables considered in this investigation, the data were first analyzed by
calculating the corresponding Pearson product-moment correlation coefficients for various pairs of variables as shown in Table 11. Although variables such as the self-

Table 11. Pearson's Product-Moment Correlation Coefficients For All Variables.

<table>
<thead>
<tr>
<th></th>
<th>OCLI</th>
<th>Age Exc.</th>
<th>Mental Education</th>
<th>Health</th>
<th>Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WAPI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r=</td>
<td>0.19</td>
<td>0.21</td>
<td>0.10</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>p=</td>
<td>0.00*</td>
<td>0.00*</td>
<td>0.00*</td>
<td>0.04*</td>
<td>0.53</td>
</tr>
<tr>
<td>N=</td>
<td>375</td>
<td>389</td>
<td>385</td>
<td>389</td>
<td>390</td>
</tr>
<tr>
<td><strong>OCLI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r=</td>
<td>--</td>
<td>0.30</td>
<td>0.22</td>
<td>0.33</td>
<td>0.23</td>
</tr>
<tr>
<td>p=</td>
<td>--</td>
<td>0.00*</td>
<td>0.00*</td>
<td>0.00*</td>
<td>0.42</td>
</tr>
<tr>
<td>N=</td>
<td>--</td>
<td>374</td>
<td>370</td>
<td>374</td>
<td>375</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r=</td>
<td>--</td>
<td>--</td>
<td>0.45</td>
<td>0.15</td>
<td>0.00</td>
</tr>
<tr>
<td>p=</td>
<td>--</td>
<td>0.86</td>
<td>0.00*</td>
<td>0.00*</td>
<td>0.93</td>
</tr>
<tr>
<td>N=</td>
<td>--</td>
<td>384</td>
<td>388</td>
<td>389</td>
<td>389</td>
</tr>
<tr>
<td><strong>Mental Exc.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r=</td>
<td>--</td>
<td>0.14</td>
<td>0.04</td>
<td>--</td>
<td>-0.08</td>
</tr>
<tr>
<td>p=</td>
<td>--</td>
<td>0.00*</td>
<td>0.45</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>N=</td>
<td>--</td>
<td>384</td>
<td>385</td>
<td>385</td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r=</td>
<td>--</td>
<td>--</td>
<td>0.02</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>p=</td>
<td>--</td>
<td>--</td>
<td>0.74</td>
<td>0.90</td>
<td></td>
</tr>
<tr>
<td>N=</td>
<td>--</td>
<td>389</td>
<td>389</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Health</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>r=</td>
<td>--</td>
<td>--</td>
<td>0.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>p=</td>
<td>--</td>
<td>--</td>
<td>0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=</td>
<td>--</td>
<td>--</td>
<td>390</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05

reporting of mental exercise and perceived health are ordinal rather than interval in nature, they are treated as
interval data in this analysis in the sense that Pearson's \( r \) assumes interval level measurement. An alternative would have been to use Spearman's rho, a correlation based on ranks, when ordinal variables are involved. However, in order to have a comparable statistic for all pairs of variables, it was decided that Pearson's \( r \) was most appropriate.

The results in Table 11 indicate the types of associations expected, but are preliminary in the sense that the relationships need to be further evaluated in a multivariate setting (in order to account for possible effects of control variables). As far as directing the remainder of the analysis, these results can be taken to indicate that hemisphericity is appropriately measured by treating the variable WAPI as a continuous variable rather than categorical as was noted when using the variable balance. Further, the results indicate that the direction of deviation from a balanced brain (i.e., left or right dominance) as measured by the WAPI score is a more useful measure than the absolute difference from center that the variable balance measures. Accordingly, the variable balance will not be considered further in the analysis.

The main hypothesis examines the overall relationship between the two major variables of self-directedness and
hemisphericity. Based on supporting evidence from the literature, it was predicted that a relationship would be found. The following null hypothesis was tested.

$$H_0: \text{There is no statistically significant relationship between scores on the OCLI and scores on the WAPI II.}$$

To test this hypothesis, a Pearson product-moment correlation was obtained between total self-directedness scores on the OCLI, and hemisphere dominance scores on the WAPI II. In Table 11, the $r$ value of .19 was found to be significant at the .05 level ($p = .00$). The number of observations with usable scores for this test was 375. Thus the null hypothesis was rejected, indicating that a significant positive relationship exists between increasing self-directedness and the tendency toward left hemisphere dominance. A high score on WAPI indicates increased left hemisphere dominance, therefore, this finding suggests that the person who demonstrates a high degree of self-directedness will tend to be left hemisphere dominant.

Another way to look at the relationship between hemisphericity and self-directedness is to calculate mean OCLI scores for each of the three categories of dominance as defined by the variable dominance. These results are presented in Table 12.
Table 12. Scores on the OCLI by Hemisphere Dominance.

<table>
<thead>
<tr>
<th>Dominance</th>
<th>No. of Observ</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left</td>
<td>82</td>
<td>74</td>
<td>157</td>
<td>121.57</td>
<td>22</td>
</tr>
<tr>
<td>Balanced</td>
<td>170</td>
<td>67</td>
<td>154</td>
<td>118.29</td>
<td>45</td>
</tr>
<tr>
<td>Right</td>
<td>123</td>
<td>67</td>
<td>160</td>
<td>114.69</td>
<td>33</td>
</tr>
</tbody>
</table>

N=375

The pattern of the means in this table supports the correlation results. That is, higher OCLI scores are associated with left brain dominance. Furthermore the pattern and spacing of the means in the three categories indicates that the assumption of linearity inherent in doing the correlation analysis is appropriate.

Hypotheses Regarding Age

Two hypotheses were included to examine the relationship between the major variables and their relevance to studying adult learners. They are designed to consider each major variable vis-a-vis age. A Pearson product-moment correlation coefficient was used to test the following null hypotheses.

H02: There is no statistically significant relationship between scores on the OCLI and age.
There is no statistically significant relationship between scores on the WAPI II and age.

In both cases, significant positive relationships were found, thus both null hypotheses were rejected. The correlation coefficient between total OCLI score and age was found to be significant with an $r$ of .30 as shown in Table 11 ($p < .01$). This means that the older participants in this study tended to be more self-directed than the younger participants.

The correlation coefficient between adjusted WAPI scores and age was found to be significant with an $r$ value, as shown in Table 11, of .21, ($p < .01$). This relationship suggests that the older participants in this study tended to be more left-hemisphere dominant than the younger participants.

**Hypotheses Regarding Attribute Variables**

As noted in Chapter 3, several hypotheses were considered to examine the relationship between scores on the Oddi Continuing Learning Inventory and the attribute variables. The following paragraphs will discuss the findings regarding the supporting variables of gender, health, mental exercise, and number of years in school.
Ho₄: There is no statistically significant difference between scores on the OCLI and gender.

In this test, the null hypothesis was retained. As shown in Table 7, the mean OCLI score for males was 115.78, and the mean score for females was 119.35. A t-test showed no significant difference between these two means at a .05 level of significance. This means that gender was not a factor in self-directedness among this sample.

Ho₅: There is no statistically significant relationship between scores on the OCLI and perceived health.

In this correlational test, the null hypothesis was rejected. Perceived health had a significant positive relationship with scores on the OCLI as shown in Table 11 at a .05 level of significance. This finding suggests that persons who are more self-directed tend to perceive themselves to be physically healthy. This finding is consistent with those that believe positive self-concept is a characteristic of self-directedness.

Ho₆: There is no statistically significant relationship between scores on the OCLI and amount of mental exercise.

In this correlational test, the null hypothesis was
rejected. The amount of mental exercise taken per day shows a significant positive relationship with scores on the OCLI. This relationship is found in Table 11 at the .05 level of significance. This finding suggests that the individuals in this study who were more self-directed also tended to spend more time involved in keeping their minds active.

\( H_{07} \): There is no statistically significant relationship between scores on the OCLI and number of years in school.

In this correlational test, the null hypothesis was rejected. The number of years in school showed a significant positive relationship with scores on the OCLI as shown in Table 11 at the .05 level of significance. This finding suggests that those individuals who are more self-directed have spent more time in school than those who are less self-directed.

The following additional hypotheses considered the relationship between scores on the Refined Wagner Preference Inventory for hemisphericity and the four attribute variables.

\( H_{08} \): There is no statistically significant difference between scores on the WAPI II and gender.
In this test, the null was retained. As demonstrated in Table 7 the mean score for males was -0.96 and the mean score for females was -0.72. A t-test showed no significant difference between hemisphericity and gender at the .05 level of significance. This is not an unusual finding, according to Springer and Deutsch (1985) most studies, both published and unpublished, do not report a gender difference in hemisphericity.

Ho9: There is no statistically significant relationship between scores on the WAPI II and perceived health.

The null hypothesis was retained with an r of .032. No significant correlation was found as shown in Table 11. There seems to be no apparent relationship between health and cognitive structure in the current sample. This indicates that health is not a factor in hemisphere preference.

Ho10: There is no statistically significant relationship between scores on the WAPI II and amount of mental exercise.

In this correlational test, the null hypothesis was rejected as shown in table 11 at the .05 level of significance. This finding suggests that left hemisphere
dominant respondents tended to get more mental exercise on a daily basis.

$H_{011}$: There is no statistically significant relationship between scores on the WAPI II and number of years in school.

The null hypothesis was rejected at the .05 level of significance. This correlational test found a significant positive correlation between hemisphericity and number of years in school. This suggests that education and hemisphere dominance do have some common ground. However, because of the evidence that hemisphericity is biologically bound, this finding does not suggest that longevity in the school system determines hemisphere dominance. This finding does suggest that those persons in the study who were more highly self-directed tended to be involved in educational experiences longer than those who were less self-directed. This supports the earlier suggestion that education may impact hemisphere dominance.

In summary, findings of significance with respect to the demographic variables were that positive relationships between self-directedness and age, mental exercise, education, and health were identified. In addition, positive relationships were also identified between
hemisphere dominance and age, mental exercise, and education.

The Regression Hypotheses

The final two hypotheses tested what combination of all of the study variables made significant contributions to hemisphericity or self-directedness. To test the relationship of OCLI and WAPI to other variables of interest ($H_{02}$ and $H_{13}$), a stepwise multiple regression was performed. Multiple regression determines the collective and separate contribution of the independent variables to the dependent variable (Kerlinger, 1973). Its purpose is to discover general explanations of natural events by explaining variation in the variables.

$H_{02}$: The squared multiple correlation coefficient between the dependent variable self-directedness (OCLI) and the combination of the independent variables (WAPI) age, gender, years in school, health, mental exercise is equal to zero.

The null hypothesis was rejected. The $R^2$ of .27 is statistically significant at the .05 level of significance. All of the test variables entered into the regression equation on OCLI at the .05 level of significance. The variables used in this study accounted for 27% of the
variance in self-directedness. This means that all of the variables tested were statistically useful in predicting self-directedness. Information regarding the regression is presented in Table 13.

Table 13. Summary Table for Stepwise Multiple Regression of Independent Variables on Self-Directedness.

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable Entered</th>
<th>Partial $R^2$</th>
<th>Model $R^2$</th>
<th>% change in $R^2$</th>
<th>Sig. Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Education</td>
<td>.11</td>
<td>.11</td>
<td>-</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>2</td>
<td>Health</td>
<td>.06</td>
<td>.17</td>
<td>54.55</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>3</td>
<td>Age</td>
<td>.04</td>
<td>.21</td>
<td>23.53</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>4</td>
<td>Mental Exe.</td>
<td>.03</td>
<td>.24</td>
<td>14.30</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>5</td>
<td>Gender</td>
<td>.02</td>
<td>.26</td>
<td>8.33</td>
<td>p &lt; .05</td>
</tr>
<tr>
<td>6</td>
<td>WAPI</td>
<td>.01</td>
<td>.27</td>
<td>3.85</td>
<td>p &lt; .05</td>
</tr>
</tbody>
</table>

All the independent variables were entered into the equation with significance levels below .01 in all cases. Since all variables were entered into the model it indicates that the demographic variables are all important in determining self-directedness. It is important to note that, even after considering the effects of the demographic variables, hemisphericity (WAPI) is an important predictor.
The analysis yielded the following regression equation for predicting self-directedness:

\[
Y = 93.42 + 1.39(X1) + 6.66(X2) + .20(X3) + 3.02(X4) + 3.72(X5) + .36(X6)
\]

where \(Y\) is the OCLI score, \(X1\) is the number of years in school, \(X2\) is the coded health score, \(X3\) is the age of the respondent, \(X4\) is the coded score on the mental exercise question, \(X5\) is gender (with males coded as a 1 and females as a 2), and \(X6\) is the WAPI score.

The regression coefficients in the above equation represent the effects of each of the independent variables on OCLI after accounting for the effects of the other variables. As such they are in a sense more refined indicators of the effect of each of the variables than were the univariate statistics presented earlier (e.g. the OCLI means by gender and the correlation of OCLI and WAPI).

Each regression coefficient represents the change in the predicted OCLI score associated with a unit change in the independent variable. For example, a unit change on the WAPI score produces a change of .36 in the predicted OCLI score and a change of one year in age results in a change of .20 in the predicted score on the OCLI. The difference between being male and female (i.e. going from a code of 1
to a code of 2 for gender) produces a change of 3.72 in the predicted OCLI value.

The regression analysis showed that there was a significant relationship between hemisphericity and self-directedness in this sample. Specifically, high scores on WAPI (i.e. left brain dominance) are associated with increased self-directedness as measured by OCLI. Furthermore, the multiple regression results indicate that the relationship was maintained even after controlling for various demographic variables. Finally, the regression equation quantifies the manner in which scores on WAPI and the other variables can be used to predict which individuals will likely exhibit high levels of self-directedness.

To assess the relationship of the demographic variables to the variable WAPI, a stepwise regression was performed. In this regression, WAPI was the dependent variable and age, gender, education, mental exercise, and health were the independent variables.

$H_{013}$: The squared multiple correlation coefficient between the dependent variable hemisphericity (WAPI) and the combination of the independent variables OCLI, age, gender, years in school, health, mental exercise is equal to zero.
The null hypothesis was rejected. The $R^2$ of .06 is statistically significant at the .05 level of significance. Only age ($p = .00$) and mental exercise ($p = .03$) entered into the equation at the .05 level of significance or stronger. The remaining variables did not contribute significantly to predicting WAPI scores. The results are presented in Table 14.

Table 14. Summary Table for Multiple Regression of Independent Variables on WAPI.

<table>
<thead>
<tr>
<th>Step</th>
<th>Variable</th>
<th>Partial $R^2$</th>
<th>Model $R^2$</th>
<th>% Change in $R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Age</td>
<td>.05</td>
<td>.05</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>Exercise</td>
<td>.01</td>
<td>.06</td>
<td>20.00</td>
</tr>
</tbody>
</table>

The resulting regression or prediction equation was:

$$Y = -4.03 + .07(X_1) + .66(X_2)$$

where $Y$ is the predicted WAPI score, $X_1$ is the age of the subject in years, and $X_2$ is the coded level of mental exercise. This finding suggests that to an extent, hemisphere dominance can be predicted by a combination of age and amount of mental exercise one tends to engage in.
SUMMARY AND CONCLUSIONS

The previous chapters have established the purpose of the study, examined the related literature, determined the methodology, and displayed the findings. This chapter is divided into three parts. First, is a brief summary of the previous four chapters. Next, a brief review of the instruments used in the study is presented. This review discusses some problems encountered with the instruments and some suggestions for future researchers who use them. Finally, the chapter will examine the several implications of this study for future research and theory-building.

The Purpose of the Study

As stated in Chapter 1, the theoretical purposes of this study were to:

1) Add to our understanding of learning theory.

2) Clarify the role of self-directedness within the realm of self-directed learning in adult education.
3) Identify the role of hemisphericity in adult education.

The adult education literature was found to be replete with discussions regarding the lack of empirical evidence distinguishing adult learning from childhood learning. To begin to lend empirical evidence to make this distinction, self-directedness was chosen as a quantifiable measure of adulthood and hemisphericity as representative of cognitive learning style. If evidence could be found to support this relationship, a better understanding of adult learning theory as well as learning theory in general would result. To operationalize these broad concepts, self-directedness was measured as a personality construct and hemisphericity was measured as a cognitive learning style.

The Participants in the Study

A total of 392 individuals participated in the study. Participation was completely voluntary; however, only negligible refusal to participate in the study was noted. Only two of the packets were completely unusable because of inadequate data.

The participants were all students in intact classroom groups. The majority of the university classes selected
were chosen for their status as a core curriculum course. These classes were chosen so as to not bias the study. For example, classes in areas such as English, art, statistics, and logic were avoided to control for possible hemisphere dominance bias. Approximately two-thirds of the study sample were attending Montana State University. The remaining third were participating in Elderhostel sessions held in the state of Montana.

Subjects ranged in age from 18 to 78, with a mean of 30.5 years of age. Slightly more than half of the sample were women. A range of 4 to 23 years of formal education was reported by the participants, with an average of 14 years in school.

Procedure

Data were collected using a demographic questionnaire and two instruments. Self-directedness was measured using the Oddi Continuing Learning Inventory (OCLI). This instrument is a 24-item Likert scale that provides a score for self-directedness as a personality construct. It was developed in 1984 and is a relatively new instrument. A reliability coefficient of .73 found in this study was felt to be consistent with the findings of earlier studies using the scale, including those of the developer.
Hemisphericity was measured through Wagner and Wells' instrument, the \textit{Refined Wagner Preference Inventory} (WAPI II). This 12-item forced-choice inventory is a new instrument and therefore has had limited use, other than by the developers. However, the reliability coefficient of .66 seems to be within the range that would make it an instrument appropriate for use in the present study.

The instruments were administered in group settings. A written set of instructions read before giving out the test packet was designed to insure consistency in administration. All but two of the administrations were performed by this researcher. In the other cases, a research assistant, trained in administration gave the study packets.

\textbf{Findings}

\textbf{Self-directedness}

A mean score of 117.8 was found on the OCLI which was lower than scores found in other studies that used this instrument. Scores on the OCLI were found to correlate in a significant manner with the variables WAPI, age, educational attainment, mental exercise, and health. Mean OCLI scores were slightly higher in females than in males, but the difference was not statistically significant.
Hemisphericity

Scores on the WAPI II showed that, of the 390 participants completing the entire instrument, 87 (22%) demonstrated a left hemisphere dominant learning style, 177 (45%) were considered to be balanced between both hemispheres, and 126 (33%) of the participants demonstrated a right hemisphere dominant learning style. Self-directedness, mental exercise, and age all correlated significantly with hemisphericity. No significant relationship was found between hemisphericity and perceived health, or hemisphericity and educational attainment. The mean WAPI scores were shown to be within the balanced range (+3 to -3) with no significant difference between male and female respondents.

Hypotheses

One main hypothesis regarding hemisphericity and self-directedness, two hypotheses regarding the major variables and age, and a number of hypotheses regarding the two main variables and selected attribute variables were tested. Each of these hypotheses are summarized below. All hypotheses are stated in the null form.

Ho₁: There is no statistically significant relationship between scores on the OCLI and scores on the WAPI II.
A significant positive correlation existed between self-directedness and left hemisphere dominance. This finding suggested that the person who demonstrated a high degree of self-directedness also tended to be left hemisphere dominant. Two hypotheses were included to make the relationship between the major variables relevant to the specific study of adult learners. They were designed to link each major variable with age.

Ho2: There is no statistically significant relationship between scores on the OCLI and age.

Ho3: There is no statistically significant relationship between scores on the WAPI II and age.

In both cases, a significant positive relationship was found. This means that the older participants tended to be both highly self-directed and left hemisphere dominant.

Several hypotheses (Ho4 through Ho11) were considered to examine the relationship between scores on the Oddi Continuing Learning Inventory and the attribute variables of gender, health, years in school, mental exercise and WAPI. In addition, similar hypotheses were considered to examine scores on the Refined Wagner Preference Inventory and the same attribute variables and with OCLI.
Significant relationships were found to exist between the OCLI scores and all of the attribute variables. But of these variables, only scores on the OCLI, and mental exercise correlated significantly with scores on the WAPI II.

The final two hypotheses examined the contribution that all of the attribute variables made in the prediction of self-directedness and in the prediction of hemisphericity.

\[ H_{012} \]: The squared multiple correlation coefficient between the dependent variable self-directedness (OCLI) and the combination of the independent variables WAPI, age, gender, years in school, health, mental exercise is equal to zero.

A regression equation was found that accounted for 27% of the variance in self-directedness. All of the test variables contributed to predicting self-directedness. Education alone accounted for about 11% of this variance.

\[ H_{013} \]: The squared multiple correlation coefficient between the dependent variable hemisphericity (WAPI) and the combination of the independent variables OCLI, age, gender, years in school, health, mental exercise is equal to zero.
A regression equation was found that accounted for 6% of the variance in hemisphere dominance. Only two of the test variables, age and mental exercise contributed to predicting hemisphericity in an individual. The variable age accounted for 5% of the variance.

Issues Surrounding The Study Instruments

As observed in Chapter 4, when working with new areas of research, the instruments available are often comparatively untested. Each research effort that uses the instruments adds to establishing their validity and reliability. Therefore, it may be useful to express some thoughts regarding both instruments used in this study.

Oddi Continuing Learning Scale

Since the development of the Oddi Continuing Learning Inventory in 1984 at least three studies have reaffirmed its validity and reliability. However, difficulty in administration of the scale was encountered by this investigator and should be expressed. Oddi (1984) stated that one of the reasons for developing her scale was to address the problems encountered with the administration of Guglielmino's (1977) scale with certain subgroups of the adult population. Some of the participants in the current study volunteered comments regarding questions on this
instrument. Although 375 of the 390 participants filled out the entire scale, many of them felt that the questions did not reflect their current life status. For example, for college students in the early adult age range the following questions were often difficult to respond to:

2. My work is beneficial to society.

9. I regularly read professional journals.

A different set of questions gave the upper age range groups, especially those who have retired, some difficulty:

9. I regularly read professional journals.

11. I volunteer for new assignments.

12. I'm not comfortable with my performance on an assignment until my supervisor, teacher or colleague says it's acceptable.

Item number 20 also presented a problem with some participants. Some older respondents reported that they felt incapable of answering this question. Even though they attended semiformal or formal classes, they did not relate to the teacher-student relationship that this question implied. It is suggested that question number 20;

20. When in school, I tend to have difficulty estimating whether or not the teacher is going to like my work.

be revised to be more universally relevant to semiformal, informal, and self-directed learners.
The response categories seemed to be appropriate. However, upon scoring, it was noted that some respondents started out the scale marking the questions opposite of the instructions. Precaution was taken in the verbal explanation and in the written preface to the scale to mark response number 7 to indicate "strongly agree" to mark response number 1 to indicate "strongly disagree" with the statement. Still many respondents mistakenly answered on the scale as if response number 1 indicated strongly agree. When the author entered all of the data into the computer to be scored, it was noted that approximately 15 participants crossed out responses made in error and started over. Incorrect responses were made until approximately statement number 6 or 7 when the respondent would realize the error, cross out the incorrect responses and began again.

One possible explanation of this occurrence could be that this came about in part because of the example statement/response given on the preface sheet. The preface sheet written by the author of the scale reads:

```
SD SA
"I am too old to learn anything new"  1  2  3  4  5  6  7
```

In the sample, the response was 7 or "strongly agree." Some respondents in the middle to older age ranges may not
only disagree but find this offensive. To avoid false starts, it is possible that either a more age-sensitive or a more positive sample statement should be used in future printed copies of this scale.

As reported earlier, the mean number of years in school among the study participants was higher than average. However, there was still some difficulty by the participants to answer some of the questions. Thus, lack of experience or education of the respondents was not likely the cause of the response problems.

To bring conclusion to this discussion, it was felt that the instrument continues to be a reliable and valid measure of self-directedness as a personality trait. However, some minor semantic changes in certain questionable statements on the OCLI would improve the instrument.

Refined Wagner Preference Inventory

None of the respondents reported difficulty with interpreting the instructions or knowing how to respond on the WAPI II. However, it was noted that some respondents did not like being forced to indicate a preference among four choices of which none would necessarily be preferred over any of the others. A few respondents felt that their
scores did not reflect their idea of how they think. For example, one female participant felt that her score, which indicated she was right hemisphere dominant, did not reflect her engineering career. However, when informally questioned further, she described her job as one in which creative and spacial traits are highly desirable. Therefore, her right hemisphere dominant score was indeed consistent with her daily activity. The Refined Wagner Preference Inventory requires continued use and testing in order to add to its validity and reliability. It should be remembered that the WAPI II is a test of hemisphere preference, not of innate hemisphere dominance. The instrument measures learned cognitive style. However, it is still recommended for use in studies such as this one, where being able to determine the degree of hemisphere lateralization greatly enhances the ability to analyse the results.

Implications for Practice

The findings of this study suggested that older adults tended to be more left-hemisphere dominant. However, this finding does not confirm that our educational system has promoted only left hemisphere teaching techniques. Nor should it be concluded that educators in the United States
should specifically promote left hemisphere, or right hemisphere teaching techniques in the future. Without further research into the role of hemisphericity in adult education, a caveat against leaping into curriculum design based on current findings is warranted.

The findings also suggested that older adults tended to be more self-directed. It is believed that this gives support to Knowles' (1980) andragogical principle that adults are self-directed in their self-concept. However, the mean scores of this sample were lower than those in other samples. This low mean, together with a large standard deviation, indicates that there is great variety in the scores of adults on the OCLI. Therefore, it should not be concluded that all adults are self-directed. The implication for practice is that self-directed teaching techniques should not be the sole, or even preferred, method of teaching in a formal or semiformal setting.

One of the anticipated contributions of this study was to add to a better understanding of learning theory. Another way of interpreting these findings regarding hemisphericity and self-directedness is that they support Houle's (1972) implication that self-directedness is the result of, not the means of education. Combining Houle's theory with Knowles' application, the first assumption of
adragogy then is the process of the self-concept moving from one of dependence toward one of self-directedness and is the personification of the learning process itself.

The finding that left hemisphericity and age are linked suggests that, as the adult matures, characteristics identified as left hemisphere specific tend to be enhanced. These characteristics include convergent, sequential thinking; the ability to think critically, and a serious, sequential, logical approach to education. This finding could explain why adults who return to post secondary education often have a more successful experience than they did in early adulthood or before their lateralization was complete.

Knowledge of an adult student’s degree of self-directedness is useful in selecting appropriate learning settings, thereby insuring success. Likewise, knowledge of an adult student’s hemisphere dominance can help a student select a compatible learning situation and lessen the risk of failure. This does not imply that students should change their preferred style, nor does it imply that teachers should change their teaching method. Rather it implies that students should be provided the skills with which to judge their own learning style and then select a compatible learning experience. It is useful knowledge the
advisor and adult student alike to know the student's hemisphere dominance. It can be concluded that understanding learning process through cognitive learning style, specifically hemisphericity, is equally as important in learning outcomes as any teaching technique or curriculum design.

**Conclusions and Recommendations**

From the findings in this study, several conclusions can be drawn. Those conclusions are presented below.

First, the statistically significant relationship found to exist between a high degree of self-directedness and a left hemisphere dominant learning style is inconsistent with the results reported by Even (1982), and Torrance and Mourad (1978). Both previous studies identified right hemisphere dominance as a correlate of self-directedness. However, as noted earlier, both studies were unable to explain hemisphere dominance on a definitive scale. Even's "two shape test" used to determine hemisphere dominance was far too simplified in its methodology to lend empirical verification to the research. In Torrance and Mourad's study, the design of the study instrument forced differentiation of hemisphere preference into just three categories: left, right, and integrated. The current study
showed that analysis of the data using categorical methods caused important data to be lost. In addition Torrance and Mourad's study suffered from possible sampling bias. They reported their findings based on a test sample of 41 participants, all of whom were students in the major author's university class in creative thinking. As was discussed in Chapter 2, one of the characteristics of right hemisphere dominance is creativity, implying that this sample selection might be biased to right hemisphere dominance. It is concluded that this study brings into significant question the results of previous studies. It is therefore recommended that repetition of these studies be performed.

Second, the significant positive correlation between age and self-directedness, as measured by the OCLI, is consistent with the findings of Six (1987) and Oddi (1984). In light of this finding, it can be concluded that older adults tend to be more self-directed than younger adults. This being true, an even greater difference in degree of self-directedness between adults and children might be expected.

Third, a significant positive correlation between hemisphericity and age suggests that older adults tend to be more left hemisphere dominant. These findings are
consistent with neuropsychological studies demonstrating that our verbal ability (left hemisphere) does not decline with old age but visuospatial ability (right hemisphere) does (Koss, 1987). There have been no other studies that compared hemisphere dominance and age using the WAPI II. However, in studies between age and other cognitive learning styles, (Davenport, 1986) this finding was consistent with the findings that older adults prefer linear and ordered materials, both left hemisphere dominant traits.

Due to the cross-sectional design of the study, it cannot be definitively concluded that self-directedness or hemisphericity actually change with age. However, the observed relationships are consistent with the hypothesized trends in the sense that, if such changes do occur with age they would produce the kinds of cross-sectional patterns observed in this study.

Fourth, the number of years of formal education attained correlated significantly with both self-directedness and with hemisphericity. With regard to self-directedness, this means that the more years in school an individual has completed, the more self-directed he or she tends to become. This finding supports other studies (Brockett, 1982) on self-directed learning that also found
this positive relationship. Since the test in this study showed correlation, but not causation, it cannot be stated that the length of time in school determines self-directedness or that high scores in self-directedness determine how long an individual will stay in school or seek educational experience. However, the multiple regression showed education to be a predictor of self-directedness by accounting for 11% of the variance. It is concluded that education does contribute substantially to the degree of human self-direction.

The other noteworthy finding regarding the number of years in school is that it correlated significantly with left hemisphere dominance. This finding was surprising, since the hemisphericity literature suggests that hemisphere dominance is biologically based, and not a learned trait. Corbalis (1983) believed that the lateralization of the brain is in part evolutionary in nature and led to the species-specific ability to speak. While studying handedness, Annett (1981) found a genetic basis for cerebral dominance. She found that parents can actually pass on the trait for hemisphere dominance. However, the instrument used to measure hemisphericity in this study measures hemisphere preference and not innate hemisphere dominance. The finding therefore suggests that
hemisphere dominance responds to nurture as well as nature and therefore is responsive to the learning/teaching transaction. It is concluded that education in general has an effect on the preference for left hemisphere dominance.

Fifth, virtually all of the participants considered themselves to be in either good or excellent health. Because of this, the variable "health" could not effectively be evaluated as a descriptive variable in this study. However, there was found to be a significant positive correlation between health and self-directedness. In addition, the variable entered into the regression equation as the second most significant predictor of OCLI. Although no particular conclusions can be drawn from this finding, further research in this area is suggested.

No significant relationship was found between health and hemisphericity. Therefore, this study does not support perceived health as either a correlate, or predictor of hemisphericity.

Sixth, the amount of mental exercise performed daily correlated significantly with both of the major variables. This significant positive relationship suggests that the more self-directed one is, the more mental exercise one will tend to perform daily. This finding suggests that an
active and pliable mind plays an important role in the degree of self-directedness.

The amount of mental exercise performed daily also showed significant positive correlation with hemisphericity. Along with age, mental exercise was the only variable that entered into the prediction equation of hemisphere dominance. This relationship may appear contradictory in light of the believed biological base of hemisphere dominance. However, it is felt that this relationship supports Diamond's (1984) findings that both genetic programming and environment play an important role in intellectual development. It also supports Schaie's (1958) conclusion that persons who engage in cognitive emotive activity age more successfully than those who do not. Even if we are born with an inherent ability to learn, and a genetic link that determines the way in which we process information, environmental factors play a role in the upkeep of that inheritance. It is concluded that persons who keep the mind/brain active are more successful in maintaining this biological process throughout old age.

Finally, in this study female participants tended to be more highly self-directed and less lateralized than males; however, the difference was not statistically significant. This finding is consistent with multimethodological studies
of brain lateralization that find females to generally be slightly less lateralized than males (Springer and Deutsch, 1985). However, it is premature to draw specific conclusions from this finding due to lack of statistical significance. Further research in the area of gender differences in both self-directedness and hemisphericity should be conducted to further clarify this finding.

**Recommendations for Future Research**

As is usual with any research effort, the findings in this work have stimulated many questions for future research. The discussion of the findings in this research effort are divided into three areas: 1) research needs in the study and measurement of self-directedness, 2) the study and measurement of hemisphericity as a cognitive learning style, and 3) general recommendations.

**Self-Directedness**

An intended contribution of this study was to aid in the clarification of the meaning and role of self-directedness in adult education. This study supports the view that it is both relevant and important to study self-directedness as a personality construct. It also supports the continued use of the Oddi Continuing Learning Inventory as a reliable and valid measure of self-directedness from a
personological perspective. It is recommended that other characteristics of self-directedness be examined to further define our understanding of both the adult learner in general and the self-directed learner specifically. Suggested characteristics for further study include: assertiveness, self-confidence, and competitiveness.

Further, it is recommended that a correlational study similar to this one be conducted jointly by experts in both educational psychology and adult education, to administer tests for hemisphericity and self-directedness across the entire age span. Such a study would be conducted to confirm the linear relationship found in this study between hemisphericity and age, and self-directedness and age extended over the entire life span.

**Hemisphericity**

Another intended contribution of this study was to solidify the role of hemisphericity in adult education. This study supports the view that hemisphericity plays an important role in adult education. It also supports the continued use of the Refined Wagner Preference Inventory in measuring hemisphericity to add further reliability and validity to the instrument. However, in view of the low reliability coefficient, it is recommended that the
inventory be tested for content validity by comparing it to scores obtained on other paper and pencil hemisphericity tests or physical testing for hemisphere dominance. The ease of administration in both a group or individual setting, its brevity, and immediate feedback that it provides makes the WAPI II a highly desirable test instrument.

**General Recommendations**

The results of this study are in conflict with the findings of Torrance and Mourad (1978) who found a significant positive relationship between self-directedness and right hemisphericity. It is therefore recommended that replications of this study be conducted to verify a directional link between hemisphere dominance and self-directedness.

One limitation of this study was the cross-sectional design. It is recommended that longitudinal studies be undertaken to determine whether the correlations detected in this study are reflective of actual changes within individuals as they age.

**Concluding Comment**

It would appear that there is substance to the idea that adult learning theory is indeed a separate theory from
general learning theory. The study responds in part to Brookfield's challenge that

\[
\text{If we could discover certain empirically verifiable differences in learning styles between children . . . and adults . . . then we could lay claim to a substantive area for research that would be unchallengeably the property of educators and trainers of adults (1986, p. 33).}
\]

This research lends empirical evidence to that challenge by identifying self-directedness and hemisphericity as two constructs that are different in older adults than younger adults.
REFERENCES CITED


Cafferella, R. S. (1982). The learning plan format: A technique for incorporating the concept of learning how to learn into formal courses and workshops. Paper presented at the Lifelong Learning Research Conference, College Park, MD.


APPENDICES:
APPENDIX A

Instruments Used in the Study
THE OCLI

PURPOSE: This set of statements is designed to collect information on how you approach learning. There are no "right" or "wrong" answers to these statements. Rather, you should indicate on the scale provided how much you agree or disagree that each item describes your behavior.

HOW TO RESPOND: Read each item and choose the response number that best indicates how much you agree or disagree that the item describes your behavior. Do not think too long about the statement. Your first reaction will usually be your most accurate response. If you have difficulty responding, select the one response that is least objectionable and move on.

Please select only ONE response to every statement.

Please respond to EVERY statement.

HOW TO MARK RESPONSES: To mark your response, find the number of the response that best describes how much you agree that the item describes you.

7 - STRONGLY AGREE. You would agree most of the time.
6 - MODERATELY AGREE. You would frequently agree.
5 - SLIGHTLY AGREE. You would occasionally agree.
4 - UNDECIDED. You can't really agree or disagree with the item.
3 - SLIGHTLY DISAGREE. You would seldom agree.
2 - MODERATELY DISAGREE. You would infrequently agree.
1 - STRONGLY DISAGREE. You would almost never agree.

EXAMPLE: In the sample statement below, if you strongly agree with the item, you would circle the "7."

118. I am too old to learn anything new. 1 2 3 4 5 6 7

Answer column

Please turn the page and begin.

© 1984 L. F. Oddi
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<td>Strongly</td>
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<td>UNDECIDED</td>
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<td>1.</td>
<td>I successfully complete tasks I undertake.</td>
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<td>2.</td>
<td>My work is beneficial to society.</td>
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<td>3.</td>
<td>I seek involvement with others in school or work projects.</td>
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<td>4.</td>
<td>I make an effort to learn the meaning of new words I encounter.</td>
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<td>5.</td>
<td>My values and beliefs help me to meet daily challenges.</td>
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<td>6.</td>
<td>I seek the views of others when I am curious about something.</td>
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<td>7.</td>
<td>I have a hobby (such as writing, painting, or making things) which provides me with a means of self-expression.</td>
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<td>8.</td>
<td>I am able to resist the efforts of others to pressure me into doing something I don't want to do.</td>
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<td>9.</td>
<td>I regularly read professional journals.</td>
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<td>10.</td>
<td>I select serious literature (such as history, biographies, or the classics) for my reading pleasure.</td>
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<td>11.</td>
<td>I volunteer for new assignments.</td>
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<td>12.</td>
<td>I'm not comfortable with my performance on an assignment until my supervisor, teacher, or colleague says it's acceptable.</td>
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<td>13.</td>
<td>I have been an eager reader since childhood.</td>
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<td>14. After I read a book or see a play or a film, I talk to others to see what they think about it.</td>
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<td>15. I resist judging others (such as new managers or teachers) until I've had an opportunity to associate with them.</td>
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<td>16. When I do a job well, it's because I have been prepared and have put in personal effort.</td>
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<td>17. I find it difficult to judge if I've performed well or poorly on a task such as giving a speech, writing a paper, or answering a test question.</td>
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<td>18. Once I start to work on a task, I keep working until it's done to my satisfaction.</td>
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<td>19. I read an average of one or more national news magazines each week.</td>
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<td>20. When in school, I tend to have difficulty in estimating whether or not the teacher is going to like my work.</td>
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<td>21. I find it useful to think about people (or refer to them) according to categories (such as by education, occupation, race, or ethnic background).</td>
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<td>22. I work more effectively if I have freedom to regulate myself.</td>
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<td>23. I make an effort to meet new people.</td>
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<td>24. Being afraid to take a chance has prevented me from doing something I have wanted to do at some time in my life.</td>
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WAGNER PREFERENCE INVENTORY

Read the statements carefully. There are 12 statements with four items each. Place a cross mark (X) in the appropriate bracket in front of each item you select. Mark one item only under each of the 12 statements. Choose the activity you prefer even though it does not necessarily mean that you have ability to do it. If you are undecided, make a decision anyway by guessing.

1. ( ) a. Major in logic
   ( ) b. Write a letter
   ( ) c. Fix things at home
   ( ) d. Major in Art

2. ( ) a. Be a movie critic
   ( ) b. Learn new words
   ( ) c. Improve your skills in a game
   ( ) d. Create a new toy

3. ( ) a. Improve your strategy in a game
   ( ) b. Remember people's names
   ( ) c. Engage in sports
   ( ) d. Play an instrument by ear

4. ( ) a. Review a book
   ( ) b. Write for a magazine
   ( ) c. Build new shelves at home
   ( ) d. Draw a landscape or seascape

5. ( ) a. Analyze market trends
   ( ) b. Write a movie script
   ( ) c. Do carpentry work
   ( ) d. Imagine a new play

6. ( ) a. Analyze management practices
   ( ) b. Locate words in a dictionary
   ( ) c. Put Jigsaw puzzles together
   ( ) d. Paint in oil

7. ( ) a. Be in charge of computer programming
   ( ) b. Study word origins and meaning
   ( ) c. Putter in the yard
   ( ) d. Invent a new gadget

8. ( ) a. Analyze production cost
   ( ) b. Describe a new product in words
   ( ) c. Sell a new product on the market
   ( ) d. Draw a picture of a new product

9. ( ) a. Explain the logic of a theory
   ( ) b. Be a copy writer for ads
   ( ) c. Work with wood and clay
   ( ) d. Invent a story

10. ( ) a. Be a comparison shopper
    ( ) b. Read about famous men and women
    ( ) c. Run a traffic control tower
    ( ) d. Mold with clay and putty

11. ( ) a. Analyse your budget
     ( ) b. Study Literature
     ( ) c. Visualize & rearrange furniture
     ( ) d. Be an artist

12. ( ) a. Plan a trip and make a budget
     ( ) b. Write a novel
     ( ) c. Build a house or shack
     ( ) d. Make crafts your hobby

Scoring

Add the number of responses for each of the four categories (a, b, c, and d) and enter them into the spaces. Each cell contains the subscore of the particular category. A difference of at least 3 points between left & right is needed to show a significant difference. Otherwise, the ratio is considered to be balanced.
Please take a minute to fill in this information sheet.

Age: __________

M _____ F _____

Number of years in school __________

How much time do you spend in a day reading, solving problems, playing word games like crossword puzzles or scrabble, or similar activities?

1-2 hrs _____ 2-3 hrs _____ more _____

Do you consider yourself to be in generally,

Excellent health _____ good health _____ poor health _____

Thank you, please go on to the next page.....
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5. The Licensee shall provide Licensor with item scores and demographic data, which shall be used only for further development of the OCLI.

AGREED this 15th day of April, 1987.

Lorys F. Oddi (Licensor)

Constance C. Blackwood (Licensee)

Licensee's research proposal attached.
TO: Constance C. Blackwood  
Kellog Fellow

FROM: Steven Guggenheim, Chair  
Human Subjects Committee

SUBJECT: Questionnaires for Campus Distribution

Because your questionnaires are anonymous and voluntary, they are exempt from the requirements of Human Subjects Committee approval on the basis of Item 46.101 B (2, 3) of the Federal Regulations on Protection of Human Subjects.

Jfl