

DAVID KOLB'S THEORY OF EXPERIENTIAL LEARNING AND LEARNING STYLES

4.1 INTRODUCTION

The experiential learning movement emerged through the theories and work of John Dewey, Kurt Lewin and Jean Piaget. The work of these three theorists form the foundation of Kolb's theory of experiential learning (Hickcox, 1990). Dewey emphasized the need for learning to be grounded in experience, Lewin stressed the importance of a person being active in learning and Piaget described intelligence as the result of interaction of the person and the environment (Claxton & Murrell, 1987). Kolb (1984) regarded Dewey as the most influential educational theorist of the twentieth century as through his work experiential learning ideas have found their way into "traditional" educational programmes. The challenges of coping with change and lifelong learning that Dewey's ideas were developed to address, remain highly relevant. Lewin, through his work in group dynamics research, emphasised the value of subjective personal experience in learning. He was also concerned with the integration of theory and practice. Piaget's work on cognitive development described how intelligence is shaped through experience and the application of Piaget's theory led to the introduction of experience-based learning programmes in schools where children were encouraged to learn through discovery, rather than utilizing memorization.

Kolb's characterization of experiential learning brings together the similarities in the work of these three theorists to provide a unique perspective on learning and development which is described in the next section of this chapter. Whereas Piaget's model focuses on the cognitive development of children and adolescents, Kolb's model is centred more on an **adult** model of learning.

4.2 THE THEORY

4.2.1 Characteristics of experiential learning

Kolb (1984, p. 41) defined learning as follows: "*Learning is the process whereby*

knowledge is created through the transformation of experience. Knowledge results from the combination of grasping experience and transforming it." Experiential learning, according to Kolb, is described by the following characteristics.

4.2.1.1 Learning is a continuous process grounded in experience

Learning should be seen as a process rather than in terms of outcomes. Learning is a process through which knowledge is derived from, and modified through, testing out the experiences of the learner. The purpose of education should be *"to stimulate inquiry and skill in the process of knowledge getting, not to memorize a body of knowledge"* (Kolb, 1984, p. 27). The learning process requires the person to activate prior knowledge, to critically evaluate their existing cognitive structure and then to integrate new or more refined ideas into their cognitive structure.

4.2.1.2 The process of learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world

Kolb in his theory of experiential learning postulated *"two fundamental dimensions of the learning process, each describing basic adaptive processes standing in dialectical opposition"* (Kolb, 1984, p. 74). On the prehension (perceiving) dimension the process of apprehension (concrete experience) opposes the process of comprehension (abstract conceptualisation). Kolb (1984) referred in this regard to research on brain hemisphere dominance that provides evidence that *"there are two distinct, coequal, and dialectically opposed ways of understanding the world"* (p. 48), the right-brain mode corresponding to apprehension and the left-brain mode corresponding to comprehension. On the transformation (processing) dimension the process of intention (reflective observation) opposes the process of extension (active experimentation). Kolb (1984) stated that Carl Jung's concepts of introversion (intention) and extraversion (extension) best describe the transformation dimension.

Learning results from the resolution of conflicts between involvement in new experiences versus conceptualising, and between acting versus reflecting. The way in which these conflicts are resolved determines the level of learning that results and Kolb (1984) stated *"if conflicts are resolved by suppression of one mode and/or dominance by another, learning tends to be specialized around the dominant mode and*

limited in areas controlled by the dominated mode (p.31). It is Kolb's premise that effective learners rely on all four learning modes. Higher forms of adaptation, personal development and creativity require the integration of the four adaptive modes.

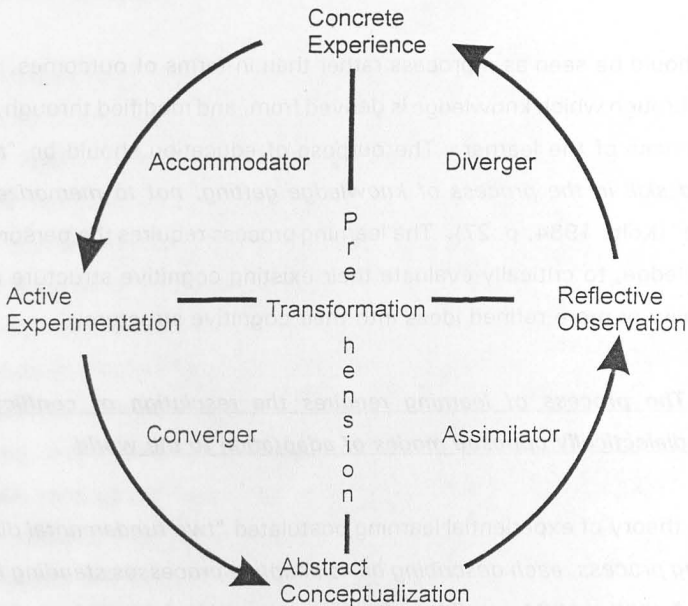


FIGURE 4.1 KOLB'S MODEL OF EXPERIENTIAL LEARNING

4.2.1.3 Learning is an holistic process of adaptation to the world

Learning is a holistic adaptive process involving the integrated functioning of the whole organism: thinking, feeling, perceiving and behaving. It is not confined to the classroom or the lecture hall, but occurs in all human settings, across all life stages. Learning is seen as a continuous lifelong process. Kolb emphasised the need for a holistic theory of learning even though such an undertaking would be incredibly complex, encompassing such areas as creativity, problem solving, decision making, attitude change and human adaptation.

4.2.1.4 Learning involves transactions between the person and the environment

Experiential learning involves *"the transaction between internal characteristics and external circumstances, between personal knowledge and social knowledge"* (Kolb, 1984, p. 133).

4.2.1.5 Learning is the process of creating knowledge

To understand learning one must understand the nature of knowledge and the processes whereby knowledge is created. Knowledge results from the transaction between personal knowledge and social knowledge, between subjective and objective experiences, in a process called learning.

4.2.1.6 The experiential learning cycle

The process of experiential learning is described as a four-stage cycle involving the four learning abilities Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE) (see Figure 4.1). It is theorized that one learns best by going through the CE, RO, AC, AE sequence of the cycle and that people learn more effectively as they develop learning abilities in their areas of weakness. In the experiential learning process concrete experience is followed by observation and reflection, leading to the formation of abstract concepts that result in hypotheses to be tested in future actions and this in turn leads to new experiences. The learning cycle is continuously recurring and is directed by individual needs and goals (Kolb, Rubin & McIntyre, 1984). The four stages of the learning cycle are described in Table 4.1 (Kolb, 1993, p. 5) on the following page.

TABLE 4.1 THE FOUR STAGES OF THE LEARNING CYCLE

<p>Concrete Experience (CE)</p> <p>This stage of the learning cycle emphasizes personal involvement with people in everyday situations. In this stage, you would tend to rely more on your feelings than on a systematic approach to problems and situations. In a learning situation, you would rely on your ability to be open-minded and adaptable to change.</p>	<p>Learning from feeling</p> <ul style="list-style-type: none"> * Learning from specific experiences * Relating to people * Being sensitive to feelings and people
<p>Reflective Observation (RO)</p> <p>In this stage of the learning cycle, people understand ideas and situations from different points of view. In a learning situation you would rely on patience, objectivity, and careful judgment, but would not necessarily take any action. You would rely on your own thoughts and feelings in forming opinions.</p>	<p>Learning by watching and listening</p> <ul style="list-style-type: none"> * Carefully observing before making judgments * Viewing issues from different perspectives * Looking for the meaning of things
<p>Abstract Conceptualization (AC)</p> <p>In this stage, learning involves using logic and ideas, rather than feelings, to understand problems or situations. Typically, you would rely on systematic planning and develop theories and ideas to solve problems.</p>	<p>Learning by thinking</p> <ul style="list-style-type: none"> * Logical analysing ideas * Systematic planning * Acting on an intellectual understanding of a situation
<p>Active Experimentation (AE)</p> <p>Learning in this stage takes an active form - experimenting with influencing or changing situations. You would take a practical approach and be concerned with what really works, as opposed to simply watching a situation. You value getting things done and seeing the results of your influence and ingenuity.</p>	<p>Learning by doing</p> <ul style="list-style-type: none"> * Ability to get things done * Risk-taking * Influencing people and events through action

4.2.1.7 Developmental stages of experiential learning

The model of the experiential learning theory of growth and development depicted in Figure 4.2 (Kolb, 1984, p. 141) links learning and individual development. Dimensions of growth are depicted by a cone with the base representing lower stages of development and the apex the peak of development. It also represents the idea that the four dimensions become progressively more integrated with higher stages of development. The developmental process is represented by three broad stages: acquisition, specialization and integration.

The first stage, or acquisition stage, spans birth to adolescence and is characterized by the acquisition of basic learning abilities and cognitive structures. Kolb uses Piaget's four stages of cognitive development to describe this stage. A person is quite concrete and the self is experienced as undifferentiated and immersed in the world (Claxton & Murrell, 1987).

The second stage, or specialization stage, spans adolescence and young adulthood and is strongly associated with preparing for and entering a career. In this stage a sense of individuality is achieved through specialized adaptive competence in a chosen "career". The self is primarily defined in terms of **content**. The primary mode of relating to the world is **interaction** where the person acts on the world and the world acts on the person, but neither is fundamentally changed by the other (Kolb, 1984). Specialization is a way of coping with a complex world through developing a degree of mastery in a particular area. However this can occur at the expense of personal fulfilment as specialization in one mode may preclude developing skills in other areas (Claxton & Murrell, 1987).

The third stage is referred to as integration and occurs at about age 40 and beyond. The drive for personal fulfilment can be counteracted by the specialization process of the previous stage if the person has to compromise personal fulfilment needs to obtain the rewards of social security and achievement. The existential conflict between the need for specialized competence and personal fulfilment needs heralds the transition from stage two to stage three. The process may occur gradually, or suddenly in response to a life crisis such as losing one's job. It is part of the major shift adults typically experience around mid-life, but some may never experience the transition.

If the transition takes place the self is experienced less as content and more as process and learning processes that were previously suppressed become increasingly integrated into the self.

Kolb's view of human development is one of increasing competence and experience in all four learning abilities and styles leading to greater complexity, relativism and integration. This implies that teaching strategies should ensure that the learner engages in all four the learning modes (Claxton & Murrell, 1987). These authors reported research results that indicated that nursing students became more similar in learning styles as they progressed to the senior years as well as becoming more competent in a diversity of learning modes rather than specializing in one learning style.

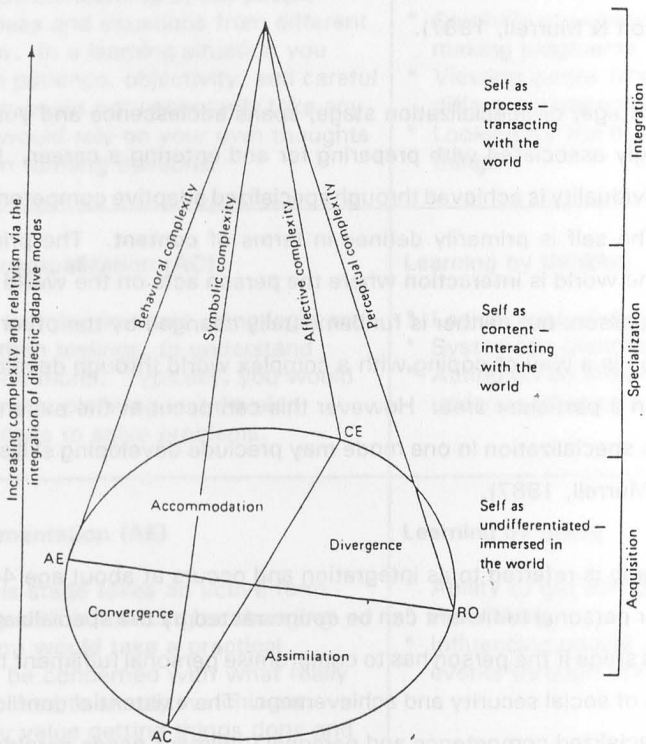


FIGURE 4.2 THE EXPERIENTIAL LEARNING THEORY OF GROWTH AND DEVELOPMENT

4.2.2 Learning abilities and styles

Based on his theory of experiential learning, Kolb proposed four learning abilities: Concrete Experience (CE) (feeling), Reflective Observation (RO) (watching), Abstract Conceptualization (AC) (thinking), and Active Experimentation (AE) (doing). These learning abilities are represented on a two dimensional learning styles plane by two bipolar dimensions, one a vertical axis running from CE to AC, and the other a horizontal axis running from AE to RO. The four quadrants formed by the intersection of the two bipolar axes represent the four learning styles derived from the combination of two preferred learning abilities: Diverger (CE and RO), Assimilator (AC and RO), Converger (AC and AE), and Accommodator (CE and AE). (See Figure 4.1). Kolb (1984) took a contextualist view of learning styles and stated that *"psychological types or styles are not fixed traits but stable states"* (p. 63). These stable states or enduring patterns of individual human behaviour arise from consistent patterns of transactions between the person and the environment. However, an individual can adjust their learning style according to the demands of the task at hand. The four learning abilities and learning styles are described in Tables 4.2 (Kolb, 1984, pp. 68-69), 4.3 (Kolb, 1984, pp. 77-78), and 4.4a and 4.4b (Kolb, 1993, pp. 7, 11) on the following pages.

TABLE 4.2. CHARACTERISTICS OF THE FOUR LEARNING STYLES

CONVERGER	DIVERGER
<p>Focuses on the abstract and logical aspects of the learning process. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories.</p>	<p>Focuses on the concrete and experiential aspects of the learning process. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations.</p>
<p>Focuses on the abstract and logical aspects of the learning process. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories.</p>	<p>Focuses on the concrete and experiential aspects of the learning process. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations.</p>
<p>Focuses on the abstract and logical aspects of the learning process. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories.</p>	<p>Focuses on the concrete and experiential aspects of the learning process. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations.</p>
<p>Focuses on the abstract and logical aspects of the learning process. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories. Prefers to work with numbers, symbols, and logic. Likes to work with abstract concepts and theories.</p>	<p>Focuses on the concrete and experiential aspects of the learning process. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations. Prefers to work with real objects and situations. Likes to work with concrete experiences and situations.</p>

TABLE 4.3. THE LEARNING ABILITIES

TABLE 4.2 THE FOUR LEARNING ABILITIES

CONCRETE EXPERIENCE (CE)	REFLECTIVE OBSERVATION (RO)	ABSTRACT CONCEPTUALIZATION (AC)	ACTIVE EXPERIMENTATION (AE)
<p>FOCUSES ON:</p> <p>being involved in experiences and dealing with immediate human situations in a personal way.</p>	<p>FOCUSES ON:</p> <p>understanding the meaning of ideas and situations by carefully observing and impartially describing them.</p>	<p>FOCUSES ON:</p> <p>using logic, ideas and concepts.</p>	<p>FOCUSES ON:</p> <p>actively influencing people and changing situations.</p>
<p>EMPHASIZES:</p> <ul style="list-style-type: none"> - feeling (* a.o.t. thinking) - concern with uniqueness and complexity of present reality (* a.o.t. theories and generalizations) - intuitive "artistic" approach (* a.o.t. systematic, scientific) to problems 	<p>EMPHASIZES:</p> <ul style="list-style-type: none"> - understanding (* a.o.t. practical application) - concern with what is true or how things happen (* a.o.t. what will work) - reflection (* a.o.t. action) 	<p>EMPHASIZES:</p> <ul style="list-style-type: none"> - thinking (* a.o.t. feeling) - concern with building general theories (* a.o.t. intuitively understanding unique, specific areas) - a scientific approach (* a.o.t. artistic approach) to problems 	<p>EMPHASIZES:</p> <ul style="list-style-type: none"> - practical applications (* a.o.t. reflective understanding) - a pragmatic concern with what works (* a.o.t. what is absolute truth) - doing (* a.o.t. observing)
<p>ENJOY AND ARE GOOD AT:</p> <ul style="list-style-type: none"> - relating to others - intuitive decision makers - function well in unstructured situations 	<p>ENJOY AND ARE GOOD AT:</p> <ul style="list-style-type: none"> - intuiting the meaning of situations and ideas and seeing their implications - looking at things from different perspectives and appreciating different points of view - relying on their own thoughts and feelings to form opinions 	<p>ENJOY AND ARE GOOD AT:</p> <ul style="list-style-type: none"> - systematic planning - manipulation of abstract symbols - quantitative analysis 	<p>ENJOY AND ARE GOOD AT:</p> <ul style="list-style-type: none"> - getting things accomplished - taking some risks to achieve their objectives
<p>VALUES:</p> <ul style="list-style-type: none"> - relating to people - being involved in real situations - having an open-minded approach to life 	<p>VALUES:</p> <ul style="list-style-type: none"> - patience, impartiality and considered, thoughtful judgement 	<p>VALUES:</p> <ul style="list-style-type: none"> - precision - the rigour and discipline of analysing ideas - the aesthetic quality of a neat conceptual system 	<p>VALUES:</p> <ul style="list-style-type: none"> - having an influence on the environment around them - like to see results

*a.o.t. = as opposed to

TABLE 4.3: CHARACTERISTICS OF THE FOUR LEARNING STYLES

CONVERGER	DIVERGER	ASSIMILATOR	ACCOMMODATOR
RELIES PRIMARILY ON THE DOMINANT LEARNING ABILITIES OF:			
CE and AE	CE and RO	AC and RO	AE and CE
<p>GREATEST STRENGTH LIES IN:</p> <ul style="list-style-type: none"> - problem solving - decision making - practical application of ideas 	<p>GREATEST STRENGTH LIES IN:</p> <ul style="list-style-type: none"> - imaginative ability - awareness of meaning and values 	<p>GREATEST STRENGTH LIES IN:</p> <ul style="list-style-type: none"> - inductive reasoning and the ability to create theoretical models - assimilating disparate observations into an integrated explanation 	<p>GREATEST STRENGTH LIES IN:</p> <ul style="list-style-type: none"> - doing things - carrying out plans and tasks - getting involved in new experiences
<p>OTHER CHARACTERISTICS</p> <p>Do best in situations like conventional intelligence tests where there is a single correct answer or solution to a question or problem.</p> <p>Knowledge is organized in such a way that through hypothetical-deductive reasoning it can be focused on specific problems.</p> <p>Controlled in their expression of emotion.</p> <p>Prefer technical tasks and problems rather than social and interpersonal issues.</p>	<p>OTHER CHARACTERISTICS</p> <p>Do best in situations that call for generation of alternative ideas and implications such as brainstorming.</p> <p>View concrete situations from many perspectives.</p> <p>Organize many relationships into a meaningful "gestalt".</p> <p>Emphasis on observation rather than action.</p> <p>Interested in people and tend to be imaginative and feeling oriented.</p>	<p>OTHER CHARACTERISTICS</p> <p>Less focused on people and more concerned with ideas and abstract concepts.</p> <p>Ideas are judged less by their practical value - it is more important that the theory be logically sound and precise.</p> <p>Where the theory or plans do not fit the facts more likely to disregard or reexamine the facts than the theory.</p>	<p>OTHER CHARACTERISTICS</p> <p>Do best in situations where one must adapt oneself to changing immediate circumstances.</p> <p>Emphasis on opportunity seeking, risk taking and action.</p> <p>Solve problems in an intuitive trail-and-error manner.</p> <p>Rely heavily on others for information rather than their own analytic ability.</p> <p>At ease with people but sometimes seen as impatient and "pushy".</p> <p>Where the theory or plans do not fit the facts more likely to discard the plan or theory than the facts.</p>

TABLE 4.4a: CHARACTERISTICS OF THE FOUR LEARNING STYLES

CONVERGER	DIVERGER
<p>People with this learning style are best at finding practical uses for ideas and theories. They have the ability to solve problems and make decisions based on finding solutions to questions or problems. They rather deal with technical tasks and problems than with social and inter-personal issues. These learning skills are important for effectiveness in specialist and technology careers.</p>	<p>People with this learning style are best at viewing concrete situations from many different points of view. Their approach to situations is to observe rather than take action. They enjoy situations that call for generating a wide range of ideas, as in brainstorming sessions. They have broad cultural interests and like to gather information. This imaginative ability and sensitivity to feelings is needed for effectiveness in arts, entertainment and service careers.</p>
<p>STRENGTHS</p> <ul style="list-style-type: none"> Problem-solving Decision-making Deductive reasoning Defining problems <p>TOO MUCH:</p> <ul style="list-style-type: none"> Solving the wrong problem Hasty decision-making <p>NOT ENOUGH:</p> <ul style="list-style-type: none"> Lack of focus No shifting of ideas Scattered thoughts 	<p>STRENGTHS</p> <ul style="list-style-type: none"> Imaginative ability Understanding people Recognizing problems Brainstorming <p>TOO MUCH:</p> <ul style="list-style-type: none"> Paralysed by alternatives Can't make decisions <p>NOT ENOUGH</p> <ul style="list-style-type: none"> No ideas Can't recognize problems and opportunities
<p><u>To develop your Convergent learning skills, practice:</u></p> <ul style="list-style-type: none"> Creating new ways of thinking and doing Experimenting with new ideas Choosing the best solution Setting goals Making decisions 	<p><u>To develop your Divergent learning skills, practice:</u></p> <ul style="list-style-type: none"> Being sensitive to people's feelings Being sensitive to values Listening with an open mind Gathering information Imagining the implications of uncertain situations

TABLE 4.4b: CHARACTERISTICS OF THE FOUR LEARNING STYLES

ASSIMILATOR	ACCOMMODATOR
<p>People with this learning style are best at understanding a wide range of information and putting it into concise, logical form. They probably are less focused on people and more interested in abstract ideas and concepts. Generally, people with this learning style find it more important that a theory have logical soundness than practical value. This learning style is important for effectiveness in information and science careers.</p>	<p>People with this learning style have the ability to learn primarily from "hands-on" experience. They probably enjoy carrying out plans and involving themselves in new and challenging experiences. Their tendency may be to act on "gut" feelings rather than on logical analysis. In solving problems, they may rely more heavily on people for information than on their own technical analysis. This learning style is important for effectiveness in action-oriented careers such as marketing or sales.</p>
<p>STRENGTHS</p> <ul style="list-style-type: none"> Planning Creating models Defining problems Developing theories <p>TOO MUCH:</p> <ul style="list-style-type: none"> Castles in the air No practical application <p>NOT ENOUGH:</p> <ul style="list-style-type: none"> Unable to learn from mistakes No sound basis for work No systematic approach 	<p>STRENGTHS</p> <ul style="list-style-type: none"> Getting things done Leadership Risk-taking <p>TOO MUCH:</p> <ul style="list-style-type: none"> Trivial improvements Meaningless activity <p>NOT ENOUGH:</p> <ul style="list-style-type: none"> Work not completed on time Impractical plans Not directed to goals
<p><u>To develop your Assimilative learning skills, practice:</u></p> <ul style="list-style-type: none"> Organizing information Building conceptual models Testing theories and ideas Designing experiments Analysing quantitative data 	<p><u>To develop your Accommodative learning skills, practice:</u></p> <ul style="list-style-type: none"> Committing yourself to objectives Seeking new opportunities Influencing and leading others Being personally involved Dealing with people

The LSI was developed by Kolb and takes the form of a self-description, self-scoring test that aims to help an individual to identify their relative emphasis on the four learning abilities within the learning cycle (CE, RO, AC and AE) as well as their predominant learning style (Diverger, Assimilator, Converger or Accommodator). (See Figure 4.1).

According to Hickcox (1990) Kolb published the first version of the LSI in 1971. However, the inventory is generally referred to in the literature as the 1976 version. This version will be referred to as the **LSI-1976**. The LSI-1976 consists of nine sets of words, each set consisting of four words. The four words, each representing one of the four learning abilities, are presented in the same order (CE, RO, AC, AE) throughout so that the words associated with each of the four learning abilities are grouped in columns to facilitate scoring for the self-scoring format of the inventory. A respondent rank orders the four words in each of the nine sets according to how well he/she perceives each word as describing his/her individual learning style. The rankings for only six of the nine items, that is, for only 24 of the 36 words contribute to the scores for the four learning abilities CE, RO, AC and AE. The other twelve words serve as distracters. Two combination scores AC-CE (that indicates the extent to which an individual emphasizes abstractness over concreteness) and AE-RO (the extent that an individual emphasizes action over reflection) are calculated. By plotting these scores on the vertical and horizontal axes respectively, the respondent is positioned in one of the four quadrants representing one of the four learning styles (see Figure 4.1). Due to the ranking format the instrument is an ipsative measure (Kerlinger, 1973).

A revised version of the LSI was published in 1985. This version of the LSI will be referred to as the **LSI-1985**. The format was changed and the LSI-1985 consists of 12 sentence-completion items and therefore has more items than the LSI-1976. Each sentence has four word endings corresponding to the four learning abilities. As for the LSI-1976 the four words are presented in the same order (CE, RO, AC, AE) throughout to facilitate the scoring of the self-scoring inventory. A respondent rank orders the four words for each sentence or item. The ratings for all 12 words are summed for each of the learning abilities CE, RO, AC, AE. These scores are used to

calculate the combination scores AC-CE and AE-RO and by plotting these two scores on the corresponding bipolar axes, the respondent is assigned to one of the four quadrants, each representing one of the four learning styles. Kolb thus increased the number of items and placed the words in the context of a sentence, but remained committed to the ranking format and the instrument remains an ipsative measure.

In 1993 a further revised version of the LSI was published. The instrument is called the **LSI IIA** and the following information is given in the publishers McBer & Company's 1994 catalogue: *"The LSI IIA has a revised questionnaire format and scoring key. The twelve-question inventory now has scrambled sentence endings and new scoring instructions that have proved to have high test-retest reliability in recent studies."* (p. 11). The same 12 items are presented in the same order, but the four word endings for each item have been randomized. Kolb remains committed to the ranking format and the instrument remains an ipsative measure.

4.2.3.1 The LSI-1976

Studies reporting on research findings related to the LSI-1976 are grouped according to the following fields: accounting and business; the human sciences; medical and related fields (which includes nursing and pharmacy education); and other populations.

(i) Accounting and business

The first major criticism of the psychometric properties of the LSI-1976 came from Freedman and Stumpf (1978, 1980) and Stumpf and Freedman (1981). They administered the LSI-1976 to two samples of university business students of which 1591 provided usable information. An independent sample of 101 students responded in a test-retest study with a five-week interval. With respect to **reliability** the alpha coefficient values indicated only moderate consistency within three of the four scales, the most reliable scale being AC = .70 and the least reliable CE = .40. The median reliability of the four scales for both samples was .54. The combination scales (AC-CE and AE-RO) demonstrated a moderate reliability which was not the alpha coefficient, but estimates based on the reliability of the linear combination of the two scales (median = .71). The test-retest reliability was fairly low (median = .50). The study opposed the reliability of the LSI-1976. With respect to **construct**

validity the authors compared their results with data of a similar sample provided by Kolb in 1971 in which variables which are likely to covary with learning style (such as undergraduate major, occupation, educational level) were analyzed. The results were similar to Kolb's, providing limited support for the construct validity of the LSI-1976. Less than 5% of between-group variance could be accounted for by knowledge of learning style. With respect to the **bipolar theory** the correlations between opposite poles of each factor were negative and of moderate strength (-.49 and -.43). A two-factor solution showed that items in general loaded on two bipolar factors, but loadings were low and the total variance in the LSI-1976 accounted for by the two bipolar factor theory was only 20.6%, some of which was an artifact of the scoring method. The ranking and scoring method caused the four scales (CE, RO, AC, AE) to be dependent and results in some scales being negatively correlated. To reduce the strength of column dependencies and to facilitate factor analysis the authors randomly selected and deleted one rank from two of the rows. The factor analysis and factor congruence between the two samples thus provided weak support for a theory of two bipolar learning style dimensions. The authors concluded that the amount of unexplained variance was large enough to produce misleading results and recommended suspending the use of the LSI until further research provided sufficient empirical support for the LSI and Kolb's theory.

In his reply to Freedman and Stumpf, Kolb (1981) stated that it was a mistake to see learning styles as fixed traits as Freedman and Stumpf had done. Kolb (1981) stated *"An individual's learning style is conceived to be a modal orientation that varies to some degree from situation to situation."* (p. 291). The four learning abilities are interdependent and situationally variable. Kolb tabled the test-retest **reliability** coefficients (Pearson product moment correlations) for five studies, four of which were reported in the LSI Technical Manual and the fifth reported by Geller (1979). Referring to this data Kolb pointed out that in general test-retest reliabilities for the six scales of the LSI were highest when the test-retest time was short and experience in the test-retest period was highly similar to previous experience (i.e. low discontinuity of experience). The sample sizes for these five studies are small, ranging from 18 to 50 and totalling 160 subjects. Of the five studies, the study with the shortest test-retest interval and low discontinuity of experience was that of Geller (1979) (see page 79). Kolb also tabled the Spearman-Brown split-half reliability coefficients for five different studies totalling 687 subjects. The reliabilities for all five groups were:

CE = .55, RO = .62, AC = .75, AE = .66, AC-CE = .74 and AE-RO = .82. Kolb pointed out that split-half reliabilities (which are unaffected by situational variability) reported for these studies were better than the test-retest coefficients reported for the other studies. In the second set of studies the internal reliability coefficients for the combination scores (AC-CE and AE-RO) were consistent for all five samples and were of the order of .80 which Kolb stated was comparable with most psychological self-report instruments. He recommended that researchers rely on the combination scores and should only use the single scales for qualitative description. Kolb remained committed to the forced-choice ranking format of the LSI for what he called ecological validity. The four learning abilities are interdependent and life situations require resolution of conflicts among them and therefore the LSI requires a similar conflict among choices. He stated that Likert scale or True/False formats are susceptible to social desirability response sets. The four words selected for each of the nine ranking items of the LSI are of equal positive social desirability to control for this response bias. Kolb stated that to assess measurement error one should rely more on the construct validity of the LSI and stated that there was empirical evidence that the LSI showed a consistent pattern of relationships with predicted dependent variables.

In a study by Wilson (1986) three versions of the LSI-1976 were developed. The first version was the standard LSI-1976. In the second or randomised version, the words in a given row corresponded to those in the standard version, but the order of the words in the rows was randomised so as to reduce the chance of students detecting a pattern. In the third or elaborated version, supplementary defining words were added to the words of the randomized version. This was done as it was thought that the words used in the inventory may not always be interpreted by subjects in the way intended. One hundred and thirty adult management studies students, 85% of whom were employed and studying part-time, were randomly assigned to the three versions which were administered twice with an interval of six weeks in a high continuity of experience situation (standard version N = 51, randomized version N = 50, elaborated version N = 29). The **test-retest** correlations for the standard version were as follows: CE = .40, RO = .77, AC = .63, AE = .40, AC-CE = .53 and AE-RO = .61. The correlations for the randomized and elaborated versions were poorer. The moderate test-retest stability of the group masked considerable variation at the individual level, with for example only 26 of the 51 subjects who completed the standard version receiving the same classification on both test and retest. The **split-**

half reliability showed correlations that were moderate for the standardized version and tended to be poorer for the randomized and elaborated versions. The split-half correlation coefficients for the standard version were as follows: CE = .15, RO = .53, AC = .49, AE = .41, AC-CE = .45 and AE-RO = .52. Changing the order of the items reduced the test-retest and the split-half correlations. The author opposed the stability and internal reliability of the LSI-1976. **Factor analysis** of all 36 words was done using the same procedure as Freedman and Stumpf (1978). The first three factors accounted for 46%, 42.5% and 34.7% of the variance. These factors appeared to be bipolar in nature, but the poles of the factors involved words from different modes and occasionally words from the same mode appeared at the opposite poles of the same factor. The composition of the factors varied according to the inventory used. Only one factor, a Thinking-Doing factor, emerged on all three versions. However, the factor was not clearly defined and accounted for less than 20% of variance. Factor analysis of only the 24 words used for scoring yielded similar results. These findings opposed the proposed bipolar dimensions. The author rejected the proposition that learning styles can be assessed by the LSI-1976.

(ii) **The human sciences**

Green, Snell and Parimanath (1990) supported the **validity** of the LSI-1976 in a study that found that learning styles as measured by the LSI were related to academic and vocational variables. They recommended the use of the instrument as part of an assessment package to help students entering community college in making academic and career decisions. The LSI-1976 and the Occupational Aptitude Survey and Interest Schedule (OASIS) were administered to 147 (104 female, 43 male) community college first-year students taking social science. The mean age was 22 years. The OASIS consists of 12 occupational interest and six aptitude measures. Discriminant analysis accurately classified 40.4% of subjects' learning styles using four classification variables: academic major (decided versus undecided), the Accommodating (person-orientated) and Science scores on the OASIS Interest Schedule and the Numerical score on the OASIS Aptitude Survey. The discriminant analysis results showed Divergers to be people-orientated and more undecided regarding their academic majors. Kolb describes Divergers as imaginative, people-orientated with an inability to make decisions or being paralysed by alternatives. The results showed Convergers to be things and science orientated in vocational interests.

Assimilators showed higher quantitative abilities than other groups on the Aptitude Survey. Accommodators were notable by their lack of distinction on the discriminant functions.

(iii) Medical and related fields

In a doctoral study by Plovnick (1974, 1975) 72 first-year and 64 senior medical students completed the LSI-1976 and 27 completed it again three months later. Only students that indicated they were "certain" of their medical career speciality choice, a total of 47, were included in the analysis of the relationship between learning style and career choice. With respect to the **test-retest reliability** the following Pearson product-moment correlations were reported: CE = .483, RO = .729, AC = .648, AE = .642, CE-AC = .612 and RO-AE = .710 (Plovnick, 1974). Eleven students (41%) after retest had changes in one or both the combination scores that resulted in a change of learning style type. However, many of the changes resulted from a one or two point change. In a **validity** study it was reported that learning styles correlated with or were related to different medical career specialities. For example, family medicine and primary care careers were chosen more by Accommodators and by Divergers than were surgical careers. Internal medicine specialities were chosen more often by Convergents. Academic medicine and pathology attracted more Assimilators. The differences in preference between different learning style types for these fields tended to increase between the first and senior years. Although these findings supported the LSI-1976, Wunderlich and Gjerde (1978) pointed out that the sample was too small to draw definite conclusions, that Plovnick reported only descriptive statistics and performed no statistical analysis on his data, and that he did not classify individuals into the four learning types according to "*their pure definitions in the theoretical model*" (p. 47). Plovnick divided the samples at the median points of the combination scores, rather than at the zero points which represent the instrument's "neutral" point (Plovnick, 1974). As the median combination scores are bound to vary from sample to sample this makes comparison of results between groups less meaningful. Contrary to Kolb's method of scoring, Plovnick obtained the combination scores CE-AC and RO-AC and then multiplied the results by -1 so that when the learning style was plotted on the graph the concrete dimension appeared on the top of graph and the reflective dimension on the right, corresponding with Kolb's representation (Plovnick, 1974).

In a study by Wunderlich and Gjerde (1978) 109 working physicians and 63 resident physicians (referred to as the M.D. group, $N = 172$) and 44 fourth-year medical students completed the LSI-1976. Twenty-four of the student group also completed the LSI six weeks later. The **test-retest** correlations for the four column totals for the 24 students ranged from .44 to .72 and all were significant at the .05 level. With respect to aspects of **validity** a comparison of the percentage distributions of learning types among this study's subjects and those of Plovnick's did not support Plovnick's claim that "*different types of medical careers become associated with certain predictable learning styles*" (Plovnick, 1975, p. 857). These authors did not use Plovnick's technique of redefining learning styles according to median combination scores. Convergers were the most numerous learning type in both the M.D. group (46%) and for the students (56%). Discriminant analysis showed that the LSI did not differentiate between the six medical career groups the subjects represented. Analysis of variance of the two combination scores for the MD group found that the AC-CE score did not differ significantly for any pair of career groups. For the AE-RO combination score a significant result was found for one pair of career groups and was interpreted to mean that family doctors were significantly more active than psychiatrists, who in turn were significantly more reflective than family doctors. The authors concluded that the combination scores of the LSI had only minimal value in distinguishing one medical career group from another. A principal component factor analysis yielded four factors (desirable physician attributes versus non-physician attributes, doing versus thinking, impartial versus critical, and observation) whose underlying hypothetical dimensions did not generally coincide with Kolb's primary dimensions. The authors recommended that the LSI should not be used to provide career guidance to medical students and that a new instrument should be constructed.

A **validity** study by Whitney and Caplan (1978) supported Wunderlich and Gjerde's (1978) finding that learning style and medical speciality choice of physicians were not associated. Their sample consisted of 68 family practice physicians who attended a continuing medical education (CME) course and 43 who did not attend the course. The four learning styles were fairly evenly represented in the combined sample (Diverger 27%, Assimilator 25%, Converger 22% and Accommodator 26%). A difference between attenders and non-attenders was found based on their learning styles and instructional preferences. Attenders, classified as active learners (Accommodators and Convergers), appeared to prefer concrete settings, while non-

attenders appeared to prefer abstract settings. A characteristic learning style was defined by scores in the extreme outer corners of the four learning style quadrants. Forty of the original 111 subjects fulfilled this criterion. In this subsample active learners, compared with reflectives, preferred audiotapes as a method of continuing education. Convergents most preferred colleague group activities and the Accommodators liked it the least. Age was related to instructional method preference with physicians 55 years and older preferring textbooks as CME method.

Geller (1979) reprinted data on the **reliability** of the LSI-1976 as reported by Kolb in the 1976 Technical Manual for the LSI. The split-half reliabilities (Spearman-Brown) for five groups totalling 687 subjects as reported in the manual are: CE = .55, RO = .62, AC = .75, AE = .66, AC-CE = .74 and AE-RO = .82. Variation in reliabilities among the five groups was modest for the combination scores and for the AE scale, but marked for the other learning abilities. Data on test-retest reliability reported by Kolb was also printed. The sample sizes for the four groups are small, ranging from 18 to 42 and the test-retest intervals range from three to seven months. The coefficients for the four learning abilities range from .33 to .73 and for the two combination scores from .43 to .71. In Geller's study 50 American students (48 male, 2 female) enrolled in foreign medical schools and attending a six-week review course, completed the LSI-1976 twice with an interval of 31 days characterized by high continuity of experience. Ages ranged from 22.5 to 41.3 years with $m = 26.3$. The following Pearson product moment correlations were reported: CE = .56, RO = .52, AC = .59, AE = .61, AC-CE = .70 and AE-RO = .55. Although significant these reliability coefficients are relatively low and fall within the range reported by Wunderlich and Gjerde (1978) and by Kolb. Despite a short test-retest interval and high continuity of experience these results did not yield better results than those reported by Kolb. Geller (1979) concluded that although these results *"might be reasonably satisfactory for employing the inventory in distinguishing between the means of two relatively small groups with a narrow range of difference, they are unsatisfactory for its use in reliably differentiating among individuals or between the means of larger, more disparate groups."* (p. 555). Geller stated that the LSI was a potentially valuable instrument and recommended it be revised and the number of items be increased to improve reliability.

West (1982) in a **construct validity** study of learning style types administered the

LSI-1976 together with the Myers-Briggs Type Indicator (MBTI), the Survey of Interpersonal Values (SIV) and the Omnibus Personality Inventory (OPI) to 48 first-year medical students of which 42 completed all the instruments. The study sought to investigate if the personality traits identified by Kolb as characteristic of each of the four learning styles could be related to personality factors identified through factor analysis of the three personality inventories. Factor analysis yielded seven factors and a median test was calculated to examine group differences on each of the factors. The only significant difference found was that Convergents had significantly higher scores on the social adaptability factor than did Divergers and this result was in the opposite direction than was predicted by theory. West noted that despite Wunderlich and Gjerde's (1978) cautions against the validity of the LSI the instrument was still widely used. West concluded that it was questionable to use the LSI in developing medical education programmes that match instructional techniques to the learning style of the individual, and it was questionable to associate career choice of medical students with learning style as measured by the LSI. Hickcox (1990) referred to a taxonomy drawn up by Lynn Curry in which the LSI is classified in the information processing category and the MBTI in the cognitive personality category. She also noted that West used a trait definition of learning style, whereas Kolb described the learning style concept as interdependent learning abilities, which in turn describes a state versus a trait concept. Hickcox concluded that West's study used an inappropriate comparison for validity purposes.

Fox (1984) described Lynn Curry's hierarchical taxonomy of cognitive styles. Curry defined three different layers of cognitive style. Cognitive personality style is the most fundamental layer and is described as "*the individual's approach to adapting and assimilating information*" (Fox, 1984, p. 73). It is isolated from the environment and is a relatively permanent personality dimension. The outermost layer is that of instructional preferences and is described as "*the individual's choice of environment in which to learn*" (p. 73). It is the most observable and least stable of the three dimensions of cognitive style. Mediating between cognitive personality style and instructional preference is the information processing style. It does not relate directly to the environment and is mediated through instructional preference. It is more stable than instructional preference and is in effect the active underlying factor in the educational choices of learners. Research by Marshall (1987) provided support for the independence of the information processing and instructional preferences levels

providing some validity for Curry's taxonomy. Kolb's theory of experiential learning and learning styles is described by Curry as one of the prominent theories of information processing style. Fox also reported that in a psychometric evaluation of cognitive style inventories Curry reported that the LSI has an average test-retest reliability of .58 and an internal consistency of .69 and she concluded that the test-retest reliability and internal consistency of the LSI was "*adequate considering its role in cognitive style assessment*" (Fox, 1984, p. 75). Fox investigated two aspects of the **construct validity** of the LSI-1976 using 36 educators and 18 health professionals who attended a continuing education programme. His first hypothesis was that responses of participants to evaluative statements of the programme which were directly derived from Kolb's descriptions of learning styles would differ according to their learning styles as measured by the LSI. His second hypothesis was that individuals with different learning styles would differ with respect to their instructional preference for lecture or small group methods. Evaluative statement scores did not differ as a function of learning styles and no association between learning styles and reactions to different methods of instruction was found. Fox did not support the use of the LSI as a guide to educational design decisions.

Garvey, Bootman, McGhan and Meredith (1984) investigated the **reliability** and **validity** of the LSI-1976 by investigating the relationship of learning style to several variables. A total of 501 pharmacy students (first through fourth year students) were tested. Of the respondents 270 were female and 230 were male and 184 indicated that their home language was a language other than English (mainly Oriental). The Cronbach's alpha values for the four scales were: CE = .30, RO = .58, AC = .60 and AE = .36. The Spearman-Brown coefficients for the two combination scores were: abstract (AC-CE) .72 and active (AE-RO) .79. If either of the combination scores was equal to zero then it was not possible to assign the subject a learning style and 445 of the 501 respondents were assigned a learning style. The majority of the students (50.8%) were classified as Convergents and the remainder were equally divided among the other three learning styles. It was found that females were higher on CE and males higher on AC, but no differences on the active/reflective dimension were found. No significant relationship between age and learning style was found, but the age range was narrow: the mean age of respondents was 25.2 years \pm 3.2. Of the six scores, RO varied significantly with year of study with beginning students more reflective than advanced students. Garvey *et al.* reported this confirmed a trend Kolb

reported that students became less reflective at master's level. Differences were found between students for whom English was a home language or a second language. For English second language speakers scores were higher on RO, and lower on AC and the combination score for abstract, than for English language speakers. Students who do not speak English in the home may interpret the words used in the LSI differently or these results may reflect cultural differences. Some significant results were obtained for preference for learning situation and learning style. Students scoring high on RO ranked discussion with peers low. Students scoring high on AC ranked theoretical readings high. Students scoring high on AE preferred case studies, discussions with peers, laboratories, practicums and homework.

Laschinger (1990) reviewed research on Kolb's experiential learning theory in the nursing profession. As far as can be ascertained the LSI-1976 was used in all the research referred to. A consistent finding was the predominance of concrete learning styles for nurses. Some studies found no differences in learning style among nurses in different roles or specializations, but one study found nursing faculty significantly more abstract than nursing students, and another study found nursing students became more active (AE) learners as they completed their education. One study found that students with concrete learning styles preferred small group discussions and practical experience, whereas those with abstract learning styles preferred readings and lectures. Although the results were not significant they were interpreted as being consistent with the theory and thus adding to the **construct validity** of the theory.

(iv) **Other populations**

In a **validity** study reported by Welman and Huysamen (1993) 987 first-year students in 13 fields of study at the University of the Orange Free State completed the LSI-1976, the 16 Personality Factor Questionnaire (16PF) and the Mental Alertness test (MA). Three years later 573 of these students had successfully completed most of their degree requirements and these students' results were subjected to discriminant analysis to investigate the relationship between sex, the two combination scores AC-CE and AE-RO of the LSI, the second order factors of the 16PF, the MA score and field of study. None of the instruments used were good predictors of field of study.

The inclusion of the LSI combination scores only improved correct classification by 3%. However, on its own the LSI provided 16,4% correct classification. On the whole the mapping of field of study to one of the four learning style quadrants was in line with the theory. With respect to **reliability** the alpha coefficients for the whole sample (N = 987) were reported as follows: AC-CE = .63 and AE-RO = .55, which the authors regarded as unsatisfactory. Despite the disappointing reliability and validity results of the LSI the authors felt that Kolb's theory should not be dismissed, the problem lying with the LSI and not the theory.

(v) **Summary remarks regarding research using the LSI-1976**

(a) **Reliability**

According to Fox (1984) Curry, after a review of the literature, reported an average test-retest reliability of .58 and an average internal consistency of .69 for the LSI which is of the same order for the studies reported above. Curry concluded that the test-retest reliability and internal consistency of the LSI were adequate for an instrument assessing information processing style. In the studies described above Freedman and Stumpf (1978), Plovnick (1974), Wunderlich and Gjerde (1978), Geller (1979) and Wilson (1986) reported test-retest reliability figures. Sample sizes tended to be large and Freedman and Stumpf, Geller and Wunderlich and Gjerde reported that correlations were significant at the .05 level. However, Freedman and Stumpf, Geller and Wilson opposed the test-retest reliability of the LSI, whereas Curry and Kolb (1981) supported it. Wunderlich and Gjerde stated that the test-retest reliability was relatively constant over a short period of time. Studies investigating the classification stability of the LSI reported that it was poor with a high number of subjects changing classification (Plovnick, 1974; Sims *et al.*, 1986 (see page 85); Wilson, 1986). In the studies described Freedman and Stumpf (1978), Garvey *et al.* (1984), Wilson (1986) and Welman and Huysamen (1993) reported internal consistency figures. Garvey *et al.* did not comment on the internal consistency, but Freedman and Stumpf, Wilson, and Welman and Huysamen opposed the internal consistency of the LSI. The CE scale was consistently the least reliable and on the whole the two combination scores (AC-CE and AE-RO) were more reliable than the four scale scores and Kolb (1981) recommended that researchers rely on the combination scores. Geller (1979) recommended that the number of items be increased to improve reliability.

(b) Format of the LSI-1976

A study by Wilson (1986) investigated the possible effect of a response bias due to the four words of each of the nine items of the LSI-1976 always being presented in the same order. A randomized and an elaborated randomized version (in which supplementary defining words were added to the words of the randomized version) of the LSI displayed poorer psychometric properties than the standard version.

Hunsaker (1981) pointed out that for each row of the LSI-1976 the individual is forced to rank a mixture of two words representing opposite poles of one orthogonal dimension and two words representing opposite poles of the other dimension. She felt that it was difficult to compare words from the orthogonal dimensions and suggested that only two items representing opposite ends of the same dimension should be compared at a time.

(c) Validity

Most of the research using the LSI as an indicator of career choice was conducted in the field of medical education. Although Plovnick (1974) supported the validity of the LSI in this regard, he used a different method of classification and his sample was very small. Whitney and Caplan (1978) and Wunderlich and Gjerde (1978) did not support the validity of the LSI in studies that found that choice of medical speciality and learning style were not related. Similarly Garvey *et al.* (1984) found that learning style did not predict choice of speciality for pharmacists.

Studies by Freedman and Stumpf (1978), Green *et al.* (1990), and Welman and Huysamen (1990) reported that variables such as undergraduate major or field of study, occupation, educational level and vocational interests were related to learning style and thus provided support or limited support for validity. However, West (1982) opposed the construct validity of the LSI in a study that found no relationship between personality traits and learning style.

With respect to educational applications of the theory Garvey *et al.* (1984) and Laschinger (1990) provided limited support for validity and reported some instructional preferences related to learning style. Fox (1984), however, opposed the construct

validity of the LSI and reported that evaluative statements of a training programme and reactions to different methods of instruction were not related to learning style.

Studies using factor analysis either provided weak support for the bipolar dimensions or opposed the four learning abilities and the bipolar theory. Freedman and Stumpf (1978) demonstrated weak support for two bipolar factors, but Wilson (1986) opposed the bipolar theory. Wunderlich and Gjerde (1978) demonstrated four factors, but these factors did not coincide with those theorised by Kolb. More recently Cornwell and Dunlap (1994) stated that ipsative scores cannot be factored, so the results of factor analytical studies of the LSI should be interpreted with caution.

(d) Concluding remarks

Studies have been mixed in supporting or opposing the psychometric properties and validity of the LSI-1976. Kolb (1981) remained committed to the ranking format of the LSI and the instrument is thus an ipsative measure. This makes the investigation of reliability estimates and validity of the instrument problematic. In general authors agreed that Kolb's theory of experiential learning had considerable face validity and was useful, but the LSI-1976 needed improving or replacing.

4.2.3.2 The LSI-1985

Studies reporting on research findings related to the LSI-1985 are grouped according to the following fields: accounting and business; the human sciences; and other populations.

(i) Accounting and business

Sims, Veres, Watson and Buckner (1986) used the LSI-1976 and LSI-1985 to investigate the internal consistency, test-retest reliability and classification stability of the two instruments. Both instruments were administered three times at five-week intervals at the beginning, middle and end of an academic quarter to graduate and undergraduate students enrolled in business courses. The LSI-1976 was administered to 438 students (age range 17 to 53, $m = 23.03$). Of the 438 students, 309 completed the LSI-1976 twice and 132 three times. The LSI-1985 was administered

to 181 students (age range 17 to 58, $m = 23.85$) and 131 completed the LSI-1985 twice and 94 three times. About 40% of the both samples was male. The following **internal consistency** indices were reported. Low alpha coefficients were reported for the LSI-1976: CE = .48, RO = .58, AC = .52, AE = .23. High alpha coefficients were reported for the LSI-1985: CE = .76, RO = .84, AC = .85, AE = .82. The **classification stability** for both instruments was poor with a high number of subjects changing classification as shown by low kappa coefficients. The **test-retest** indices for the LSI-1976 ranged from .42 to .60 and those for the LSI-1985 ranged from .24 to .66. The internal consistency of the LSI-1985 thus seemed substantially improved, but both instruments remained unstable across time with significant differences in classification from one application to the next, with the magnitude of instability greater for the LSI-1985. The authors noted that their results may be sample dependent in that the students may have been in the process of developing a particular learning style. The authors noted that the items of the LSI-1985 are adjectival in nature and do not focus on responses or behaviours of the individuals. This may have fostered the observed instability. They also noted that the high internal consistency of the LSI-1985 may be due to a particular response set as the four sentence endings corresponding with the four dimensions of the LSI always appear in the same order for each of the 12 items to facilitate self-scoring of the instrument. A tendency to respond in the same numerical fashion across items would tend to result in high internal consistency indices. They suggested that the order of the responses should be varied in future research to investigate this possibility. The authors concluded that the LSI-1985 was not a significant improvement on the LSI-1976.

Ruble and Stout (1991) compared the LSI-1985 or standard version with a scrambled version and also investigated the **internal consistency**, **test-retest reliability** and **classification stability** of the instrument. A total of 644 graduate (median age = 27.3) and undergraduate (median age = 20.5) students studying business courses participated in the study. About 61% of the students were male. The LSI-1985 was completed by 231 students and 139 of them completed the instrument again five weeks later. The scrambled version of the LSI-1985 was completed by 413 students and 253 of them completed the instrument again five weeks later. In the scrambled version the four word endings for each item were scrambled, but the order of the 12 items remained the same. The means and standard deviations for the four ability

scales of both the standard and scrambled versions were very similar to those reported by Kolb for the normative sample reported in the LSI-1985 user's guide. The alpha coefficients for the four ability scales of the standard version varied from .79 to .82 and those for the scrambled version from .67 to .78. The Pearson product moment correlations for the test-retest ability scores for the standard version were moderate, ranging from .18 to .47 and were higher for the scrambled version, ranging from .37 to .61. The CE scale was the least reliable. Correlations for the two combination scores were also higher for the scrambled version. The internal consistency for the standard version was thus greater than for the scrambled version, but the test-retest reliability was higher for the scrambled version. The classification stability was 56% for the standard version and 53% for the scrambled version. Compared to the scrambled version, the standard version yielded more extreme classification changes. The LSI-1985 did not provide a reasonably stable measure of learning styles. The authors concluded that many of the differences between the two versions may be due to a response set bias on the standard version. They recommended further revision of the instrument to improve its psychometric properties.

Geiger, Boyle and Pinto (1992) investigated the **construct validity** of the LSI-1985. A total of 718 students enrolled in introductory accounting courses at two universities completed the LSI-1985. Of these students 188 were non-business students (economics, engineering and forestry). The students were mainly second-year students with an age range from 18 to 48 and a mean age = 19.8. There were 420 males and 298 females. Factor analysis results supported two bipolar dimensions, but they were different to those theorized by Kolb. The results of a two-factor solution suggested dimensions running from CE to RO and from AC to AE. The four-factor solution supported only one distinct learning ability for the AC items. The results did not support the construct validity of the LSI-1985. The authors pointed out that the ipsative scales of the LSI-1985 would tend to result in bipolar factor representations which makes it difficult to conclude if resulting bipolar dimensions are an artifact of the ipsative scales or true representations of learning styles.

(ii) **The human sciences**

Highhouse and Doverspike (1987) in a **construct validity** study of the LSI-1985

investigated the relationship between learning styles and measures of cognitive style and occupational preference. The LSI-1985, the Group Embedded Figures Test (GEFT) and Holland's Vocational Preference Inventory (VPI) were administered to 111 introductory psychology university students, 48 of whom were male and 63 female. No significant correlations between the LSI-1985 and the GEFT were found and thus none of the LSI-1985 scores predicted field independence - field dependence. Correlations between the four LSI-1985 scales and the VPI scales produced a significant relationship between the CE scale of the LSI and the Artistic scale of the VPI. There was also a significant relationship between the AE scale and the Realistic, Conventional, Enterprising and Social scales. The RO scale was significantly negatively correlated with the Realistic, Conventional and Enterprising scales. The AC scale did not correlate significantly with any VPI scale. The authors did not draw conclusions relating to the construct validity of the LSI-1985. Hickcox (1990) commented that the absence of correlation between the LSI-1985 and the GEFT verifies Curry's classification of the LSI-1985 as an instrument assessing information processing style (see page 80).

Atkinson (1988) investigated the **reliability** of the LSI-1985. A randomly selected sample of 26 (11 male, 15 female) first-year university students attending sociology classes completed the LSI-1985 twice with a nine-day interval. The Pearson product moment coefficients were as follows: CE = .57, RO = .40, AC = .54, AE = .59, AC-CE = .69 and AE-RO = .24. Given the short test-retest interval these results were seen as unsatisfactory. Atkinson recommended the instrument be revised by using a scoring format less vulnerable to possible response bias and by increasing the number of items.

(iii) Other populations

The **reliability** and **classification stability** of the LSI-1985 was investigated by Veres, Sims and Shake (1987) using a sample of 230 employees of two manufacturing organizations. The age range was from 17 to 61 ($m = 28.32$) and jobs ranged across all levels. About 64% of the subjects were male, 73% were white and 27% black. The LSI-1985 was administered three times at three week intervals. Results were compared with the results of a similar study on a student sample conducted by Sims *et al.* (1986) as described on page 85. The internal consistency of the industrial

sample was comparable to that of the student sample. The test-retest indices were low and in some cases were lower for the industrial sample than the student sample. The stability of classification over the three testing times was consistently low for the industrial sample whereas a consistent reduction in stability was found for the student sample. This would appear to indicate that the students' learning styles were still developing as it was assumed that the learning styles for the working industrial sample were fully developed. The researchers pointed out that although the results were disappointing, significant kappa coefficients reflected a level of classification beyond chance indicating that the LSI-1985 could provide useful information. However, the lack of stability reduced the instrument's usefulness.

In a follow up study to Sims *et al.* (1986) described earlier, and Veres *et al.* (1987) described above, Veres, Sims and Locklear (1991) created a version of the LSI-1985 in which the order of the four sentence endings for each item was randomly determined. This random version of the LSI-1985 was administered to 763 subjects comprising employees of a savings and loan company, employees of a glass manufacturing company, undergraduate university students and MBA students. In this sample 63% were male, and 84% were white, 14% black and 2% were otherwise classified. The results of this study were positive prompting the researchers to replicate the study. In the replication study the 1115 subjects comprised employees of a public agency, employees of a manufacturing company, bank employees and undergraduate and graduate university students. In this sample 59% were male, and 86% were white, 12% were black and 2% were otherwise classified. The random version of the LSI-1985 was administered three times at eight-week intervals to all the subjects. The results showed little variability across the samples and subjects were combined to form two samples (initial and replication) for analysis purposes. With respect to **internal consistency** the mean alpha coefficient values ranged from .52 to .71 for the initial sample and from .56 to .78 for the replication sample. **Test-retest** reliabilities were calculated by computing zero-order correlation coefficients between scale scores produced by each subject at administrations 1, 2 and 3. Test-retest indices ranged from .92 to .97 for the initial sample and from .97 to .99 for the replication sample. The number of subjects who changed learning style classifications from one administration to another was low as reflected by high kappa coefficients. The internal consistency estimates for the random version of the LSI-1985 dropped as expected (the high internal consistency

of the standard LSI-1985 was contributed to a suspected response set associated with the four sentence endings being presented in the same order for all 12 items), but the test-retest reliabilities and kappa coefficients increased dramatically. The authors concluded that, contrary to expectation, the random version of the LSI-1985 demonstrated adequate levels of reliability to evaluate learning styles.

In a **construct validity** study factor analysis of the LSI-1985 by Cornwell, Manfredo and Dunlap (1991) did not support Kolb's two bipolar dimensions of learning. The LSI-1985 was completed by 277 undergraduate students at a university in New Orleans. The students were enrolled for an introductory psychology course. The instrument was also completed by 40 young professionals from a major corporation in New York. The range in age was from 18 to 35 years with a median age of 19 and there were 140 males and 177 females. The two-factor solution provided strong support for a bipolar dimension running from AC to AE (thinking versus doing). The four-factor solution suggested a pair of bipolar dimensions involving CE and RO. These dimensions were interpreted as feeling versus watching styles. Two separate dimensions also appeared for AC and AE. The authors noted that the ipsative scoring of the instrument resulted in non-independent scores which precluded their use to evaluate or confirm a factor structure based on theory. The authors pointed out that ipsative scales produce negative correlations and thus it was not clear to what extent these results could be attributed to ipsative scales. They recommended the use of independently generated (non-ipsative) scores for evaluating the construct validity of the LSI.

Cornwell and Manfredo (1994) used nominal-level analysis of the four primary learning styles (PLS) (i.e. feeling, watching, thinking, doing) of the LSI-1985 and demonstrated their discriminant and convergent **validity**, but not the validity of Kolb's learning style types (LST) (i.e. Diverger, Assimilator, Converger, Accommodator). The LSI-1985 was completed by 292 subjects consisting of 252 university undergraduate students enrolled for an introductory psychology class and 40 university graduates in management positions. The age range was from 18 to 35 years (median age = 20) and 44% were males. Each respondent was classified as one of four PLS types (i.e. feeling, watching, thinking or doing) and as one of four LST types (i.e. Diverger, Assimilator, Converger, Accommodator). A randomly chosen subsample of 40 students and 34 professionals also completed a measure of general mental ability and

participated in an origami learning and performance task. Nominal-level PLS categories were used to determine the prevalence of primary learning style in the sample compared to the LST typology for the whole sample (N = 292). Subjects were significantly more likely to have the thinking PLS, and significantly less likely to have the feeling PLS. For the subsample (N = 74) the thinking PLS was highly associated with high general mental ability, and watching and feeling styles were more likely at lower levels of general mental ability. The doing style was associated more with moderate levels of mental ability. The LST categories did not demonstrate a significant relationship with general mental ability. Latency or the average amount of time taken by a subject to complete the learning and performance or doing task was significantly less for individuals with a doing PLS. Latency was significantly related to general mental ability and PLS, but not to LST. These results supported the validity of the PLS typology and demonstrated the lack of utility of the LST typology. The authors pointed out that the LST were derived from differences of ipsatively scored variables and that this study and other empirical studies had in general not supported Kolb's theory or the psychometric properties of the LSI. Ipsative scales were not regarded as suitable for theory testing. However, the use of nominal-level PLS categories were shown to be useful in this study. The authors recommended the use of primary learning style as a nominal-level construct for diagnostic and research purposes.

(iv) Summary remarks regarding research using the LSI-1985

(a) Reliability

Sims *et al.* (1986) and Veres *et al.* (1987) reported high internal consistency for the LSI-1985 for two different populations, but pointed out that the high internal consistency could be due to a response set. Although the internal consistency dropped as expected when randomized versions of the LSI-1985 were used, it maintained adequate levels (Veres *et al.*, 1991). However, the instrument was found to be unstable with low test-retest indices and consistently low classification stability across three administrations. Atkinson (1988) also reported poor test-retest reliability. Both Ruble and Stout (1991) and Veres *et al.* (1991) reported improved and adequate test-retest indices and moderate to high classification stability for randomized versions

of the LSI-1985.

(b) Validity

Highhouse and Doverspike (1987) found no significant relationship between field independence - field dependence and learning style, but did find some significant relationships consistent with Kolb's theory between Holland's personality types and the four learning abilities.

Both Cornwell *et al.* (1991) and Geiger *et al.* (1992) found that a two-factor solution yielded bipolar factors, but contrary to Kolb's proposed dimensions these factors ran from AC to AE (thinking versus doing) and from CE to RO (feeling versus watching). A four-factor solution yielded only one distinct factor for the AC items in Geiger's study, and two separate dimension for AC and AE in Cornwell's study.

(c) Concluding remarks

Hicks (1970) defined an ipsative measure as follows: *"A format in which respondents compare or rank items will always yield purely ipsative scores if respondents rank all alternatives per item, if all these rankings are scored, and if alternatives representing all assessed variables are compared with each other and presented for preferential choice by the respondent."* (p. 170). According to this definition the LSI-1985 and LSI IIA are purely ipsative instruments. The LSI-1976 is a partially ipsative instrument as not all alternatives ranked by respondents are scored (Hicks, 1970).

Kolb remained committed to the ranking format of the inventory thus making it an ipsative measure. An ipsative measure is designed to measure within-individual differences, and this creates difficulties when researchers try to make between-subjects analyses. Statistically the ipsative measure results in a between-subjects sum of squares of zero and one individual's preferences cannot be compared with another's (Merritt & Marshall, 1984). Cornwell and Dunlap (1994) stated that ipsative scores cannot be factored and that correlation-based analysis of ipsative data produced uninterpretable and invalid results. As ipsative scores contain only categorical information across individuals multinomial statistical techniques are appropriate. Instead of using the sum of the rank ordered ipsative scores, Cornwell

and Dunlap suggested rank ordering the summed responses across the four learning modes for each individual and then applying multinomial techniques to this categorical data. Cornwell *et al.* (1991) recommended the use of non-ipsative scores for evaluating the construct validity of the LSI.

The minimum requirement for an instrument's scores to be amenable to construct interpretations is that the instrument must yield internally consistent scores (Tenopyr, 1988). Tenopyr states that the internal consistencies of scales of ipsative inventories are interdependent and that there is a possibility for artifactual internal consistency to be generated in such inventories. This places limitations on the usefulness of reliability data for ipsative inventories and such instruments are not suitable for psychometric evaluation and should not be used for making important decisions concerning individuals. Ipsative scores are also not suitable for theory building (Hicks, 1970). The usual statistics are not applicable to ipsative measures because of the lack of independence and negative correlations among items and analysis of correlations, as in factor analysis, could be seriously distorted by the negative correlations (Kerlinger, 1973). Many of the studies described in this chapter have treated ipsative data normatively and the results of such studies are of little value. Although an ipsative measure is designed to measure intra-individual differences, the limitations placed on the statistical analysis of data of ipsative measures makes it inappropriate for reliability and validity evaluation of the instrument.

4.2.3.3 Normative (non-ipsative) versions of the LSI

Merritt and Marshall (1984) developed a normative version of the LSI-1976 where the same word list was used, but respondents had to rate each word on a four-point scale Likert-type format (characteristic, somewhat characteristic, somewhat uncharacteristic and uncharacteristic). Both forms of the LSI were administered to 187 nursing students, 95% of whom were female. Internal consistency reliabilities as measured by alpha coefficient ranged from .292 to .587 for the LSI-1976 and from .520 to .739 for the normative version. The means for the four scales for the normative version were consistently about four points higher than the means for the ipsative form and the standard deviations were similar for both forms. Correlations for the four scales of the two versions were used to determine equivalence and the following correlations were reported: CE = .335, RO = .321, AC = .441,

AE = .169. After correction for attenuation the adjusted scale correlations were as follows: CE = .859, RO = .552, AC = .441, AE = .357. Principal axis factor analysis with varimax rotation was used to determine the factor structure. Factor analysis of the ipsative form yielded two bipolar factors, RO-AE and CE-AC. Similar results were obtained for the normative form. A second study was carried out to cross-validate the normative version of the LSI. The normative form of the LSI was completed by 343 nursing students, 92% of whom were female. Alpha reliabilities ranged from .546 to .725 and were similar to the first study. The factor structure was similar to the findings of the first study. The structure of the ipsative form was found to be consistent with the learning style model proposed by Kolb with moderate to low scale reliabilities. The structure of the normative form was congruent with the theoretical model with scale reliabilities equal to or greater than those of the ipsative form. The construct validity of both forms was thus tentatively supported. The authors recommended that the normative version of the LSI-1976 be used instead of the ipsative version for research purposes to meet the requirements of independence for statistical analyses.

In a follow-up study to the one described above, Marshall and Merritt (1985) developed an alternative normative version using a semantic differential format. The same words as used in the LSI-1976 were used, but each word was contrasted with a word representing the theoretically opposite learning ability. A five-point scale was used. The two normative forms of the LSI used in this study will be referred to as the LSI-Likert (Likert format as used in the Merritt and Marshall (1984) study) and the LSI-SD (semantic differential format). The subjects were the 343 nursing students used in the 1984 study. All 343 students completed the LSI-Likert and 181 completed the LSI-SD. Scale scores (CE, RO, AC, AE) were obtained by adding the points assigned to the original word comprising each scale. Internal consistency reliabilities based on alpha coefficient ranged from .546 to .725 for LSI-Likert (mean scale reliability .624) and from .608 to .861 for LSI-SD (mean scale reliability .771). Scale intercorrelations (corrected for attenuation) of the LSI-Likert and LSI-SD were moderate: CE = .34, RO = .53, AC = .58, AE = .67. Principal axis factor analysis with varimax rotation was used to determine the factor structure of the LSI-SD. Both four-factor and two-factor solutions were derived that were congruent with scales defined by Kolb. The authors concluded that valid normative forms of the LSI could be developed and that the semantic differential format showed improved internal consistency compared with

the LSI-Likert format.

From their previous studies Marshall and Merritt (1986) concluded that a semantic differential format could be used to develop a reliable and valid normative assessment instrument to assess individual's preferences for ways of learning as proposed by Kolb. They developed the Learning Style Questionnaire (not to be confused with the LSQ of Honey and Mumford). In the experimental phase 100 semantic differential word pairs were compiled, with 25 word pairs for each of the four scales. A five-point scale was used by respondents to rate the consistency with which the opposing words characterized their particular learning style. This experimental form of the LSQ was administered to 543 university students from randomly selected classes at two universities. Thirty-seven different majors were represented. About three-fourths of the subjects were under 23 years of age; two-thirds were female and about two-thirds had completed at least two years of college. The 100 items were analyzed and 40 items were selected for the final instrument, 10 items for each of the four scales (CE, RO, AC, AE). The internal consistency reliabilities based on alpha coefficient for the finalized 40-item LSQ were: CE = .78, RO = .86, AC = .85, AE = .88, CE-AC = .90 and RO-AC = .93. Least squares factor analysis was used to examine the construct validity of the instrument. All 40 items loaded on bipolar factors in accordance with Kolb's proposed learning abilities and styles. The authors concluded that the reliability estimates for both bipolar dimensions were very high and that the construct validity for these dimensions had been demonstrated. They recommended that the instrument be used to determine individual learning styles as well as for research purposes.

Romero, Tepper and Tetrault (1992) developed a normative, two-dimensional instrument to measure learning style. Rather than construct an instrument that assesses the four learning abilities, the authors constructed an instrument that assessed the two dimensions concreteness/abstractness and reflection/action directly. The instrument consists of 14 pairs of self-descriptive anchor statements, each pair on a six-point Likert scale. Seven bipolar items assess concreteness versus abstractness, and seven bipolar items assess reflection versus action. The instrument was administered to two independent samples. The one sample consisted of 507 undergraduate students in the fields of liberal arts, business and engineering. The average age was about 21 years and 53% were male. The instrument was

administered once to this sample. The second sample consisted of 153 MBA students and the instrument was administered twice with a six week interval. The average age was 28 years and 65% were male. The internal consistency alpha coefficient for the concreteness/abstract scale was .84 for sample 1 and .78 for sample 2. The coefficient alpha for the reflective/action scale was .86 for sample 1 and .80 for sample 2. The test-retest stability for sample 2 was .75 for the concreteness/abstract scale and .73 for the reflection/action scale. The authors reported that the internal consistency and test-retest stability were acceptable. The two dimensional structure of the instrument was confirmed by factor analysis of both samples using LISREL. Validity support was obtained by comparing student majors with learning style for sample 1.

Geiger, Boyle and Pinto (1993) constructed a normative version of the LSI-1985 that was scored on a seven-point Likert scale consisting of 48 (12 sentence items X four word endings) separate items randomly presented. The standard LSI-1985 and the normative versions were administered to 455 business administration students (first, second and third year students). The age range was from 18 to 47 years (mean age = 21.4 years) and 281 were male and 174 female. Alpha coefficient internal consistency reliability measures for the ipsative version were as follows: CE = .83, RO = .81, AC = .85 and AE = .84. Alpha coefficient reliabilities for the normative version were as follows: CE = .83, RO = .77, AC = .86 and AE = .84. The authors reported that these findings do not support the presence of a response set on the standard ipsative LSI and these results were contrary to the findings of Ruble and Stout (1990). Correlations of the four scale scores were used to determine the equivalence of the ipsative and normative versions. Correlations ranged from .368 to .526 indicating a moderate amount of agreement. Adjusted scale correlations ranged from .466 to .615 with three of the four coefficients exceeding .50. Separate factor analyses were performed on the two versions. For the ipsative version two strong bipolar dimensions were identified running from CE to RO and from AE to AC. These dimensions are not congruent with Kolb's theorized bipolar dimensions. Analysis of the normative version did not produce any bipolar dimensions, but strong support for the four separate learning abilities was obtained.

4.3 PRACTICAL USE OF KOLB'S THEORY

4.3.1 Establishing relationships between learning styles and fields of study and career choices

Kolb (1984) reported research results demonstrating a relationship between undergraduate major and learning style of managers in various professions. Business majors tended to be Accommodators, engineers tended to be Convergents, history, English, psychology and political science majors tended to be Divergers, and mathematics, chemistry, economics and sociology majors tended to be Assimilators. Physics majors fell between Convergents and Assimilators. Other research results (Kolb, 1984) indicated that various professions are characterized by certain learning styles. On the whole professionals tended to have an active rather than a reflective orientation. Social professions such as education, nursing, social work and agricultural extension tended to be Accommodators. Technical or scientific based professions such as accounting, engineering and medicine tended to be Convergents.

Hickcox (1990) reviewed 81 studies and articles spanning the period 1971 to 1989 that focused on the application or the relationship of Kolb's theory and/or the LSI to higher or adult education settings. Of these, 18 were classified as pertaining to the "*LSI administered to various special populations*" (Hickcox, 1990, p. 150). Of these 18 studies and articles, 15 were supportive of Kolb's theory. Many of them reported on the relationship between learning style and field of study or career.

In two different studies business major students and a small group of marketing students were found to have learning styles of all types. In two other studies, accounting students were found to have predominantly Converger and Assimilator learning styles, whereas professional accountants were typified by the Converger learning style.

In a study of social worker students', faculty and field instructors' learning styles it was found that faculty were predominantly Convergents, the majority of graduate students and field workers were Divergers, and undergraduates were predominantly Accommodators.

Four of the studies were carried out in the field of medical education. In one study a relatively equal distribution of learning styles was found for physicians invited to attend continuing education. In two studies on anaesthesiologists one study found anaesthesiology residents to be predominantly Accommodators and another study found students and faculty to be predominantly Accommodators and Convergents. In the fourth study involving medical students and practising physicians, nearly half the sample were Convergents and a quarter were Accommodators. The LSI did not, however, discriminate among medical specialities. In a study in the field of teacher education it was also found that the LSI did not discriminate between subspecialities within a professional group, namely between principals and teachers at both elementary and secondary level.

In the field of nursing education several studies have found a predominance of concrete, people-oriented learning styles (Accommodators and Divergers) in samples of nurses and nursing students. The same applied to a study of elementary and secondary level student teachers.

A study in the field of pharmacy education found that the majority of pharmacy students were Convergents.

4.3.2 Managing the learning process

Although Kolb's model has made a significant impact on management training and development (Hickcox, 1990; Hunsaker, 1981; Kolb, 1976; Kolb *et al.*, 1984), it has not always been taken up with the same interest by other disciplines. However, the use of the learning cycle to guide and to improve teaching practice through curriculum design as well as choice of instructional and assessment methods is endorsed by authors representing several disciplines. The application of the theory mainly focuses on two aspects. First, both teachers' and students' learning styles can be assessed to provide them with personal information on their preferred style. This information can then be used to understand the implications for the learning process. Claxton and Murrell (1987) stated that having information on learning style can help faculty to become more sensitive to the differences that students bring to the classroom. If students have information on their own learning style it could increase their chances of succeeding in courses and they could develop strategies for learning in alternate

ways to their predominant style. Secondly, the theory is used to plan for teaching with a view to improving teaching and learning practices. Learning experiences can be designed to match or mismatch students' style. Matching learning experiences and student learning style is probably important for beginning or at-risk students, while mismatching aims to produce flexible learners. Teaching strategies can be chosen, for example, to encourage students to engage in all the stages of the learning cycle. Claxton and Murrell (1987) noted that as Kolb's experiential learning cycle and learning styles are anchored in human development research, his model facilitates systematic and intentional course design that can foster student development as well as enable students to become actively involved in the learning process. Some studies that address the application of the experiential learning model in managing the learning process will be highlighted.

In a study by Certo (cited in Hickcox, 1990) the level of perceived trainee learning at each stage of the learning cycle was investigated in a business education programme. Significant differences were found, with the RO and CE stages resulting in higher levels of perceived learning.

Hunsaker (1981) reviewed literature on the usefulness of the experiential learning model and concluded that the model received some support, but the reliability of the LSI-1976 was discredited and the predictive validity of the instrument had not been confirmed. Whereas the use of the LSI was rejected, the use of the learning model appeared to receive enough support to merit further use and development. The inclusion of the learning model in popular experiential texts (Kolb *et al.*, 1984) and its widespread dissemination as a tool in management education supported its usefulness.

In the counselling setting Sugarman (1985) proposed that the experiential learning model could be used effectively by counsellors and clients, as well as by trainers and students as a sophisticated teaching model. The abstract quality of Kolb's theory allows it to be applied in a flexible way to a variety of learning needs. The learning cycle was equated with the counselling process and counsellors could use Kolb's model to reflect on their counselling styles and to plan interventions with clients. Clients could be taught to use Kolb's ideas to expand their repertoire of learning skills. Trainers could use the model to plan for both individual sessions as well as for

developing balanced training programmes. Abbey, Hunt and Weiser (1985) also supported the use of the learning cycle in counselling and in the supervision of trainee counsellors. The clinician needs to be flexible and to apply all four the learning abilities in therapy, as well as in supervision. In therapy the four learning abilities should be made available to the client. Counsellors were trained to be more sensitive to all four phases of the learning cycle and the four learning abilities were used in describing the sequences of counselling; variations among clients, counsellors and supervisors; and how the variations affected counselling and supervision.

Claxton and Murrell (1987) described how information on students' learning styles could be used to improve educational practice and they recommended the application of the learning cycle in course design. It was assumed that the most effective learning experience is one where students experience all four phases of the learning cycle. The learning cycle should thus be used to design learning activities such that students systematically engage in each of the four learning abilities and become more skilled learners. Concrete experience can include field work, interviews, viewing films and participating in role plays or simulations. For reflective observation students can write a reflective paper, keep a journal or share their perspectives with other students in small groups. Students engage in abstract conceptualization when they take in information, such as in a lecture, or engage in research and developing hypotheses or theories of their own. For active experimentation students apply principles or theories through field placements or laboratory work. The authors pointed out that students could experience a mismatch of teaching strategy with their learning style as threatening and faculty should be sensitive to this. The learning cycle can also be used in planning assessment procedures to assess students' ability to think in divergent, assimilative, convergent and accommodative ways (Murrell & Claxton, 1987).

Stice (1987) described how the learning cycle can be used to improve teaching and learning in a chemical engineering class. Learning is enhanced as more learning abilities are used. Retention is increased from 20% if only abstract conceptualization is used to 90% if all four modes are used.

4.3.3 Learning and problem solving

Kolb *et al.* (1984) pointed out that the concept of learning often evokes associations of a process in which the learner plays a relatively passive role and the teacher plays an active role making decisions regarding learning objectives, and teaching and assessment strategies. In contrast to this the concept of problem solving evokes associations of an active process with the responsibility of solving the problem resting with the problem solver. Kolb *et al.* provided an integrated learning and problem solving model in which the stages of problem solving are linked to the stages of the learning cycle. Most problem solving is learning and learning is often a process of problem solving. Carlsson, Keane and Martin (1984) used this integrated learning and problem solving model to describe research and development organizations as learning systems. Knowledge of learning styles in the work setting is relevant for two reasons (Claxton & Murrell, 1987). First, persons with different styles can be used to perform different functions according to their strengths. For example, Divergers are good at generating ideas and Convergents are good at making decisions. Some tasks could be more appropriately carried out by teams comprising people with a variety of styles, whereas a homogeneous group may be more appropriate for other tasks. It is also important that people be given the opportunity to develop competence in styles other than their area of strength. Secondly, learning from experience should be an explicit objective for organizations to ensure the organization remains vibrant and effective.

4.3.4 Student guidance

Curry (1990b) pointed out that learning style theory offers the *"opportunity for guidance to focus on diagnosis and adaptive planning to make best use of the student's particular constellation of learning styles"* (p. 2). If a student is having problems in a course information on their learning styles could be useful for counselling and for taking possible remedial action.

Although research has shown that professions are characterized by specific learning styles (see 4.3.1) the criticism of the psychometric properties of the LSI (see 4.2.3) indicates caution in helping people make career decisions using information on learning styles as measured by the LSI. Some authors have recommended the use of learning styles in career guidance (Green *et al.*, 1990). However, others (Wunderlich & Gjerde,

1978; West, 1982) have warned that the LSI should not be used, especially in the case of identifying a speciality within a profession such as medicine. Atkinson and Murrell (1988) advocated the use of Kolb's theory of experiential learning as a meta-model for career development. The four stages of the learning cycle can be used to guide self-exploration and career exploration. For example, the client could prepare a vocational life history (CE), engage in guided imagery to promote personal evaluation (RO), take psychometric tests and have them interpreted by a counsellor (AC), and interview someone in a profession to explore how they might apply their skills in that particular career (AE).

4.3.5 Lifelong learning

Kolb's theory of experiential learning with its emphasis on learning as a continual process of interacting with life experiences sees education and learning as a lifelong process essential for personal development and career success (Kolb, 1984). Lifelong learning must meet the challenges of integrative learning. Noel and Sims (1984) listed the conditions of adult learning applicable to continuing education. Adult education should address the needs of the adult learner, it should be experienced based, it should provide for immediate application and should take place in a group context. These authors demonstrated how the learning cycle provides an effective framework for incorporating these conditions for adult learning in a continuing education programme for managers by focusing on a work related problem or situation, requiring the learner to reflect upon the experience, to examine possible solutions and then to devise a strategy for implementing necessary change.

4.4 CRITICISM OF THE THEORY

Kolb's major achievements according to Murrell and Claxton (1987) were to illuminate the role of learning in individual development and in the words of Warren Bennis to provide *"the missing link between theory and practice, between the abstract generalization and the concrete instance, between the affective and cognitive domains."* (Kolb, 1984, p. ix).

Sugarman (1985) pointed out that as Kolb's theory combines a theory of learning and a theory of learning styles there are at least three components that must be addressed

in an evaluation of his work: (a) establishing the existence of individual differences in learning styles, (b) effectively measuring these differences, if they are found to exist, and (c) validating the cyclical model of learning. Kolb's work is viewed favourably for aspects (a) and (c), but the major criticism against his work is focused on his method of measuring learning styles and more specifically on the psychometric properties of the LSI. This criticism has been fully described in 4.2.3. As a result of restrictions an ipsative measure places on statistical analysis of results, the researcher decided to use two normative measures of learning styles (see 6.3.3.3) in the empirical part of this study.

Another aspect of the theory that is challenged is Kolb's assumption that learning styles are not fixed traits but stable states. It is thus assumed that students could be encouraged to develop learning styles they least use or prefer. The ideal would be to produce flexible learners. Some research findings lend credence to the idea that learning styles can be changed. Kolb (1984), for example, referred to a longitudinal study that demonstrated that students' preferences after two years of college shifted from concrete to more abstract and from reflective to more active. Miller (1991) contended that learning styles should be defined more comprehensively as personality styles (types). As such he saw learning styles as *"complex adjustments to life that are learned early in life and remain held in place, as it were, by demands of psychodynamics"* (Miller, 1991, p. 231). He is thus sceptical of the idea that students could be taught to use styles other than those they usually prefer. The more "specialized" a student's learning style is, the more difficult it will be to encourage versatility. He believes that attempts to encourage learning style versatility among all students to be a waste of time and resources, and that for some emotionally unstable students, for whom the style serves as a defensive function, it could be psychologically damaging.

Furnham (1992) in a study of personality and three learning style instruments, including the LSI, concluded that well-established and theoretically sound personality variables were closely and coherently related to learning styles. He posed the question *"why bother to measure learning style; why not simply measure personality?"* (Furnham, 1992, p. 437). In the light of a proliferation of learning style measures he advocated parsimony both of theory and measurement. He advocated the use of personality tests in the investigation of the role of learning in conjunction

with, or in place of, the three learning styles measures used in his study.

Curry (1990b) noted that consensus appeared to be emerging in the literature on the use of the concept **style** to refer to *"information processing routines which function in a trait-like manner at the personality level"* and the concept **strategy** to refer to *"cross-situational consistency in how students approach school learning"* (p. 2). In 1983 Curry proposed a three-level hierarchical taxonomy of learning style (Fox 1984; Marshall, 1987). This taxonomy was adapted by Claxton and Murrell (1987) to include social interaction as a dimension. They used the metaphor of an onion with personality, in the sense of basic characteristics of style, at the core. Information-processing models, describing how persons take in and process information, formed the second layer. Social-interaction models, describing how students interact and behave, made up the third layer. The fourth and outermost layer was represented by learning environment and instructional preferences. Curry revised her 1983 taxonomy in 1990 proposing a learning style taxonomy in which the contributions of learning style to learning outcomes is depicted (see Figure 4.3 on the following page). In this taxonomy the fundamental influences of preferences for environmental conditions and preferences for social conditions combine to maintain motivation. The level of motivation in turn determines the level of engagement in a new task by the learner. Once engaged in the learning task, some habitual or preferred cognitive information processing relevant to the task takes place, at least initially. This hierarchical process describes learning style. These aspects of learning style (maintenance of motivation, level of engagement and cognitive processing) combine with metacognitive skills, specific knowledge and skills to produce a detectable learning outcome. Curry categorized 13 learning style theorists according to her taxonomy and Kolb's experiential learning theory was categorized at the cognitive information processing level. Curry (1990a) in a critique of the research on learning styles noted that the operationalization of learning style theory is plagued by three pervasive problems: confusion in definitions (Claxton & Murrell, 1987); weakness in reliability and validity of measurements (Claxton & Murrell, 1987); and identification of relevant characteristics in learners and instructional settings. Use of a taxonomy such as Curry's could clarify much of the confusion characteristic of the learning style research and application (Marshall, 1987).

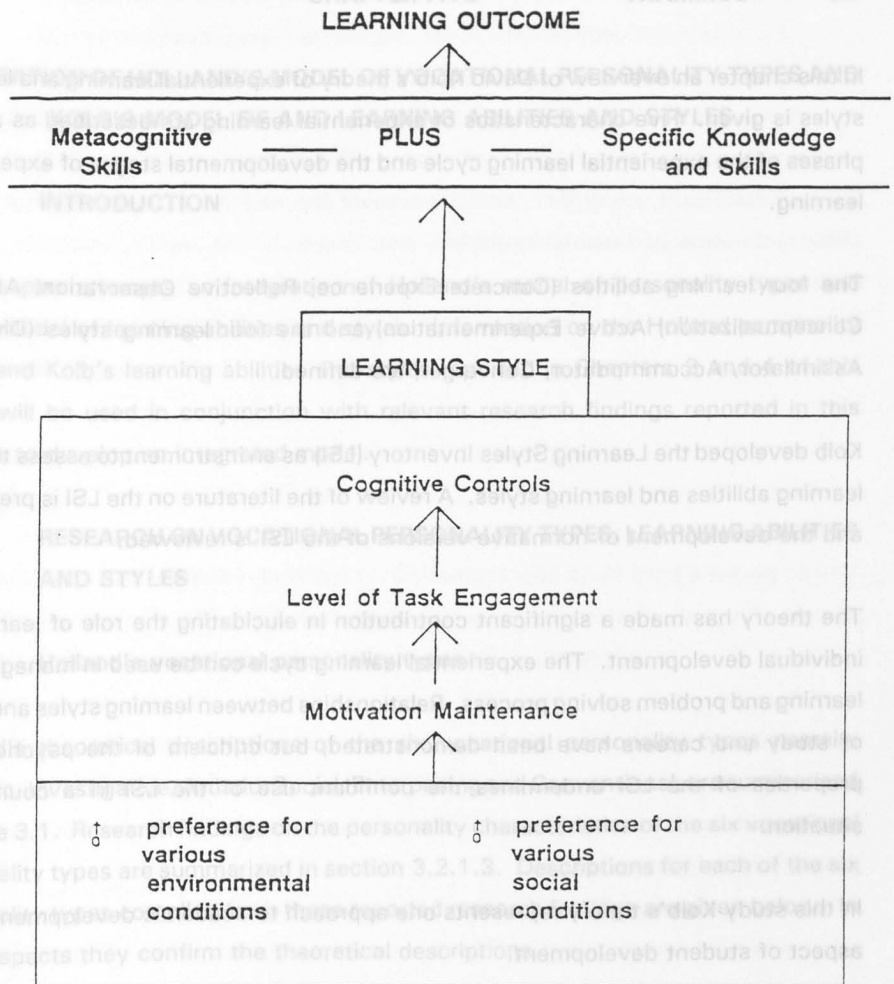


FIGURE 4.3 LEARNING STYLE TAXONOMY AND CONTRIBUTIONS OF LEARNING STYLE TO LEARNING OUTCOMES

Other aspects that have as yet not been adequately addressed with respect to learning styles in general are whether cultural differences are related to learning styles; whether learning styles of minority students differ from those of the dominant culture; and what the advantages of matching and mismatching learning style and teaching strategy are (Claxton & Murrell, 1987).

In this chapter an overview of David Kolb's theory of experiential learning and learning styles is given. Five characteristics of experiential learning are described as are the phases of the experiential learning cycle and the developmental stages of experiential learning.

The four learning abilities (Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation) and the four learning styles (Diverger, Assimilator, Accommodator, Converger) are defined.

Kolb developed the Learning Styles Inventory (LSI) as an instrument to assess the four learning abilities and learning styles. A review of the literature on the LSI is presented and the development of normative versions of the LSI is reviewed.

The theory has made a significant contribution in elucidating the role of learning in individual development. The experiential learning cycle can be used in managing the learning and problem solving process. Relationships between learning styles and fields of study and careers have been demonstrated, but criticism of the psychometric properties of the LSI undermines the confident use of the LSI in a counselling situation.

In this study Kolb's theory represents one approach to academic development as an aspect of student development.

In the following chapter a theoretical integration of Holland's model of vocational personality types and Kolb's model of learning abilities and styles will be presented.