AN INTEGRATION OF THE THEORIES OF JL HOLLAND AND DA KOLB: A THEORETICAL AND EMPIRICAL STUDY OF VOCATIONAL PERSONALITY AND LEARNING STYLE TYPES

BY

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In loving memory of my parents

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SUMMARY

AN INTEGRATION OF THE THEORIES OF JL HOLLAND AND DA KOLB: A THEORETICAL AND EMPIRICAL STUDY OF VOCATIONAL PERSONALITY AND LEARNING STYLES

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The purpose of this study was to explore the relationship between vocational personality and learning style as aspects of student development and the broad aims of the study can be stated as follows:

- to integrate John Holland's model of vocational personalities and David Kolb's model of learning abilities and styles;
- to use subjects representing different cultural groups from two fields of study at the University of Pretoria in an empirical study to investigate the possible integration of the two models;
- to investigate the psychometric properties of two normative forms of Kolb's Learning Style Inventory.

The subjects used in the empirical part of the study were first-year university students registered for English courses for either a science (BSc) or a human sciences (BA) degree. The study was thus placed in the context of student development. A literature study of student development was undertaken. Student development comprises academic development, career development and personal development. In this study Kolb's theory of experiential learning represents an aspect of academic development and Holland's theory of person-environment interaction represents an aspect of career development.

In order to develop a theoretical integration of Holland's model of vocational personalities and Kolb's model of learning abilities and styles a literature study on these two theories was done. The six vocational personality types (Realistic,

Investigative, Artistic, Social, Enterprising, Conventional), the four learning abilities (Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation) and the four learning styles (Diverger, Assimilator, Converger, Accommodator) were described. Special attention was paid to the literature on the Learning Styles Inventory (LSI), the instrument Kolb devised to assess learning abilities and styles. Kolb's LSI is an ipsative instrument and problems relating to determining the psychometric properties of an ipsative instrument were highlighted. It was decided in this study to use two normative measures of learning style.

A theoretical integration of Holland's model of vocational personality types and Kolb's model of learning abilities and styles was proposed. A description and visual representation of the integrated model was presented.

In the empirical part of this study the interaction of vocational personality type as measured by the Self-Directed Search (SDS) and learning abilities and styles as measured by the Learning Style Inventory (LSI) and the Learning Style Questionnaire (LSQ) for the BSc and BA groups was investigated. Hotelling's T test was used to test for significant differences between the average profiles of these two groups. Discriminant analysis and factor analysis was then carried out. Intercorrelations for personality types and learning abilities for the two groups were determined. Frequency distributions of personality types and learning styles for the two groups were determined. Results pertaining to the proposed integrated model of vocational personality types, and learning abilities and styles were discussed. Although there were some findings contrary to the proposed integrated model, most of the findings confirmed the model. It was decided not to modify the proposed integrated model in the light of the present research findings.

The psychometric properties of the LSI and the LSQ were investigated. Item analysis of each instrument was done and the internal reliability of the four learning ability scales was determined using coefficient alpha. The frequency distribution of the four learning styles for each instrument for the BSc and BA groups was determined. The internal reliability of the LSI and LSQ was found to be relatively high. The bipolar dimensions (AC-CE and AE-RO) theorized by Kolb were confirmed for the LSQ and partially confirmed for the LSI. The presence of a response bias for both instruments was suspected. It would appear that the LSI was more successful than the LSQ in differentiating learning abilities and styles in the sample used.

Recommendations for further research to validate the proposed integrated model and to further investigate the reliability and validity of the LSI and LSQ were made.

OPSOMMING

'N INTEGRASIE VAN DIE TEORIEë VAN JL HOLLAND EN DA KOLB: 'N TEORETIESE EN EMPIRIESE STUDIE VAN BEROEPSPERSOONLIKHEIDSTIPES EN LEERSTYLTIPES

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Die doel van hierdie studie was om die verband tussen beroepspersoonlikheidstipe en leerstyl as aspekte van studente ontwikkeling te ondersoek. Die breë doelwitte van die studie kan soos volg gestel word:

- om John Holland se model van beroepspersoonlikheidstipes en David Kolb se model van leervermoëns en leerstyle te integreer;
- om studente verteenwoordigend van verskeie kultuurgroepe en twee studievelde by die Universiteit van Pretoria in 'n empiriese studie te gebruik om die integrasie van die twee modelle te ondersoek;
- om die psigometriese eienskappe van twee normatiewe weergawes van Kolb se Learning Style Inventory te ondersoek.

Eerstejaarstudente ingeskryf vir kursuse wat in Engels aangebied word in òf 'n wetenskaplike (BSc) òf 'n geesteswetenskaplike (BA) studierigting is gebruik vir die empiriese gedeelte van hierdie studie. Die studie is dus in die konteks van studente-ontwikkeling geplaas en 'n literatuurstudie oor studente-ontwikkeling is onderneem. Studente-ontwikkeling behels akademiese-ontwikkeling, loopbaanontwikkeling en persoonlike-ontwikkeling. Kolb se teorie van ervaringsleer verteenwoordig 'n aspek van akademiese-ontwikkeling en Holland se persoon-omgewing interaksie teorie verteenwoordig 'n aspek van loopbaanontwikkeling.

Om 'n integrasie van Holland en Kolb se teorieë uit te voer is 'n literatuurstudie van dié twee teorieë onderneem. Die ses persoonlikheidstipes (Realisties, Ondersoekend, Artisties, Sosiaal, Ondernemend, Konvensioneel) asook die vier leervermoëns

(Konkrete Ervaring, Reflektiewe Observasie, Abstrakte Konseptualisering, Aktiewe Eksperimentering) en die vier leerstyle (Divergeerder, Assimileerder, Konvergeerder, Akkommodeerder) is beskryf. Literatuur oor Kolb se Learning Style Inventory (LSI) is nagegaan. Die LSI is 'n ipsatiewe instrument en die problematiek rakende die ondersoek van die psigometriese eienskappe van 'n ipsatiewe instrument is uitgelig. Daar is besluit om in hierdie studie twee normatiewe vorms van die LSI te gebruik.

'n Teoretiese integrasie van Holland se model van beroepspersoonlikheidstipes en Kolb se leervermoëns en leerstyle is voorgestel.

Die interaksie tussen beroepspersoonlikheidstipe, gemeet deur die Self-Directed Search (SDS), en leervermoëns en leerstyle, gemeet deur die Learning Style Inventory (LSI) en die Learning Style Questionnaire (LSQ), is in die empiriese gedeelte van die studie vir die BSc en BA groepe ondersoek. Hotelling's T-toets is gebruik om te toets vir betekenisvolle verskille tussen die profiele van die twee groepe. Diskriminantanalise en faktorontleding is uitgevoer. Interkorrelasies tussen persoonlikheidstipe en leervermoëns vir die twee groepe is bepaal. Frekwensies van persoonlikheidstipe en leerstyle vir die twee groepe is bepaal. Resultate wat betrekking het op die voorgestelde geïntegreerde model van persoonlikheidstipes, leervermoëns en leerstyle is bespreek. Alhoewel sommige resultate nie die voorgestelde model ondersteun het nie, het die meeste resultate wel die model ondersteun. Daar is besluit om nie die voorgestelde geïntegreerde model in die lig van die resultate van hierdie studie aan te pas nie.

Die psigometriese eienskappe van die LSI en LSQ is ondersoek. Itemanalise is vir albei instrumente gedoen en die betroubaarheid vir die vier leervermoëns-skale is deur gebruik van die alphakoëffisiënt bepaal. Die frekwensie van leerstyle vir albei instrumente vir die BSc en BA groepe is bepaal. Die betroubaarheid vir albei instrumente was redelik hoog. Die bipolêre dimensies (AC-CE en AE-RO) soos deur Kolb voorgestel, is vir die LSQ bevestig en gedeeltelik bevestig vir die LSQ. Dit het geblyk dat altwee instrumente 'n responshouding uitgelok het. Dit wou voorkom dat die LSI meer suksesvol as die LSQ was om leervermoëns en leerstyle in die twee groepe te onderskei.

Aanbevelings vir verdere navorsing is gemaak ten opsigte van die validering van die voorgestelde geïntegreerde model asook die verdere ondersoek van die betroubaarheid en geldigheid van die LSI en die LSQ.

CHAPTER ONE

INTRODUCTION

1.1 GENERAL INTRODUCTION

As we stand on the threshold of a new millennium South Africa is undergoing a political, social and economic transition from minority rule and apartheid to a democratic society seeking to position itself in the wider international economy and community. In this process all existing practices are being rethought in terms of their relevance to the new situation. Higher educational institutions, as providers of high-level manpower, face telling challenges in these changing times.

A number of factors create a complex backdrop against which transformation in education is taking place. For some time there has been a mismatch between education and employability. South Africa does not have an education system that can support a high-technology environment needed to stimulate an economy that has been performing poorly for some time. There is a low general level of education with an adult functional literacy rate of only 50 percent. The educational profile of the working population is that of a developing country: 30% have no education, 36% have primary schooling only, 31% secondary schooling only, and only 3% have degrees or diplomas (Hofmeyr & Buckland, 1992). The population growth rate of the white, coloured and Indian communities is static or declining whereas the population growth rate of the African population is 2.8% per annum (Hofmeyr & Buckland, 1992). The already changing student profiles, especially at historically white tertiary institutions, will continue to change radically into the future. Huge inequalities and backlogs have resulted in education due to decades of apartheid education and rising pupil numbers. Education has also been a site of struggle and crisis during the last decade. African students entering tertiary institutions often come from educationally disadvantaged backgrounds. An enormous challenge faces tertiary institutions to provide high-level skills training and human resource development to equip a larger and more diverse student population as flexible, lifelong learners able to meet the needs of a changing labour market which needs to be internationally competitive.

The draft white paper on higher education (Ministry of Education, April 1997)

introduced a higher education bill that seeks to address the legacy of inadequate training in South Africa. It is proposed that the entire higher education sector will be governed by a single national law. High-level skills training: *"the creation through higher education of professionals and knowledge workers with globally equivalent skills to strengthen this country's enterprises, services and infrastructure"* (p.11) as an aim of higher education is highlighted, as is a requirement for expanding enrolments that will lead to a more diverse student body. Furthermore, the ministry intends *"encouraging new learning and teaching strategies, in particular, modifying traditional models of discipline-based and sequential courses and qualifications with a flexible credit-based system, with multiple entry and exit points and a range of delivery mechanisms, including distance education and resource-based learning."* (p.16). The enabling mechanism for this approach will be the National Qualifications Framework (NQF) and the statutory body, the South African Qualifications Authority (SAQA), that will regulate the functions of the NQF has been established.

1.2 PROBLEM FORMULATION

The choice of an occupation is a major decision and has far reaching consequences for the individual. Work occupies a sizable part of most people's lives. A satisfactory choice of occupation can lead to personal growth and well-being. Levitz and Noel (1989) reported that uncertainty about what to study is the most frequent reason high-ability students give for dropping out of college. Uncertainty about career choice is typical of students entering higher education. Higher education institutions should make provision for helping students with their career development. It is also important for the economy of the country that people's talents and potential be maximally utilized. For high-level manpower, preparation for an occupation usually entails study at a higher education institution. In this context it is important to provide learners with optimal learning experiences and provision should be made for diversity within the student population. Acknowledging and making provision for different learning styles is one aspect of good undergraduate practice in institutions of higher education. This study aims to explore the relationship between vocational personality and learning style. This could lead to identifying characteristics that could be used in career counselling to ensure the best possible "fit" between the individual and his or her career options. Utilizing information on learning styles could provide optimum development of academic potential in the individual's preparation for a career.

"Institutions that impart transferable skills and relevant knowledge, bolster confidence and creativity, and engender social responsibility and self-directed learning are needed more than ever." (Chickering & Reisser, 1993, p. 44).

The theories and assessment instruments of John Holland (vocational personality types) and David Kolb (learning abilities and styles) were developed mainly within and for people of the Northern American or Western culture. This research project proposes to explore the applicability of these theories and assessment instruments to students at a South African university who represent different cultures. There is a need for career counselling theory and assessment instruments applicable to all culture groups. Academic development for diverse student populations is a necessity in higher education provision. It is also proposed that these two theories could be integrated resulting in a useful framework for career counselling and academic development.

1.3 AIMS OF THE STUDY

The broad aims of the research project are the following:

- to integrate John Holland's model of vocational personalities and David Kolb's model of learning abilities and styles;
- to use subjects representing different cultural groups from two fields of study at the University of Pretoria in an empirical study to investigate the possible integration of the two models;
- to investigate the psychometric properties of two normative forms of Kolb's Learning Style Inventory.

1.4 ORGANIZATION OF THE PRESENT RESEARCH REPORT

To clarify the complexity of the concepts used in this research project (such as the six vocational personality types as defined by Holland, and the four learning abilities and four learning styles as defined by Kolb) a detailed literature study will be undertaken. Concept clarification will be provided in the following chapters.

To achieve the stated aims the following steps are taken.

- In Chapter 2 a literature study on student development is undertaken. Theories on student development are described and factors affecting student development are identified. Student development is represented by academic development, career development and personal development. Kolb's theory of experiential learning as an aspect of academic development and Holland's theory of person-environment interaction as an aspect of career development are further investigated in this research report.

- In Chapter 3 John Holland's theory of vocational personalities and work environments is described. A review of the literature on the concepts and assumptions of the theory is done, some practical uses of the theory are highlighted and criticism of the theory is given.

- In Chapter 4 David Kolb's theory of experiential learning and learning styles is described. Characteristics of experiential learning and learning abilities and styles are described. Special attention is paid to the literature on the Learning Style Inventory, the instrument Kolb devised to assess learning abilities and styles. Some practical uses of the theory are highlighted and criticism of the theory is given.

- In Chapter 5 a theoretical integration of Holland and Kolb's models of vocational personality types, and learning abilities and styles is proposed.

- In Chapter 6 the research design and procedure for the empirical part of this research report is given.

- In Chapter 7 the results of the empirical study are given and discussed. Results pertaining to the integrated model of vocational personality types, and learning abilities and styles proposed in Chapter 5 are discussed.

- In the final chapter (Chapter 8) a brief summary of the research report is given and recommendations based on the findings of the study are made.

CHAPTER TWO

STUDENT DEVELOPMENT

2.1 INTRODUCTION

Development is defined by Plug, Meyer, Louw and Gouws (1979) as a series of continuous changes in an organism or a group of organisms such as a social group. The development of an organism begins at conception and ends at death. It accompanies maturation and growth and is influenced by the genetic composition of the organism, external physical factors and social factors. Learning plays an important role in conjunction with the last two factors.

Developmental psychologists seek the commonalities of change across individuals in order to describe and anticipate changes occurring in all persons and the sequences in which the changes take place. Development is seen by some to be discontinuous and occurring in stages. Others see behaviour as continuous, progressing in smooth, if uneven, development. Another question is whether the stimulus for change is primarily internal or external to the person. "Stage" theories emphasize inborn or biological characteristics of persons, whereas "task" theories emphasize characteristics of the environment (physical or social) that require different ways of coping. (Parker, 1978).

Sanford (1967) described development as the process of an individual's growth in a way that allows him to become increasingly complex. He recognized individual differences in development stating that individuals grow and develop at rates that are unique to their personality and experience.

The literature on **student development** provides a predominantly American perspective. In this context higher education institutions are seen to have had a long history of involvement with the development of students stretching back for three centuries. Initially the focus was religious and the aim was to instill Christian values. It was only in the twentieth century that secular influences through the development of psychology, in particular the fields of cognitive and developmental psychology, informed thinking on student development (Parker, 1978). Nevitt Sanford's writings

in the 1960s are regarded as a landmark heralding the current orientation toward student development. He consistently developed the thesis that *"institutions of higher education should have as their primary goal the individual development of each student enrolled"* (Parker, 1978, p.7). Sanford proposed that student development was a continuous process of differentiation and integration and that the process took place through the interaction between student and the collegiate environment (Sanford, 1962). He argued that student development required an environment that both challenged and supported individuals in a balanced way (Sanford, 1967). Too much challenge is overwhelming; too much support is debilitating. Growth and change occur when the student achieves equilibrium in response to challenge, and the degree of support available to the student in the college environment will contribute to his success. Sanford's writings were followed by Arthur Chickering's *Education and Identity* in 1969 and a host of other theories and models of student development (see 2.2).

Currently it is believed that student development should address the academic or intellectual development of students, as well as their personal and career development. This can be done through (a) instruction which includes the curriculum and teaching and assessment strategies, (b) the provision of support services such as tutoring, mentoring and student counselling services, and (c) through environmental management such as providing residential and study facilities; providing extra-curricula activities; liaison between student bodies, faculty and administrators, and so forth.

Student development should also be sensitive to the increasing diversity of the student body. In the 1960s research was carried out on, and student developmental theories were based on, adolescent or young adult, white, upper-middle-class, male student populations. Over the years the profile of the student body has changed to include women, black and non-traditional adult and part-time students (Stage, 1991).

Over the past three decades a growing body of literature in higher education has dealt with changes students undergo, factors influencing those changes and student success, and the development of student development theories (Gardner & Jewler, 1989; Parker, 1978; Pascarella & Terenzini, 1991; Upcraft & Gardner, 1989).

2.2 STUDENT DEVELOPMENT THEORIES

The original student development theory was *in loco parentis* where the educational institution acted on behalf of parents for their children. It was believed that the development of students' character in general, and Christian moral character in particular, were far more important than the development of their intellect (Upcraft & Moore, 1990). This attitude prevailed for many centuries until it was challenged in the mid-twentieth century by a combination of developing psychological and sociological theories, as well as student activism, and was replaced by the more recent thinking on student development (Upcraft, 1989). Theories of student development developed and researched in the 1960s focused on white American males between 18 and 20 years of age (Stage, 1991). Females, non-white students, minority groups and adult learners were either under-represented or left out altogether. Awareness of these inadequacies and gaps in the theories grew in the 1980s and are now being addressed (Chickering & Reisser, 1993; McEwen *et al.*, 1990; Sue & Sue, 1990; Upcraft & Gardner, 1989; Upcraft & Moore, 1990). Chickering and Reisser (1993) noted that although recent research may indicate variations in style and sequence, the fundamental themes reappear. While a large number of theories have been developed since the late 1960s and early 1970s, the theories of Chickering, Kohlberg and Perry have probably had the greatest influence on the study of the effect of college or higher education on students and on institution policies and programmes designed to promote student development (Pascarella & Terenzini, 1991). Currently the most widely used student development theories can be classified into four major families (Chickering & Reisser, 1993; Stage, 1991).

2.2.1 Psychosocial theories

These theories view development as a series of developmental tasks or stages and focus on the content or the developmental tasks the student is dealing with. Chickering and Reisser (1993) listed the following as examples of psychosocial theories: Erikson's eight developmental crises; Chickering's seven vectors of development; Marcia's model of ego identity status; Cross's model of black identity formation; Heath's maturity model; Josselson's pathways to identity development in women; and life-span theories of adult development represented by such authors as Chickering and Havighurst, Gould, Levinson, Neugarten, Sheehy, Vaillant, and Knox.

Upcraft and Moore (1990) cited Tinto's theory of stages of freshman integration into college life as an example of a psychosocial theory of student development.

Chickering's vectors of development are probably the most widely known and used theory of student development (Upcraft, 1989). His revised 1993 model of seven vectors of student development is described in more detail as an example of a psychosocial theory of student development (Chickering & Reisser, 1993). The model is not intended to be rigidly sequential. Movement along a vector can occur at different rates and can interact with movement on other vectors. Chickering likened the vectors to major highways toward individuation. Although each person may drive differently, with different vehicles, all will move along the major routes. The vectors are intended to help determine where students are and in which direction they are heading developmentally. Whereas the vector *Establishing Identity* is probably more relevant to adolescents and young adults, Chickering saw the vectors as relevant for students of all ages, gender and from diverse backgrounds. The seven vectors and their general developmental directions are given in Table 2.1 (Chickering & Reisser, 1993, pp. 38-39) on the following page.

Chickering stated that higher education institutions can have significant impact on student development along the above vectors through institutional objectives, institutional size, student-faculty relationships, curriculum, teaching, student friendships and student communities, and student development programmes and services (Chickering & Reisser, 1993).

Chickering's vectors provide useful guidelines for the development, implementation and evaluation of student affairs functions and programmes (Hurst, 1978).

TABLE 2.1 CHICKERING'S SEVEN VECTORS: GENERAL DEVELOPMENTAL DIRECTIONS

From	To
Developing Competence	
Low level of competence (intellectual, physical, interpersonal)	High level of competence in each area
Lack of confidence in one's abilities	Strong sense of competence
Managing Emotions	
Little control over disruptive emotions (fear and anxiety, anger leading to aggression, depression, guilt, and shame, and dysfunctional sexual or romantic attraction)	Flexible control and appropriate expression
Little awareness of feelings	Increasing awareness and acceptance of emotions
Inability to integrate feelings with actions	Ability to integrate feelings with responsible action
Moving Through Autonomy Toward Interdependence	
Emotional dependence	Freedom from continual and pressing needs for reassurance
Poor self-direction or ability to solve problems; little freedom or confidence to be mobile	Instrumental independence (inner direction, persistence and mobility)
Independence	Recognition and acceptance of the importance of interdependence
Developing Mature Interpersonal Relationships	
Lack of awareness of differences; intolerance of differences	Tolerance and appreciation of differences
Nonexistent, short-term, or unhealthy intimate relationships	Capacity for intimacy which is enduring and nurturing

From	To
Establishing Identity	
Discomfort with body and appearance	Comfort with body and appearance
Discomfort with gender and sexual orientation	Comfort with gender and sexual orientation
Lack of clarity about heritage and social/cultural roots of identity	Sense of self in a social, historical and cultural context
Confusion about "who I am" and experimentation with roles and lifestyles	Clarification of self-concept through roles and lifestyle
Lack of clarity about others' evaluation	Sense of self in response to feedback from valued others
Dissatisfaction with self	Self-acceptance and self-esteem
Unstable, fragmented personality	Personal stability and integration
Developing Purpose	
Unclear vocational goals	Clear vocational goals
Shallow, scattered personal interests	More sustained, focused, rewarding activities
Few meaningful interpersonal commitments	Strong interpersonal and family commitments
Developing Integrity	
Dualistic thinking and rigid beliefs	Humanizing values
Unclear or untested personal values and beliefs	Personalizing (clarifying and affirming) values while respecting others' beliefs
Self-interest	Social responsibility
Discrepancies between values and actions	Congruence and authenticity

2.2.2 Cognitive-structural theories

These theories describe changes in thinking and the developing frames of reference that students use to structure their values, beliefs and assumptions. Chickering and Reisser (1993) listed the following as examples of cognitive theories: Perry's scheme of intellectual and ethical development; Kohlberg's theory of moral development; Gilligan's "different voice" model; Belenky, Clinchy, Goldberger and Tarule's women's ways of knowing; Magolda's epistemological reflection model; Loevinger's theory of ego development; Kegan's evolving self; Fowler's stages of spiritual development; and Kitchener and King's reflective judgment model.

To illustrate the current trend of adapting and augmenting existing theories developed mainly for males to include other diverse groups' needs and characteristics the work of Belenky, Clinchy, Goldberger and Tarule (1986) will be briefly described. These authors noted that women often felt alienated in the academic environment, doubted their intellectual competence and set greater store in learning through relationships, life crises and community involvement. They interviewed women about their experiences as learners and described five perspectives of cognitive development which parallel Perry's model which they see as male based. The five perspectives are not seen as stages but as positions women take as they advance their cognitive development. The first position is **silence** in which women are powerless and rely on others for their sense of well-being. As they have relatively under-developed representational thought the ways of knowing available to them are limited to the present, the actual, the specific and to behaviours actually enacted. The second perspective is **received knowledge** and is similar to Perry's dualistic positions. Women rely on the knowledge of others and learn through listening to "those who know". Women characterized by the third perspective **subjective knowledge** move from silence and passivity to responding to *"the inner voice"* (p. 52) which challenges knowledge as absolute and authorities as infallible. This represents a move toward greater autonomy and independence. The predominant learning mode is one of inward listening and watching. Intuition is valued above objectivity. Women shape and direct their own lives and begin to choose self over others. Whereas women in the position of received knowledge derived their self-concept through definitions others supply and roles they fill, women in the position of subjective knowledge often felt insecure and did not have an integrated, enduring self-concept due to their shift away

from the familiar contexts and relationships of the received knowledge position. For women autonomy often means a break with past relationships and negative self-images to move to nurturing relationships and empowering self-images. Such separation and individuation can leave women feeling vulnerable and unconnected. In the fourth perspective **procedural knowledge** women begin to replace subjectivism and absolutism with reasoned reflection. The authors suggested that the development of procedural knowledge requires formal instruction or at least the presence of knowledgeable people who can serve as informal tutors. Women engage in the process of acquiring and applying procedures for obtaining and communicating knowledge. They apply different ways of looking at the world to generate a variety of perspectives. Procedural knowledge is more complex and more objective than subjective knowledge and procedural knowers are practical, pragmatic problem solvers. Two styles or voices of procedural knowledge were identified: separate knowing which represents the more familiar academic approach where truth is established through an impersonal, analytical approach and connected knowing where truth is gained through experience and relationships with others. The two voices of separate and connected knowing come together in the fifth perspective **constructed knowledge** where the integration of objective and subjective information, knowledge learnt from others as opposed to own reason and intuition, takes place. *"The capacity for speaking with and listening to others while simultaneously speaking with and listening to the self is an achievement that allows a conversation to open between constructivists and the world"* (Belenky *et al.*, 1986, p. 145).

2.2.3 Person-environment interaction theories

These theories focus on how the environment influences behaviour through interaction with characteristics of the individual. Chickering and Reisser (1993) listed the following as examples of person-environment interaction theories: campus ecology theories of Barker, and Banning and Kaiser; Holland's theory of vocational personalities and work environments; and perceptual models of Moos, Stern and Pervin. Holland's theory is described in Chapter 3.

2.2.4 Typology theories

These theories describe distinctive but stable differences in learning style, personality

type, temperament or socioeconomic background as contexts for development. Chickering and Reisser (1993) listed the following as examples of typology theories: Witkin's cognitive styles; Kolb's learning styles; the Myers-Briggs typology; Keirsey and Bate's temperaments; and Cross's work on sociodemographic characteristics. Kolb's theory of experiential learning and learning styles is described in Chapter 4.

2.3 FACTORS AFFECTING STUDENT DEVELOPMENT

2.3.1 Academic development

Chickering and Reisser (1993) stated that research shows that clear and consistent institutional objectives make significant contributions to student development. They facilitate internally consistent policies, programmes and practices. When faculty and students take the objectives seriously they pervade all aspects of the institution such as academic and non-academic expectations and requirements, student-faculty relationships and admissions criteria. Usually only small institutions achieve clear and consistent objectives as the diversity of larger institutions makes the formulation of clear-cut objectives for student learning and development virtually impossible. Pascarella and Terenzini (1991) suggested that to enhance the impact of institutions of higher learning their policies and programmatic efforts should be broadly conceived and diverse, as well as consistent and integrated. A university campus environment should not be seen as unitary and global, but rather as an amalgam of diverse subenvironments. While the impact of a single subenvironment may be small the cumulative effect, if the environments are supportive, could be large.

Social involvement or social integration during college is a major determinant of persistence and degree attainment (Pascarella & Terenzini, 1991). Research evidence suggests that large numbers of students result in decreased student involvement, participation and integration. Possible student isolation and anonymity needs to be countered by involving students within smaller groups of individuals both academically and socially (Pascarella & Terenzini, 1991). Levitz and Noel (1989) advocated that every first-year student should feel attached to at least one person at the institution. Research has shown quality and frequency of student-faculty contact to be key variables in student development (Chickering & Reisser, 1993). Institutional size is negatively associated with amount of student-faculty non-classroom contact.

Persistence and retention are highest when students have a strong sense of involvement and of belonging, have frequent informal contacts with faculty and experience the institution and its staff as caring. Schlossberg, Lynch and Chickering (1989) proposed a mattering/marginality theory. Students who believe that they matter and that others (faculty, peers and family) care about them will develop a sense of belonging. A minority group, such as african students in a white institution, are most vulnerable to feelings of marginality.

The curriculum and teaching and assessment strategies have a major impact on academic development. Research by Klemp (1977) found that effective performance in the world of work was not related to the amount of knowledge acquired in a content area, but to cognitive skills, interpersonal skills and motivational characteristics. These kinds of competencies can be fostered through a wide range of content areas and need to be addressed through the curriculum and teaching practice. Four guidelines for selecting content for the curriculum proposed by Chickering and Reisser (1993) follow and seven principles for good teaching practice are given in the next paragraph. To encourage academic development:

(1) make content relevant to students' backgrounds and prior experiences;
(2) recognize significant dimensions of individual difference between students;
(3) create encounters with diverse perspectives that challenge pre-existing information, assumptions and values;
(4) provide activities that help students integrate diverse perspectives, assumptions, value orientations.

Chickering and Gamson formulated the *Seven Principles for Good Practice in Undergraduate Education* (Chickering & Reisser, 1993) that apply directly to teaching and assert that good practice

(1) encourages student-faculty contact;
(2) encourages cooperation among students;
(3) encourages active learning;
(4) gives prompt feedback;
(5) emphasizes time on task;
(6) communicates high expectations;
(7) respects diverse talents and ways of learning.

2.3.2 Career development

The history of career counselling is usually traced back to Frank Parsons who in 1909 in his book *Choosing a Vocation* proposed three steps of vocational counselling: self-analysis, occupational analysis and true reasoning or the integration of self-information with occupational information (Walsh & Osipow, 1990). Since then many theories of career choice and development have evolved (Brown & Brooks, 1990; Osipow, 1983). In a review of the literature since 1980 Hackett and Lent (1992) identified the current major theories based on their empirical status (see 2.3.2.1. to 2.3.2.3). In a literature review of empirical research on career counselling in South Africa for the period 1980 - 1990, de Bruin and Nel (1996) observed that the South African research in this field was strongly influenced by the theoretical perspectives of Holland and Super. These authors advocated the development of a South African model of career development. As is the case with student development theories, career development theories are often criticized as being formulated to explain career development for white American males and thus do not address gender and culture/ethnicity differences. Issues of gender and culture/ethnicity are also the focus of current career development research (Brown & Brooks, 1990; Walsh & Osipow, 1994).

2.3.2.1 Person-environment interaction theories and work adjustment theory

The trait and factor perspective has been replaced by person-environment (P-E) fit and the two most influential vocational P-E fit theories are those of Dawis and Lofquist, and Holland. P-E fit theories focus on the match between personal characteristics and those of the work or educational environment. Good P-E fit is assumed to be associated with positive outcomes such as work satisfaction, achievement and retention. Work adjustment is the dynamic process whereby people achieve and maintain correspondence or a harmonious relationship with their work environment. (Hackett & Lent, 1992). Holland's theory is described in Chapter 3.

2.3.2.2 Developmental theories

Developmental approaches emphasize the process of career decision making and the factors which influence it. This approach is represented by a vast amount of research

and theorizing.

Gottfredson (1981, 1983, 1985) proposed a stage model of occupational aspirations in which she focused on the development of the self-concept with respect to gender, social class, intelligence, interests, values and abilities. As people move through the four proposed stages of orientation to size and power (ages 3-5 years), orientation to sex roles (ages 6-8 years), orientation to social evaluation (about ages 9-13 years) and orientation to the internal, unique self (beginning around age 14 years), they reject occupations as unsuitable according to their self-concept on the basis of gender, social class and ability level, and personal interests and values. This results in a *"zone of acceptable alternatives"* (Gottfredson, 1981, pp. 557,556) based on personal preference and perception of accessibility. People often have to compromise their vocational aspirations and compromises are made in the following order: first interests are sacrificed, then prestige level, followed by sex type. Empirical support for Gottfredson's theory has been mixed (Brooks, 1990; Hackett & Lent, 1992). From studies on the process of compromise it appears that prestige, interests and sex type of occupation interact more complexly and probably not in the exact way that Gottfredson proposed. The stage model appears to need revision and one study demonstrated that the area of the zones of acceptable alternatives increased with age up to late adolescence, whereas the theory predicts a decrease.

Vondracek, Lerner and Schulenberg (1986) emphasized a life-span developmental-contextual approach which focuses on the dynamic interaction of the individual and their context. They argued that the concept of stages may be outdated (Hackett & Lent, 1992). To date there has been limited empirical work on this theory (Hackett & Lent, 1992).

Super's (1957, 1980, 1990) segmental theory of career development is increasingly viewed as the most comprehensive and promising of the developmental theories (Brown, 1990). The theory is segmental because it represents *"a loosely unified set of theories dealing with specific aspects of career development, taken from developmental, differential, social, personality, and phenomenological psychology and held together by self-concept and learning theory."* (Super, 1990, p. 199). The Archway Model with the self as keystone provides a graphic representation of the segmental model of career development (Super, 1990). An overview of the theory

is not possible in this limited space and only certain concepts will be highlighted.

Super proposed the following stages of career development: growth, exploration, establishment, maintenance and decline (Super, 1957). Each stage is characterized by developmental tasks and coping behaviours specific to the relevant stage. The ages at which transitions occur between stages are very flexible and transitions involve recycling through one or more stages. Developmental stage and life roles were integrated in the life-career rainbow in which six life roles are depicted in schematic life space (Super, 1980). The important concept of role salience was introduced in the context of the life career rainbow. A career is seen as an interaction of life stage, life roles, personal and situational determinants and does not only focus on the role of worker. Decision making is central to career development and decision points occur before assuming a new role, at the time of giving up an old role and when making significant changes to an existing role. Super (1980) depicts a rational model of career decision making. Career maturity is defined as *"the individual's readiness to cope with the developmental tasks with which he or she is confronted because of his or her biological and social developments and because of society's expectations of people who have reached that stage of development."* (Super, 1990, p. 213). According to Super readiness to make career decisions in adulthood should be called career adaptability rather than career maturity because the link between age and developmental tasks is not as strong in adulthood as it is in adolescence. Self-concept theory plays a central role in Super's career development theory. A person does not have a self-concept, but many self-concepts which are organized in a self-concept system and Super has proposed a taxonomy of dimensions and metadimensions of self-concepts and self-concept systems (Super, 1990). More recently the construct self-concept was broadened to "personal constructs" conceptualized as products of learning (Hackett & Lent, 1992).

Osipow (1983) concluded that Super's theory was generally supported by the research literature. Stead and Watson (1995) explored the relevance of the career approaches of Super and Vondracek *et al.* for black South Africans and pointed out that although useful *"neither of these approaches adequately address racial and discrimination issues nor culturally based perceptions of work and career among Blacks."* (p. 11). They proposed that research be done to re-evaluate certain theoretical concepts within the black South African context.

2.3.2.3 Social cognitive models, including social learning and self-efficacy theory

Social cognitive models represent a relatively recent trend in the career development literature and stem from Bandura's social learning theory, more recently renamed social cognitive theory (Hackett & Lent, 1992). Krumboltz's social learning approach to career decision making and Hackett and Betz's career self-efficacy theory will be briefly described.

According to Krumboltz's social learning theory of career decision making (Krumboltz & Nichols, 1990; Mitchell & Krumboltz, 1990), four categories of factors influence career decision making:

(1) genetic endowment and special abilities such as intelligence;
(2) environmental conditions and events;
(3) learning experiences; and
(4) task approach skills which result from interaction among the first three factors.

The interaction of these four factors results in cognitions, beliefs, skills and actions. Individuals formulate self-observation generalizations about their task efficacy, interests and personal values, and world-view generalizations about the environment. The following task approach skills are important in career decision making: recognizing an important decision situation; defining the decision or task manageably and realistically; examining and accurately assessing self-observations and world-view generalizations; generating a wide variety of alternatives; determining which information sources are most reliable, accurate and relevant; and planning and carrying out these six steps of decision making. Krumboltz has stated a number of testable theoretical propositions. In reviewing the empirical evidence related to the theory Mitchell and Krumboltz (1990, p. 177) concluded *"there is considerable evidence to support the processes posited by the theory"* with respect to factors influencing educational and occupational preferences and task approach skills, however there is less evidence regarding entry behaviours. Several of the propositions have fairly strong supporting evidence while others have little or none (Hackett and Lent, 1992). These authors suggested that the theory should be updated to include recent developments in Bandura's general social cognitive theory

so that additional social cognitive concepts could be generalized to the career development domain. Krumboltz and Nichols (1990) have integrated the social learning theory of career decision making with Ford's Living Systems Framework, placing it in a broader theoretical context.

Hackett and Betz's (1981) career self-efficacy theory is an application of Bandura's self-efficacy theory to the career domain. Self-efficacy theory is concerned with a person's belief that they can successfully perform a task or behaviour, and not with their objective skills. Beliefs of self-efficacy influence whether behaviour will be initiated, the amount of effort that will be expended and how long the behaviour will persist in the face of obstacles (Brooks, 1990). Although self-efficacy is seen as the most important causal influence, other factors such as outcome expectations (beliefs about the consequences of performance), performance incentives, and environmental support also influence behaviour. Hackett and Betz proposed that self-efficacy influences the career decisions, achievements and adjustment behaviours of both men and women. However, they stressed self-efficacy theory's potential to explain women's career development (Hackett & Lent, 1992).

2.3.3 Personal development

Student development aims to educate "the whole student" implying that the students' physical, interpersonal, emotional and ethical development is as important as their cognitive or academic development. The important role people relationships and the higher education environment play in student development is emphasized by research indicating that the frequency and quality of students' interactions with faculty and peers and participation in extracurricular activities are all positively associated with persistence and development. Pascarella and Terenzini (1991, p. 620) reported that *"A large part of the impact of college is determined by the extent and content of one's interactions with major agents of socialization on campus, namely, faculty members and student peers. The influence of interpersonal interaction with these groups is manifest in intellectual outcomes as well as in changes in attitudes, values, aspirations and a number of psychosocial characteristics."*

Student development programmes and services can be grouped into three sequenced clusters of functions, namely **entering services**, **supporting services** and **culminating**

services (Schlossberg *et al.*, 1989; Chickering & Reisser, 1993).

Entering services focus on preadmissions, recruitment, admissions, financial aid, employment, orientation, educational planning, academic skills assessment, prior learning assessment and registration.

Supporting services assist students during their passage through the institution. Programmes and services include academic support services such as peer tutoring and mentoring; career development; lifeskills training; personal counselling and support groups; recreational, sport and cultural activities; student organizations; health services; and residential life.

Culminating services assist students in their transition from the higher education institution to work or further education. Programmes and services include internships, placement services, writing of a curriculum vitae and preparing for an interview.

2.4 OUTCOMES OF STUDENT DEVELOPMENT

Owens (1989) and Pascarella and Terenzini (1991) reported research findings on how students change during college and the effect of higher education on students. Students make statistically significant gains in factual knowledge and in a range of cognitive and intellectual skills. However change extends substantially beyond cognitive growth and includes development on a broad number of value, attitudinal, psychosocial and moral dimensions. Changes are thus not concentrated in a few isolated areas, but are of a mutually consistent and supporting nature occurring in a holistic, integrated way that encompasses many facets of individual development. These findings are consistent with Chickering's model of student development. Pascarella and Terenzini pointed out that as many of the dimensions on which change occurs have a developmental base, change during college may not reflect the impact of college, but may represent natural maturation. However, they reported evidence that indicates that in certain areas change is attributable to college attendance rather than rival explanations. There is more extensive and consistent evidence to support the net impact of college on learning and cognition, moral reasoning and career and economic returns than the areas of attitudes, values and psychosocial characteristics.

There is a modest tendency for changes in intellectual skills to be larger in magnitude than changes in other areas. A strong positive impact is reported on knowledge and cognitive development when first-year students are compared with senior students. Advances in general verbal and quantitative skills are reported and, as would be expected, substantial advances in knowledge of the specific subject matter related to major field of study are demonstrated. Gains are also made in a range of general intellectual competencies and skills such as oral and written communication skills, formal reasoning, critical thinking and the ability to deal with conceptual complexity and to solve ill-structured problems. There is an increase in the ability to relate ideas to one another, theoretical issues are better understood and an interest in lifelong learning is fostered. An enhanced repertoire of intellectual skills allows individuals to adapt more quickly and efficiently to changing environments and this development probably represents the most important gain for the student's future. Educational achievement, career development and income levels are positively related.

The aim of student development is to educate the whole person and evidence indicates that higher education does achieve this goal with mainly positive results. Increased self-discovery takes place with changes in attitudes, beliefs, self-concept, values and behaviour. There is a trend towards liberalization with shifts toward openness, a tolerance for diversity, a stronger "other-person orientation" and concern for the rights and welfare of others. Authoritarianism decreases and autonomy grows. Graduates tend to be more adaptable and more future orientated with more liberal views. Political sophistication increases and aesthetic capacity grows. Students not only become more competent, they become more confident as self-esteem increases. Students appear to move toward greater self-understanding, self-definition, personal commitment and more refined ego functioning. Involvement in campus activities promotes the development of leadership and lifeskills. Students also show modest gains in general personal adjustment, sense of psychological well-being and general personal development and maturity. Graduates also tend to be more efficient consumers and are more concerned with health maintenance through a healthy lifestyle, than only the treatment of physical and mental health problems. There is an increased practical competence in the area of family life with an emphasis on the quality of family life.

On the negative side some increase in hedonic behaviour such as drinking and

gambling may occur. A decrease in formal religious identification may take place and religious activity may decline. Ethical behaviour and integrity have not been found to be so positively influenced by the higher education experience, but it is thought that these characteristics are acquired at an earlier age and may be better learnt in other social and learning environments.

2.5 PROMOTING STUDENT DEVELOPMENT

2.5.1 Promoting student development through academic development

Seven principles for good teaching practice in undergraduate education were given in section 2.3.1. Research has shown that the systematic ordering of learning opportunities promotes academic development. Pascarella and Terenzini (1991, p. 141) reported the use of learning cycles as an effective general approach as follows:

"A considerable body of inquiry has focused on the effectiveness of instructional interventions designed to increase students' formal reasoning. In our synthesis of this evidence, we found one particular approach, termed ***inquiry*** *or* ***learning cycle*** *... to have the most consistently positive effects. The purpose of the learning cycle-inquiry approach is to move students from concrete to formal reasoning. It does this essentially by making the learning process highly inductive, or concrete, in nature. Concepts are taught in three stages: (1) exploration - students participate in an activity or laboratory with concrete materials (for example, collect data or conduct an experiment); (2) invention - students draw together ideas and/or concepts out of the concrete activities; and (3) discovery - students generalize or apply the concept."*

Application of such a learning cycle can increase teaching effectiveness. Kolb proposed a learning cycle in his theory of experiential learning that is similar to the approach cited above. Kolb's theory is described in Chapter 4 and in this study it represents one approach in academic development as an aspect of student development.

2.5.2 Promoting student development through career development

Career development can be promoted in many ways including self-help books such as

Bolles' (1988) *What color is your parachute?* and workbooks, through career development programmes and workshops that address career development tasks and decision making skills, through individual counselling and through the use of computerized career guidance programmes such as CAREER MENTOR (Hartley, 1992). These programmes and services can be made available to students to promote their career development.

Holland's theory of person-environment interaction is described in Chapter 3. In this study it represents one approach to career development as an aspect of student development.

2.5.3 Promoting student development through personal development

An underlying assumption in student development is that students are responsible for their own lives (Lyons, 1990). Research has demonstrated the positive effects higher education can have on students' personal development (Pascarella & Terenzini, 1991). Institutions of higher learning have a responsibility to assist students to become independent and interdependent through promoting their personal development. To do this institutions need to define this responsibility and include it in their mission and goals along with their academic goals. These goals should not remain lofty ideals, but need to be realized by devoting curricular and extra-curricular time, staff and resources to providing the necessary student development programmes and services.

Personal development as an aspect of student development is not directly represented in this study, the focus of which is to explore the possible interaction of Holland and Kolb's theories. However, typology models emphasize individual differences, and recognizing and respecting individual differences, especially with the ever increasing diversity of the student body, are important aspects of student development.

2.6 CRITICISM OF THE THEORIES OF STUDENT DEVELOPMENT

The first work on developing theories of student development dates back to the 1960s. At that time research was carried out on, and student developmental theories were based on, adolescent or young adult, white, upper-class, male American student populations. The student profile has changed dramatically since then and theories

developed at that time are now criticised as being inadequate or irrelevant for the present situation.

Theory development is a dynamic, evolving process, and research and theory development over the past few decades has responded to the changing profile of the student body, the changes students undergo and the factors that influence those changes and student success. For example, Chickering (Chickering & Reisser, 1993) has recently updated his seven vectors of development. Since the 1980s awareness of inadequacies and gaps in the theories has led to a variety of theories addressing the needs and characteristics of previously under-represented groupings in the diverse student profile, such as females, non-white students, minority groups and adult learners (Chickering & Reisser, 1993; McEwen *et al.*, 1990; Sue & Sue, 1990; Upcraft & Gardner, 1989; Upcraft & Moore, 1990).

These more recent theories which attempt to encompass the complexity and diversity of student development promote a broader view and understanding of students' needs. However, the traditional theories are not necessarily redundant because they were based on a restricted student sample. Chickering and Reisser (1993) noted that although recent research may indicate variations in style and sequence, the fundamental themes appear. The more recent theories of student development can supplement the traditional theories. A focus on commonalities of the student experience, and not only an emphasis on the diversity, is needed to promote student development.

The literature on student development provides a predominantly American perspective. Stead and Watson's (1995) criticism of career development theories developed by American authors that although useful, they do not always address issues pertinent to the South African context (see 2.3.2.2) is relevant to all the theories discussed in this chapter. Re-evaluation of certain theoretical concepts should be undertaken within the South African context.

2.7 SUMMARY

In this chapter the concepts of development and student development are elucidated. Student development theories are divided into four categories, namely psychosocial

theories, cognitive-structural theories, person-environment interaction theories and typology theories. A brief overview of major theories representing these four categories of student development theories is given. Factors affecting student development in the domains of academic development, career development and personal development are described and research results indicating the outcomes of student development are summarised. Institutions of higher education as providers of high-level manpower and professionals need to promote student development. In this study Holland's theory of person-environment interaction represents one approach to career development as an aspect of student development, and Kolb's theory of experiential learning and learning styles represents one approach to academic development as an aspect of student development. The empirical part of this study focuses on first-year university students.

In the following two chapters Holland's theory of person-environment interaction and Kolb's theory of experiential learning and learning styles will be described. The information in these chapters on Holland's vocational personality types and Kolb's learning abilities and styles will be used in Chapter 5 to develop a theoretical integrated model of vocational personality types, and learning abilities and learning styles. The empirical part of this study will then be described and reported on. Results from the empirical part of this study relevant to the proposed integrated model will then be discussed.

CHAPTER THREE

JOHN HOLLAND'S THEORY OF VOCATIONAL PERSONALITIES AND WORK ENVIRONMENTS

3.1 INTRODUCTION

The theory developed out of Holland's experience as a vocational counsellor and a clinician, from his wide reading of the vocational literature, as well as from his experience of constructing a personality/interest inventory (Holland 1966). He first introduced his theory in 1959, but it was from the 1970s, especially after the publication of the book *Making vocational choices: A theory of careers* (Holland 1973), that the theory became increasing influential in the field of vocational psychology. Hackett, Lent and Greenhaus (1991) in a 20 year review of vocational theory and research noted that Holland's theory is the most visible and highly researched theoretical perspective since 1971. The theory has been a primary research topic in vocational psychology since its inception and has probably generated more research than any other theory of career behaviour. The use of his inventories is widespread (Walsh & Srsic, 1995). Holland's theory of vocational personalities and work environments is widely considered one of the most influential career development theories and occupational taxonomies in vocational psychology (Tracey & Rounds, 1993).

The theory has been characterized as a trait-factor theory, but Chartrand (1991) posited that the trait-factor model of career counselling had evolved into a person-environment fit approach and cited Holland's theory as the best known example of a theory of person-environment fit.

The purpose of Holland's (1959, 1966, 1973, 1985) theory is to organize and interpret personal and vocational information with a view to explaining and predicting how people make vocational choices. Central to his theory is the idea that both people and work environments can be classified into six types: Realistic (R), Investigative (I), Artistic (A), Social (S), Enterprising (E) and Conventional (C). Furthermore he specified a circular RIASEC ordering of the six types and environments called the hexagonal model.

It is assumed behaviour is determined by interaction between personality and environment and thus the theory predicts outcomes regarding optimal person-environment match. Examples of such outcomes are educational and vocational choice; educational and vocational achievement; vocational satisfaction, stability and change.

3.2 THE THEORY

Holland (1985:2-4) provided four assumptions that form the heart of the theory:

3.2.1 *In our culture, most persons can be categorized as one of six types [R, I, A, S, E, C].*

The theory was developed in the United States of America and early empirical studies were conducted mainly on white males (Holland, 1966) who were mostly undergoing tertiary education in the USA. "Our culture" thus refers to this population. However, many studies have since supported the validity and usefulness of the theory, the associated assessment instruments and the classification system for both males and females (Hansen, 1992), as well as for diverse nationalities and cultures (Arbona, 1990; Brand *et al.*, 1994; du Toit, 1988; Ferreira & Hood, 1995; Fouad, 1993; Holland, 1985; Holland & Rayman, 1986; Swanson, 1992a). Holland and Gottfredson (1992) noted that differences among national or ethnic groups were usually smaller than differences between men and women from the same group. They stated that gender differences were clearly linked to vocational interests and attempts to "erase" these differences through measurement manipulation were inappropriate. Prediger and Vansickle (1992b) pointed out that this referred to Holland and Gottfredson's preference for the use of raw scores, rather than normed scores. Prediger and Vansickle stated that many studies demonstrated that raw interest scores were less valid for use for career counselling. Brown (1990), however, stated that the Self-Directed Search employed raw scores, as opposed to normative scores, which resulted in women falling in the Social and Artistic categories more often than the Conventional or Realistic categories. This resulted in criticism that the instrument was sexist and that normative scores would result in different profiles for women. Holland's view was that the results reflected the social structure where women are socialized differently to men. Brown noted that Holland's theory explains existing

phenomena and counsellors should take these differences into account.

3.2.1.1 Development of the personality types

Holland (1966, 1985) described the process of the development of a certain personality type in a person in the following way. The process is influenced to some degree by the personality types of the parents who provide environmental opportunities and deficits as well as an inherited component of physical and psychological potentials. To some extent types produce types. Other influences such as school relations and friends contribute to the process. A child will manifest preferences for certain activities and aversion to others. Engaging in the preferred activities leads to strong related interests, values and competencies. These interests and competencies create a certain personal disposition or way of perceiving and interacting with the world and this culminates in a personality type.

"In the theory, development over the entire life course can be understood as a long series of person-environment interactions in which people are modified and stabilized as they select, pass through, or avoid behavior situations that reject, select, and encourage some behavioral or personality repertoires more than others." (Holland 1985, p. 52)

Eberhardt and Muchinsky (1984) found that significantly different personal life-history experiences differentiated the lives of members of RIASEC vocational types. Moloney, Bouchard and Segal (1991) used the Strong-Campbell Interest Inventory (SCII) and the Jackson Vocational Interest Survey to investigate the vocational interests of monozygotic and dizygotic twins reared apart and found that 40-50% of the variation in vocational interests was genetic in origin. The sample was mainly female with a mean age of about 40 years and consisted mostly of mature adults with considerable work experience. Common family environmental influences on vocational interests appeared to be virtually absent. Differences in parental treatment and physical facilities in the rearing environment appeared to be unrelated or only slightly related to individual differences in vocational interests. Both Walsh and Srsic (1995) and Watkins and Subich (1995) reviewed research that indicated that approximately 50% of variance in vocational interests was attributable to genetic influence.

In a study of 949 elementary school children Trice, Hughes, Odom, Woods and McClellan (1995) found some support for the theoretical positions of Ginzberg, Gottfredson, Havighurst and Roe with respect to the role of childhood in career development. Support was found for Ginzberg's position that interests play a major role in both the selection and rejection of occupations throughout childhood. From Roe's theory evidence was found that family configuration influenced occupational choice/no choice. Support was found for Havighurst's idea that identification with a parent's work is particularly strong among younger children, but this effect diminished by the sixth grade. From Gottfredson's theory support was found for age-graded concerns with respect to sex role, prestige and ability as reasons for rejecting occupational options, and for her hypothesis of a narrowing of occupational interests during childhood. Lubinski, Benbow and Ryan (1995) found in a 15-year longitudinal study (spanning the age period of 13 to 28 years) of gifted adolescents that the dominant RIASEC type at age 13 was highly likely to be either the dominant or adjacent type at age 28. These findings support Holland's theory of the development of vocational interests.

3.2.1.2 Description of the types

Descriptions of the types are summarized in Tables 3.1a and 3.1b on the following two pages.

3.2.1.3 Literature on the personality types

Holland (1985) in a review of the literature for the period 1959 to 1983 reported that the evidence from correlational studies investigating the relationship between the Vocational Preference Inventory (VPI) or the Self-Directed Search (SDS) and a wide range of personality inventories supported the description of the types. Tokar and Swanson (1995) referred to research that supported the validity of Holland's trait characterizations of the types. In the studies referred to, VPI or SDS scores were related to a wide range of measures of personality such as Cattell's 16 Personality Factor Questionnaire (16PF), the Edwards Personal Preference Schedule, the Myers-Briggs Type Indicator (MBTI) and the Neuroticism-Extraversion-Openness (NEO) Inventory. However, these authors cautioned that the evidence was often not especially consistent or robust.

TABLE 3.1a: THE HOLLAND PERSONALITY TYPES

REALISTIC	INVESTIGATIVE	ARTISTIC
PREFERRED ACTIVITIES AND RESULTANT COMPETENCIES		
The Realistic person prefers activities that entail the explicit, ordered, or systematic manipulation of objects, tools, machines and animals. This leads to the acquisition of manual, mechanical, agricultural, electrical and technical competencies.	The Investigative person prefers activities that entail the observational, symbolic, systematic and creative investigation of physical, biological and cultural phenomena in order to understand and control such phenomena. This leads to the acquisition of scientific and mathematical competencies.	The Artistic person prefers ambiguous, free, unsystematised activities that entail the manipulation of physical, verbal or human materials to create art forms or products. This leads to the acquisition of artistic competencies - language, art, music, drama, writing.
HAVE AN AVERSION TO:		
The Realistic person has an aversion to educational or therapeutic activities and has deficits in social and educational competencies.	The Investigative person has an aversion to persuasive, social and repetitive activities and has deficits in persuasive competencies.	The Artistic person has an aversion to explicit, systematic and ordered activities and has deficits in clerical or business system competencies.
PERCEIVE THEMSELVES AS:		
They perceive themselves as having mechanical and athletic ability and lacking ability in human relations.	They perceive themselves as scholarly, intellectual, having mathematical and scientific ability and lacking in leadership ability.	They perceive themselves as expressive, original, intuitive, nonconforming, introspective, independent, disorderly, having artistic and musical ability and ability in acting, writing and speaking.
THEY VALUE:		
They value concrete things or tangible personal characteristics - money, power and status.	They value science.	They value aesthetic qualities.
PERSONALITY TRAITS AND CHARACTERISTICS		
Asocial Conforming Frank Genuine Hard-headed	Materialistic Natural Normal Persistent Practical	Self-effacing Inflexible Thrifty Uninsightful Uninvolved	Analytical Cautious Critical Complex Curious	Independent Intellectual Introspective Pessimistic Precise	Rational Reserved Retiring Unassuming Unpopular	Complicated Disorderly Emotional Expressive Idealistic	Imaginative Impractical Impulsive Independent Introspective	Intuitive Nonconforming Original Sensitive Open

HOLLAND J.L. (1985). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.;pp. 19-20). Englewood Cliffs, N.J.: Prentice-Hall.

TABLE 3.1b: THE HOLLAND PERSONALITY TYPES

SOCIAL	ENTERPRISING	CONVENTIONAL
PREFERRED ACTIVITIES AND RESULTANT COMPETENCIES		
The Social person prefers activities that entail the manipulation of others to inform, train, develop, cure or enlighten. This leads to the acquisition of human relations competencies such as interpersonal and educational competencies.	The Enterprising person prefers activities that entail the manipulation of others to attain organizational goals or economic gain. This leads to the acquisition of leadership, interpersonal and persuasive competencies.	The Conventional person prefers activities that entail the explicit, ordered, systematic manipulation of data, such as keeping records, filing materials, reproducing materials, organizing written and numerical data according to a prescribed plan, operating business machines and data processing machines to attain organizational or economic goals. This leads to the acquisition of clerical, computational and business system competencies.
HAVE AN AVERSION TO:		
The Social person has an aversion to explicit, ordered, systematic activities involving materials, tools or machines and has deficits in manual and technical competencies.	The Enterprising person has an aversion to observational, symbolic and systematic activities and has deficits in scientific competencies.	The Conventional person has an aversion to ambiguous, free, exploratory or unsystematised activities and has deficits in artistic competencies.
PERCEIVE THEMSELVES AS:		
They perceive themselves as liking to help others, understanding others, having teaching ability and lacking mechanical and scientific ability.	They perceive themselves as aggressive, popular, self-confident, sociable, possessing leadership and speaking abilities and lacking scientific ability.	They perceive themselves as conforming, orderly and as having clerical and numerical ability.
THEY VALUE:		
They value social and ethical activities and problems.	They value political and economic achievement.	They value business and economic achievement.
PERSONALITY TRAITS AND CHARACTERISTICS		
Ascendant Cooperative Patient Friendly Generous Helpful Idealistic Empathic Kind Persuasive Responsible Sociable Tactful Understanding Warm	Acquisitive Adventurous Agreeable Ambitious Domineering Energetic Exhibitionistic Excitement-seeking Extroverted Flirtatious Optimistic Self-confident Sociable Talkative	Careful Conforming Conscientious Defensive Efficient Inflexible Inhibited Methodical Obedient Orderly Persistent Practical Prudish Thrifty Unimaginative

HOLLAND J.L. (1985). *Making vocational choices: A theory of vocational personalities and work environments* (2nd ed.;pp. 20-22). Englewood Cliffs, N.J.: Prentice-Hall.

In a study by Williams (1972) 145 randomly selected male graduate students from 18 departments were sorted according to Holland type. The students completed, amongst other inventories, the 16PF and the VPI, a forerunner of the SDS consisting of occupational titles. The VPI scales correctly classified 93 of the 145 students. It was found that personality characteristics, as measured by the 16PF, were significantly related to occupational choice. The 16PF scales correctly classified 83 of the 145 students according to Holland type. Discriminant analysis showed that the Investigative, Realistic and Conventional groups were the purest groups (most well-discriminated) and the Enterprising group was the least well-discriminated. This study provided strong evidence that field of study is partially dependent on personality (Holland, 1985).

Holland (1985) reported on a doctoral study completed by Nord in 1976 in which undecided students completed the MBTI and the SDS. Correlations between scales of the two instruments were in predictable directions. Holland (1985, p. 66) cited the following examples: *"Artistic correlates -.46 with Sensing, .26 with Intuition, -.41 with Judgment, and .38 with Perception. In contrast, Conventional correlates .34 with Sensing, -.20 with Intuition, and -.20 with Perception."* Holland noted that the results are particularly impressive as SDS profiles for undecided students are often flat and unpredictive.

Weil, Schleiter and Tarlov (1981) reported on a study of the career aspirations of medical residents with a view to identifying characteristics that differentiate future generalists from future subspecialists in medical training. A sample of 468 residents surveyed in 1977 completed the VPI and the results were used to investigate the relationship between personality and career choice. The authors observed that the two groups were very similar, largely preferring Investigative and Artistic activities. Future generalists were relatively more interested in Social occupations and future subspecialists were relatively more interested in Investigative and Artistic occupations.

Bolton (1985) used the 16PF profiles given in the *Handbook for the 16PF* for 69 occupational groups to investigate the relationship between the 16PF and Holland's six personality types. The 69 occupational groups were each assigned to one of the six Holland occupational types. Analysis was based on only the first letter of the three-letter Holland occupational classification. Multiple discriminant analysis was

carried out on the data. Three discriminant functions were obtained: Independence (imaginative, unpretentious, non-conforming, liberal, self-sufficient, sensitive, reserved and dominant), Extroversion (group dependent, outgoing, undisciplined) and Anxiety (tense, apprehensive, less intelligent, suspicious and less stable). Twelve of the 16PF scales significantly differentiated among the six types. Personality profiles were drawn up for each of the six Holland personality types. The Artistic type was the most different and thus best defined type, followed by Investigative, Enterprising, Realistic, Conventional and Social. The Conventional and Social types fell near the mean on most of the 16PF scales and few unique descriptive personality characteristics could be assigned to them. The personality profiles constructed for the six Holland personality types are as follows:

Artistic. Reserved, detached; affected by feelings, easily upset; assertive, aggressive; expedient; sensitive; suspicious, self-opinionated; imaginative; unpretentious; apprehensive, worrying; experimenting, liberal; self-sufficient, resourceful; undisciplined, careless; tense, driven.

Investigative. Reserved, detached; more intelligent; emotionally stable, mature; trusting, adaptable; self-assured, confident; self-sufficient, resourceful; controlled, socially precise; relaxed.

Enterprising. Outgoing, participating; less intelligent; conscientious, persevering; shrewd, calculating; group-dependent, a "joiner" and sound follower; controlled, socially precise; relaxed.

Realistic. Less intelligent; self-reliant, realistic; practical, careful, conventional; conservative; controlled, socially precise.

Conventional. Accommodating, conforming; self-reliant, realistic.

Social. Group dependent, a "joiner" and sound follower.

In a study by Neethling (1986) 378 Afrikaans and 252 English male adolescents aged 17 - 24 years completed the SDS and the 16PF. The six Holland personality types differed with respect to certain personality characteristics as measured by the 16PF

and the differences supported the descriptions of the Holland types. Adolescents classified as Realistic were introverted with high scores on the Tough Poise [Cortertia] second order factor; [(A-) reserved, detached, critical, aloof; (I-) tough-minded, self-reliant, realistic; and (M-) practical]. The Investigative group had high scores on Tough Poise, were independent with low anxiety scores. The Artistic group had low scores on Tough Poise [(I+) and (M+)]. The Social and Enterprising types were Extrovert with low Tough Poise scores. The only significant difference for the Conventional group was lower B [crystallized intelligence] scores.

Karol (1994) used correlations, regressions and mean profile differences in a study using 194 graduate and undergraduate students (79 males and 115 females) ranging in age from 17 to 50 to investigate the ability of the 16PF to predict vocational interests as measured by the SDS. Substantial relationships between personality scales and vocational interests were found and findings were similar to those of previous studies. Overall, findings indicated that Realistic types were tough-minded, Artistic types were receptive and emotional, Social and Enterprising types were extroverted and Investigative types were introverted with good reasoning skills. Similar to previous findings the Conventional type was not distinguished by specific personality traits. Using regression analysis, the second order factor Tough-Mindedness predicted each type. Realistic, Investigative, Enterprising and Conventional types were predicted by high scores, whereas Artistic and Social types were predicted by low scores. Anxiety did not strongly predict vocational type, except for Realistic types who were predicted by low anxiety. Karol summarized previous research findings of relationships between 16PF scales and vocational interests. The summary of previous research findings for each vocational type is given below, followed by the findings of Karol's study.

Realistic types are distinguished by elements of Tough Poise, suggesting that they are more likely to process information based on facts rather than feelings. They are reserved [A-], objective [I-] and practical [M-]. They also tend to be controlled [Q3+].

Karol found Realistic types to be characterized by Tough-Mindedness and low Anxiety. They were low on warmth [A-], sensitivity [I-] and apprehension [O-].

Investigative types are somewhat introverted being reserved [A-] and self-sufficient

[Q2+]. They exhibit good reasoning skills [B+], an experimenting liberal outlook [Q1+] and control [Q3+]. They are usually low on anxiety.

Karol found Investigative types to be introverted and low on warmth [A-], high on reasoning [B+] and low on sensitivity [I-].

Artistic types are characterized by emotionality. They are sensitive [I+], imaginative [M+] and liberal in outlook [Q1+]. Dominance [E+], expediency [G-] and good reasoning ability [B+] also distinguish Artistic types. There are indications of introversion as they tend to be reserved [A-] and self-reliant [Q2+]. Some studies have shown that they score highest on anxiety and reveal a general trend of emotional reactivity [C-] and tension [Q4+].

Karol found Artistic types to be independent and extroverted, with low scores on tough-mindedness and self-control. They were expedient [G-], socially bold [H+], sensitive [I+], abstracted [M+] and open to change [Q1+].

Social types are somewhat extroverted. They are outgoing [A+] and group-dependent [Q2-]. They have good reasoning skills [B+]. This is one of the least distinctive of the types in research studies as most of the traits fall at or near the mean.

Karol found Social types to be extroverted, independent and receptive and open as indicated by low scores on Tough-Mindedness. They were warm [A+], lively [F+], socially bold [H+], personally open [N+] and group oriented [Q2-].

Enterprising types are extroverted. Like the Social types they are outgoing [A+] and group-dependent [Q2-], but they also tend to be venturesome [H+] and enthusiastic [F+] which enhances the active aspect of their extraversion. They are also dominant [E+], relaxed [Q4-] and controlled [Q3+].

Karol found Enterprising types to be extroverted and independent. They were warm [A+], emotionally stable [C+], dominant [E+], socially bold [H+], utilitarian [I-] and self-assured [O-].

Conventional types are the least distinctive in terms of personality traits with most scores falling at or near the mean. The most commonly noted characteristic is conscientiousness [G+] and they are usually humble [E-] and objective [I-].

Karol found Conventional types to be tough-minded and self-controlled, being more practical [M-] and perfectionistic [Q3+].

Randahl (1991) investigated the relations between typologies derived from vocational interests as measured by the General Occupational Theme (GOT) scale of the SCII and abilities as measured by the US Department of Labour's General Aptitude Test Battery (GATB). The GATB consists of eight paper-and-pencil and four apparatus tests measuring the following nine aptitudes: General learning ability, Verbal aptitude, Numerical aptitude, Spatial aptitude, Form perception, Clerical perception, Motor coordination, Finger dexterity and Manual dexterity. The sample was 846 vocational assessment clients (373 females with mean age 31.7 and 568 males with mean age 32.6) tested over an eight year period. The relations between high point codes measured by the GOT and ability scores of the GATB were analyzed. The results tended to confirm Holland's type-competency theoretical predictions. Persons with Realistic interests had significantly higher Spatial aptitude and Form perception abilities than other types. The Investigative interest group had significantly higher Verbal ability, Numerical aptitude and Spacial aptitude. The Social interest group was significantly higher on Motor coordination and the Artistic group tended to have significantly higher Verbal ability, Clerical perception and Spatial aptitude. The Enterprising and Conventional groups did not differ significantly in abilities from the other groups.

Borgen (1986) in a review of the assessment of interests and innovation in this field referred to the research of Costa, McCrae and Holland (1984) as *"the best research to date on the linkage of interests and personality"* (p.107) and listed the special strengths of their study as follows:

(1) use of a personality measure tapping the full range of major dimensions within a normal population;
(2) use of a personality inventory without explicit vocational interest items;
(3) use of a moderately large adult sample with a full age range;

(4) separate analyses for male and females;

(5) use of homogeneous interest dimensions rather than heterogeneous occupational scales;

(6) a six-month interval between administration of the personality inventory and the interest inventory, thus ensuring a conservative estimate of the relationship between interests and personality; and

(7) supplementary assessment of personality with spouse ratings.

Costa *et al.* examined the relationship between Holland's interest-based personality types using the SDS and the Neuroticism-Extraversion-Openness (NEO) model of personality with a sample of 394 adults. Within the NEO model **Neuroticism** is represented by subscales of Anxiety, Hostility, Depression, Self-Consciousness, Impulsiveness and Vulnerability. **Extraversion** is represented by Warmth, Gregariousness, Assertiveness, Activity, Excitement Seeking and Positive Emotions. **Openness to Experience** is represented by Fantasy, Aesthetics, Feelings, Actions, Ideas and Values. Correlations indicated that Neuroticism was only inconsistently and weakly related to SDS scales and thus demonstrated a lack of linkage with Holland's personality types. Artistic and Investigative SDS scores were moderately positively correlated with Openness to Experience. Social and Enterprising SDS scores were moderately positively correlated with Extraversion. Costa *et al.* (1984, p. 397) concluded that *"personality dispositions show strong consistent associations with vocational interests"*.

Gottfredson, Jones and Holland (1993) extended the work of Costa *et al.* (1984). A sample of 479 male and 246 female navy recruits completed the Vocational Preference Inventory (VPI) which measures the six RIASEC interest-based Holland personality types and the NEO Personality Inventory (NEO-PI). The NEO-PI measures five personality factors: Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness, and is an expansion of the NEO (Neuroticism-Extraversion-Openness) Inventory used in Costa *et al.*'s study. These five major personality trait dimensions have been recovered repeatedly in factor analyses of peer- and self-ratings of personality traits involving diverse conditions and populations (Tokar & Swanson, 1995).

Factor analysis revealed two significant factors for the female sample and four

significant factors for the male sample. However, only the first factor in both cases was large and easily interpreted and involved Artistic and Investigative interests and a personality style characterized by Openness.

Correlations between the VPI and NEO-PI showed several trends. There was a tendency for the six VPI personality scales to have small negative correlations with Neuroticism. Social and Enterprising scales usually were significantly positively correlated with Extraversion for the male sample, but correlations were smaller and nonsignificant for women. The Artistic and Investigative scales were positively correlated with Openness. The Conventional scale had significant positive correlations with Conscientiousness.

Gottfredson *et al.* (1993) also summarised correlations between Holland's six dimensions as measured by the SDS or the VPI, and the scales of a variety of personality inventories presumed to measure the five factors of the NEO-PI. Considering both the data of their study and the summarized data, Gottfredson *et al.* concluded that the personality variables represented by the five personality factors of the NEO-PI and Holland's six personality types are related. *"Extraversion is related to social and enterprising interests. Openness is related to investigative and artistic interests, and Control is related to conventional interests. Neuroticism has small negative correlations with all six Holland interest dimensions."* (Gottfredson *et al.*, 1993, p. 523). The authors also pointed out that as the Neuroticism, Likability and Control domains of the NEO-PI were not well represented in Holland's interest dimensions, counsellors should supplement Holland's formulations with such information to better understand client problems relating to work adjustment, job satisfaction, integrity and interpersonal relations in the workplace.

Holland, Johnston and Asama (1994) studied the personality types in a correlational study that used a sample of 175 men and 123 women who participated in a series of career workshops for displaced farmers, shoe workers, unemployed and employed workers. Participants completed the short form of the NEO Personality Inventory, the SDS and the Personality Styles Inventory (PSI), a measure developed to assess six personality disorders or styles from the *Diagnostic and Statistical Manual of Mental Disorders*. The NEO scales of Extroversion and Openness related to four of the SDS scales (Investigative, Artistic, Social and Enterprising) in expected ways. However,

the PSI scales only weakly related to the SDS scales. The authors concluded that the results supported the formulation of some of the Holland personality types.

Tokar and Swanson (1995) investigated the correspondence between the SDS and the NEO Five Factor Inventory (NEO-FFI), a short form of the NEO-PI, using a sample of adults (146 men and 213 women) employed in a wide range of occupations. Only data of participants with well-defined Holland personality patterns were analyzed. As there were significant differences in scores according to gender, data for men and women were analyzed separately. The authors found substantial relations between the Holland and NEO models, but the NEO five-factor model could not account for Holland's model in its entirety. For both genders Artistic and Investigative types were positioned at the "open" end of the Openness continuum, whereas Conventional and Enterprising types were positioned at the "closed" end. Although the findings concerning the Enterprising types would appear to be inconsistent with Holland's formulation of the type, the authors noted that a work environment populated with Enterprising types is probably more conservative than work environments populated by Artistic or Investigative types. For males, Enterprising types anchored at the extroverted end of the Extraversion and Friendliness continuum, and Realistic types were most introverted. For females, Artistic and Social types scored the highest on the Friendliness dimension whereas Realistic and Investigative types scored the lowest. Holland describes the Artistic type as asocial. The authors ascribed their finding of a relationship between Artistic type and Friendliness to the fact that the Artistic females sampled were represented by dance instructors and elementary school teachers. On the whole significant correspondence between Holland vocational personality types and some dimensions of the five-factor personality model were found providing further support for the validity of Holland's trait characterization of the types.

Strack (1994) investigated the relation between Holland's types measured by the SDS and Millon's eight basic personality styles measured by the Personality Adjective Check List. The sample consisted of 75 male and 77 female college students. Among men, Holland's Enterprising, Investigative, Artistic and Realistic types were associated with Millon's Socially Dominant (confident, forceful), Conscientious (respectful), Submissive (cooperative) and Neurotic (inhibited, sensitive) styles. Among women, Holland's Enterprising, Social, Conventional, Investigative, and

Artistic types were associated with Millon's Socially Dominant (confident, forceful), Conscientious (respectful), Submissive (cooperative), Introverted (introversion) and Extroverted (sociable) styles, although the pattern was different than that observed with men. The author concluded that on the whole Holland and Millon seemed closest in their conceptualization of social dominance-submissiveness and emotionality (neuroticism)-restraint (conscientious). They seemed more divergent in their views of social introversion-extroversion. Taken together the results indicated that the Holland and Millon systems are reliably, if modestly, linked at the dimensional level.

3.2.1.4 Assessment of the types

A person's personality type can be assessed qualitatively or quantitatively. A qualitative assessment could be made by using information about a person's educational and occupational preferences. For example, a person studying mathematics and wishing to become a mathematician could be classified as Investigative.

Several instruments have been devised to quantitatively assess personality type. The first instrument devised by Holland in the 1970s was called the Vocational Preference Inventory (VPI). This instrument consists of a list of 84 occupational titles (14 for each of the six types). A person would indicate which occupations appealed to him or her and the six scales would be scored and profiled. The personal pattern or code was obtained by rank ordering the scale scores from highest to lowest.

Holland developed the Self-Directed Search (SDS), also in the 1970s, as a self-assessment instrument. The SDS incorporates the occupational lists of the VPI and is described in Chapter 6 (see 6.3.3.2).

My Vocational Situation (MVS) includes an 18-item Identity Scale to assess identity, a construct which Holland added when he revised his theory in 1985. *"This scale measures the clarity of a person's vocational goals and self-perceptions and is positively associated with having a small number of occupational goals that belong to a small number of main categories. Persons with low scores have many goals belonging to many main categories."* (Holland, 1985, p. 23).

The American College Testing Programme (ACT) published the Unisex edition of the ACT Interest Inventory (UNIACT) in 1981. The instrument consists of 90 items describing work-related activities. Items were selected to reduce sex differences. Scores for six basic interest scales corresponding to the six Holland personality types are obtained, as well as scores for the two Data/Ideas and Things/People summary scales. Scores are plotted on the World-of-Work-Map on which 23 job families are located in 12 regions representing combinations of the six Holland types with the data, ideas, things and people work tasks. (Borgen, 1986).

In South Africa the Human Sciences Research Council developed the South African Vocational Interest Inventory (SAVII) (Du Toit, Gevers & Harilall, 1992). The SAVII contains 126 items about preferred work activities which are divided into six fields representing the six Holland personality types. Each of the six fields is further subdivided into three subfields.

In 1972 a merger of the Strong-Campbell Interest Inventory (SCII) and Holland's classification took place and scales that asses Holland personality types were incorporated into the SCII (Borgen, 1986). A description of the merged-sex form of the Strong Interest Inventory (SII), a later version of the SCII, which consists of 264 scales, including the General Occupational Theme (GOT) scales which measure Holland's six personality types is given by Swanson (1992a).

3.2.2 *There are six model environments [R, I, A, S, E, C].*

The six environments share common constructs with the personality types and are defined using the same descriptions of activities, competencies, perceptions and values as the personality types. The environment is thus defined by describing its inhabitants as it is assumed that the environment and its effects are transmitted mainly through the people in the environment. The relationships between the six environments are represented by the hexagonal model. Holland (1985) devised the Environmental Assessment Technique (EAT) to categorize environments. An environmental type is determined by surveying the personality types represented in a specific environment. The environment is then assigned a six-letter code according to the percentages of Holland personality types occurring in that environment. In an academic environment the curricular composition of a college or university is used to

assign a code. An alternative method used to define an environment is to use the Holland code of the worker's actual job or a student's actual college major. The concepts of differentiation and consistency with respect to the environments are also similarly defined as for the personality types. Differentiated environments offer a small range of activities and undifferentiated environments a wide variety of activities. Consistent environments offer similar rewards and demands.

Holland (1985) reported on research on categorizing environments. In educational settings environments differ according to field of study in ways that are consistent with theoretical predictions. In occupational settings personal interests are correlated with the demands of an occupation and the relations between interest profiles and occupational environments are consistent with theoretical predictions.

3.2.3 *People search for environments that will let them exercise their skills and abilities, express their attitudes and values, and take on agreeable problems and roles.*

The theory assumes that people seek out environments compatible with their skills, abilities, attitudes and values where they can take on roles agreeable to them. Thus Artistic types seek artistic environments, Realistic types seek realistic environments, and so forth.

A person in a compatible environment is encouraged to express the skills and attitudes they prefer and value in a congenial setting, thus enhancing self-esteem. A person in an incompatible environment would feel out of place and possibly inadequate.

Holland (1985) referred to research that demonstrated that different personality types perceive and process information differently and that vocational interests correlate with these differences. Witkin's work has shown that field-independent people prefer the natural sciences and mathematics, whereas field-dependent people prefer people-orientated fields of study such as teaching and social work. Holland referred to a doctoral study by Cleveland in which the Holland personality types and field independence-dependence were correlated in the expected directions. However Holland noted that on the whole the evidence for the relation of cognitive styles to Holland personality types is weak and often inconsistent.

Richards (1993) investigated the career development of 2710 population scientists in a longitudinal study spanning 10 years. The Holland type of the sample (IES) was measured on five different occasions and remained stable over time and within-type longitudinal correlations were substantial. Richards concluded the results provided broad support for Holland's theory and its application to career development through the life span.

3.2.4 *Behavior is determined by an interaction between personality and environment.*

Holland (1985) formulated a number of vocational/educational hypotheses related to personality types, environmental models and person-environment fit that flow from the formulations of the theory. The following three are relevant to this study (Holland, 1985, pp. 31-32).

(i) *A person's dominant type determines the primary direction of vocational choice.* (See 3.2.9)

(ii) *Educational achievement goes with the following personality pattern order: I S A C E R.*

In a study by Schneider and Overton (1983) first-year university students were assigned a primary personality code based on SCII scores. The single personality code and academic achievement were correlated at the end of the first semester. I, S, A and C males and females obtained the highest academic achievement (GPA) and I and A males achieved higher marks than E students. Controlling for aptitude (SAT total scores) did not improve the accuracy of theoretical predictions with respect to personality type and academic achievement.

Schwartz (1991) reviewed dissertations during the period 1965 and 1990 relating to congruence and achievement. He selected eight studies, six of which investigated academic achievement and the other two investigated aspects of work achievement. Of the six studies investigating academic achievement only one supported Holland's hypothesis and three contradicted it. One study supported an Achievement-Orientation of Personality Type (AOPT) interpretation and another study showed that

once the confounding effects of AOPT were controlled, strong support that had previously existed for Holland's hypothesis ceased to exist. The author concluded that the confounding effects of AOPT should be controlled in future research of the congruence-achievement hypothesis.

(iii) *Persons with different personality patterns respond to instructors, teaching methods and styles according to the formulations for the types. For example, a Social person should benefit from a Social teacher or a Social subject using personal teaching methods.*

In this study this is interpreted as meaning that certain personality types tend to have characteristic learning styles.

High levels of differentiation, consistency and congruence (where applicable) will increase the probability that these hypotheses will hold.

The four key assumptions discussed in 3.2.1 to 3.2.4 above are supplemented by the following key constructs, namely differentiation, consistency, identity, congruence and the classification system which are used to increase the interpretative value of the personality - environment model. A hexagonal model is used to illustrate the relationships between types and environment. A further six principles are given following descriptions of the constructs listed below.

3.2.5 The hexagonal model

A hexagon model is used to visually depict the relationships within and between types or environments (see Figure 3.1). The distances between the types or environments are *"inversely proportional to the theoretical relationships between them"* (Holland 1985, p. 5). This is called the *calculus assumption* and means that adjacent types on the hexagon are most related and opposite types are least related, with alternating types having an intermediate level of relationship. Rounds (1995) noted that Holland's structural hypothesis has taken three forms: a simple RIASEC **circular order** hypothesis, the **calculus assumption** and the **hexagonal hypothesis** which in addition to the calculus assumption requires that the interpoint distances are equal for types

within adjacent categories, alternate categories and opposite categories. These equality constraints meet the requirements for a **circumplex** (Tracey & Rounds, 1993). Holland's proposed hexagonal structural model operationally defines the degree of consistency in a person's profile (see 3.2.7) and the degree of congruence between the person and their environment (see 3.2.9). It thus plays an important role in the theory and has been extensively researched.

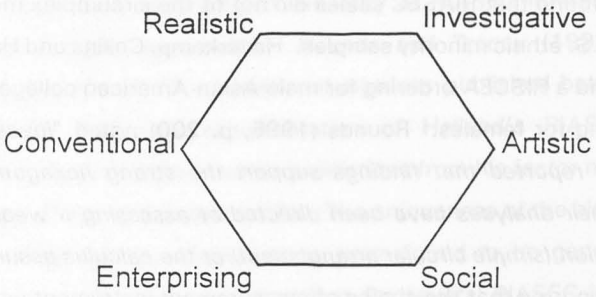

FIGURE 3.1 THE HEXAGON MODEL

Holland and Rayman (1986) described how the hexagonal model originated. Whitney and Holland observed that correlations between the six personality types resulted in a circular RIASEC formation. As Roe had claim on a circular formation at the time, Holland decided on a hexagonal model. Subsequent research has shown that an exact hexagonal configuration is not supported and Holland (1985, p. 119) confirmed that *"the hexagons resulting from real-world data are misshapen polygons"* possibly due to defects of theory, assessment or sample. Holland has not adjusted his theory to account for this. Swanson (1992b, p. 232) noted that *"the basic utility of the hexagon apparently is not in question, but the conditions of maximal utility are in question."*

Eberhardt and Muchinsky (1984) pointed out that studies seeking to validate the hexagonal/structural model fall into three categories.

The first type of study compares the pattern of item clusters measuring vocational interests to see if they conform to one of the structural hypotheses. Rounds (1995) synthesized the results of 60 correlation matrices found in test manuals and journals

through the application of multidimensional scaling in order to evaluate RIASEC structural hypotheses. Rounds (1995, p. 209) drew the following conclusions: *"The findings provide impressive support for Holland's structural hypothesis with measures that are presumed to assess the RIASEC types. The evidence not only supports the simple order hypothesis, but also supports Holland's stronger structural hypothesis, the calculus assumption."* However Tracey and Rounds (1996) reported that this empirical support related to U.S. samples and less support had been generated cross-culturally. They found that RIASEC scales did not fit the circumplex model for either international or U.S. ethnic minority samples. Haverkamp, Collins and Hansen (1994), for example, found a RISCEA ordering for male Asian-American college students and a RIASCE ordering for females. Rounds (1995, p. 200) noted *"investigators have often mistakenly reported that findings support the strong hexagonal hypothesis when, in fact, their analyses have been directed at assessing a weak form of the calculus assumption (simple circular arrangement) or the calculus assumption itself".* Rounds (1995) reported that the choice of measurement instrument used in research to investigate the structural hypotheses may affect results obtained. He identified the UNIACT and two earlier versions of the Strong SII measure (the SVIB and SCII) as providing RIASEC measures which best fit the RIASEC order hypothesis and the calculus assumption model. Intermediate measure-model fits are provided by the SDS and VPI. Using these Holland measures, a greater proportion of Social codes for women and Realistic codes for men are found, where the RIASEC codes are more evenly distributed with the UNIACT and Strong measures. Poor fits are obtained by alternative forms of assessment such as the Career Assessment Inventory-Vocational Edition (CAI-V) and the Career Decision Making Inventory (CDM).

The second type of study investigates and proposes alternative geometric models to the hexagonal model, such as Gati's (1991) hierarchical model. Such studies show that the null hypothesis of random ordering of vocational types is consistently rejected and that alternative configurations may be plausible. Tracey and Rounds (1993) found both Holland's order model and the circumplex model to be adequate representations of the structure of vocational personalities and work environment and were found to be superior to Gati's model.

The third type of study tests the validity of the hexagonal/structural model using variables other than vocational interests. Eberhardt and Muchinsky (1984) noted that

such studies are relatively rare and they considered them to be the strongest test of Holland's model. These authors used biodata to predict vocational type and their results *"highly supported"* Holland's calculus assumption model (Eberhardt & Muchinsky, 1984, p. 180).

Prediger and Vansickle (1992a) showed that a two-dimensional map (with bipolar axes Data/Ideas and People/Things) superimposed on Holland's RIASEC circumplex can be used to plot occupations according to similarity of RIASEC interests. This model assumes the circumplex hypothesis. Rounds and Tracey (1993) conducted a structural meta-analysis of 77 correlational matrices published between 1965 and 1989 to evaluate Prediger's representation of Holland's RIASEC circumplex. Prediger's model received support when predictions from his factor model conformed to the predictions of the circumplex model. The uniqueness of the bipolar dimensions was not supported, but these dimensions were found to be generalizable across subject variables (gender and age) as well as for several RIASEC inventories. The authors concluded that the circumplex structure itself was the crucial distinguishing feature.

Research continues on the verification of the hexagonal structure. Myors (1996) proposed a simple procedure for testing the full circumplex model based on the Spearman rank-order correlation coefficient, rather than using sophisticated methods such as the structural equation modelling used by Rounds, Tracey and Hubert (1992).

3.2.6 Differentiation

Differentiation is the degree to which a personality type or environment resembles the theoretical description of the six types or environments. It is concerned with the range of scores obtained on an instrument such as the VPI or the SDS and is expressed as a numerical value which is the magnitude of the difference between the highest and lowest RIASEC scores. The greater the difference between the highest and lowest scores, the greater the differentiation. Holland described a well differentiated pattern as having "*sharp peaks and low valleys*" (Holland, 1985, p.26). A person with a highly differentiated personality pattern would represent a single personality type, whereas a flat personality pattern would represent a person with characteristics of a number of different personality types. Likewise the extent to

which an environment is defined is its degree of differentiation. Iachan (1984a, 1984b) derived two indices of differentiation through sophisticated mathematical reasoning. These indices take account of a wider range of scores than just the highest and lowest scores which are used to calculate Holland's index of differentiation. Alvi, Khan and Kirkwood (1990) compared five indices of differentiation, including Iachon's two and Holland's. Iachon's indices were most similar to each other and to an index proposed by Spokane and Walsh. Alvi *et al.* suggested that Iachon's indices should be used as measures of differentiation.

Holland (1985) reported that only a few studies investigating differentiation have reported positive results. He suggested that negative findings in some instances could be attributed to poor research design, small samples and failure to control for such variables as SES and intelligence. Three large-scale studies reported positive findings. In one study level of differentiation was positively related to stability of vocational choice for male students. Results for female students were not significant. In another longitudinal study involving high school pupils differentiation increased over a one-year period and vocational choices for the high differentiation group were more stable. In the third study also involving high school students it was found that good decision makers had differentiated profiles.

3.2.7 Consistency

Consistency is the degree of relatedness between personality types or between environments. There are three levels of consistency depending on the positions of types or environments in relation to each other on the hexagon. The types or environments that are next to each other on the hexagon share more traits and characteristics and are thus more closely related than types or environments that are separated from one another by one or two others. For example, the Realistic and Investigative types are highly consistent; the Realistic and Artistic types are moderately consistent; and the Realistic and Social types have low consistency. An inconsistent person would be less predictable as they have a greater diversity of interests, skills and values. This implies that they have a greater repertoire of possible behaviours. Strahan (1987) proposed an alternative method to Holland's of calculating consistency. An index of consistency is obtained using all three letters in a person's code rather than just using the first two letters as Holland proposes, thus

yielding a more differentiated index. Strahan and Severinghaus (1992) proposed a method of dealing with ties in codes.

Holland (1985) noted that research with respect to consistency had yielded mixed results, but when studies were well-designed and follow the theory closely positive results were obtained. Consistency had been shown to have strong positive relation with stability of college students' vocational aspirations, as well as their tendency to persist in college. Consistency had also been shown to have a strong positive relation with occupational stability in working populations.

3.2.8 Identity

In his revision of the theory, Holland (1985) added a new construct **Identity** which is related to the constructs of Differentiation and Consistency. Personal identity is defined as *"the possession of a clear and stable picture of one's goals, interests and talents"* (Holland, 1985, p. 5). Identity is assessed by the Identity Scale of My Vocational Situation (MVS) and measures *"the clarity of a person's vocational goals and self-perceptions"* (Holland, 1985, p. 28).

Holland (1985) cited evidence supporting the construct validity of the Identity Scale of the MVS. Chartrand and Camp (1991) in a 20-year review of measurement of career development constructs noted that the Identity Scale appeared to be the most frequently used measure of vocational identity. The theorized relation between vocational identity, and consistency and differentiation was not demonstrated by Leung, Conoley, Scheel and Sonnenberg (1992) in a sample of 211 male and 353 female academically superior high school juniors and the authors concluded that *"'vocational identity' remains a fuzzy concept."* (p. 105). Hackett and Lent (1992) reviewed several studies that investigated Holland's concept of identity. Studies using college students found the concept to be related to career maturity, variety of career options considered, perceived academic adjustment, but not to college grades. Consistent and generally strong relations have been observed between identity and measures of career decidedness or choice certainty/confidence. Vondracek (1992, p. 139) stated that the construct of vocational identity defined by Holland *"is too simple and sterile to be of much use"* and proposed requirements for the development of an adequate conceptualization of the construct vocational identity.

3.2.9 Congruence

Congruence refers to the compatibility of a match between a personality type and an environment. The level of congruence is illustrated by the spatial arrangement of the hexagon model. For example, a Realistic type in a Realistic environment is highly congruent, while a Realistic type in a Social environment is incongruent. According to the theory congruence is associated with achievement, stability and satisfaction.

Holland (1985) noted that Iachan (1984b, 1990) had evolved an alternative index to the Holland index to calculate congruence. Holland described Iachan's index as mathematically superior and suggested that the simpler Holland index would probably be best suited to clinical work and that Iachon's index could be preferred for research purposes. To calculate Holland's index only the first letter of the person's code and the first letter of the occupation or environment's code are used. The method for calculating the Holland index is given in the SDS manual (Gevers, du Toit & Harilall, 1992). Iachan's M index is based on mathematical combinations of all six personality types, as are the Zener index of Zener and Schnuelle and the K-P index of Kwak and Pulvino. Spokane (1985) in a review of research on congruence reported that two studies had shown these three indices to be highly correlated. Gati (1985) proposed a method of computing congruence that takes into account the number of salient (i.e. significant) scales of each profile, the proximity of the types/fields in the hexagonal model (i.e. the consistency) as well as the relative number of ties or identical scales. More recently Brown and Gore (1994) compared 10 measures of congruence using simulated data. They found that none of the three-letter code measures were sensitive to differences among persons across the entire possible range of congruence scores. With one exception they were unable to make fine distinctions among people with like, but out of order, three-letter person and environment codes. The authors concluded that the K-P index is the only one that is maximally sensitive to differences among cases of like, but out of order, person environment codes. The authors then presented a new measure of congruence that retains the advantages of the K-P measure, but is easier to calculate.

Osipow (1987) emphasized the central importance of person-environment fit and interaction in the realm of vocational behaviour. It is a complex phenomenon encompassing variables such as needs satisfaction, performance capability and

achievement, and job choice and stability. Osipow noted that investigation of person-environment fit is hampered by a need to improve current assessment methods. Gati (1989) also highlighted the problems associated with defining and measuring congruence and using the construct as a predictor of vocational behaviour.

Much research has demonstrated that people usually study and work in an environment that corresponds to their personality type (Holland 1985). One of many studies that Holland referred to demonstrated that Engineering students coded as I-types persisted with greater frequency and tended to get better grades over a two year period than those coded as R or RI-types. Studies that focus on employee satisfaction, stability and achievement demonstrate a positive relation to occupational congruence, although the magnitude of the correlation coefficients is small (Meir, Melamed & Dinur, 1995). Spokane (1985) reviewed 63 studies on congruence and found that *"correlational studies consistently show significant, positive relationships between congruence and academic performance and persistence, job satisfaction, stability of choice, perceived congruence, and personality, but nonsignificant relations between congruence and self-concept or sociability."* (p.306). Spokane noted that research on congruence is impeded by overly simplistic or static research designs and a reliance on self-report criteria measures rather than, for example, actual behaviour. Further correlational studies are thus unlikely to increase understanding of congruence and he suggested alternative directions in research that include incorporating moderator variables, changes in congruence over time, or experimental manipulations.

Assouline and Meir (1987) conducted a meta-analysis of 41 different studies investigating Holland's congruence construct. Substantial relationships were found between congruence and job satisfaction (.21), especially when speciality within occupation was used (.42). Small and nonsignificant relationships between congruence and achievement (.06) and congruence and stability (.15) were found. Assouline & Meir (1987, p. 328) concluded that *"neither stability nor achievement can be predicted by any common measure of congruence or in any environmental reference."* Large differences in results were ascribed to the many different methods used to calculate congruence. Holland (1987b) in a response to Assouline and Meir's article confirmed that *"estimates of congruence which use more information (scale scores or profile shape) are more successful than simple categorizations of personal and environmental characteristics."* (p.338).

Gottfredson and Holland (1990) investigated congruence and job satisfaction in a longitudinal study of a group of newly hired bank tellers. Personality code was determined by VPI scores and Iachon's method of calculating congruence with the occupational code for teller (CES) was used. The study controlled for several possible nuisance or confounding variables and the authors found that person-job congruence did have substantial correlations with job satisfaction for the well-defined, homogeneous sample. Differentiation of VPI scores was calculated and was found to be negatively correlated with persistence and with work satisfaction.

Meir *et al.* (1995) used a broader understanding of the concept congruence to investigate if congruence related to variables other than satisfaction, stability and achievement. In a study of 120 Israeli professionals (lawyers, physicians and psychologists), three aspects of congruence (vocational, leisure and skill utilization) and six measures of well-being (occupational satisfaction, work satisfaction, anxiety, burnout, somatic complaints and self-esteem) were examined. Correlations among the congruence aspects ranged between .24 and .36 and correlated positively with occupational choice satisfaction, work satisfaction and self-esteem, and negatively with anxiety, burnout and somatic complaints. All three congruence aspects showed an additive effect: the higher the number of congruence aspects the higher the well-being scores. These findings were similar to those found in earlier studies by the authors on teachers.

Sutherland and Fogarty (1995) found evidence for the hypothesis that occupational stress and strain are inversely related to Holland measures of congruence. The relation was found to be small but significant and depended on the measure of congruence used, Iachan's M index being the best predictor.

3.2.10 The classification system

The classification scheme provides a useful framework for organizing information on persons, environments and their interaction.

A person does not resemble only one personality type, but rather is described by a personality pattern which is a profile of their resemblance to the types. A personality pattern or Holland personal code can consist of two to six types and can be derived

qualitatively or quantitatively. Usually a three-letter code is used.

Occupations likewise are assigned a three-letter code as a summary of the occupation's degree of resemblance to what are deemed to be the three most relevant occupational environments (see 3.2.2). Holland compiled The Occupations Finder which consists of lists of occupational titles with their associated Holland code. This was followed by the *Dictionary of Holland occupational codes* published in 1982. A South African dictionary of occupations was published by Taljaard and von Mollendorf (1987). Hansen (1992) noted that discrepancies in codes for same-named occupations occur in several sources that incorporate Holland's theory. This creates frustrations for career counselling professionals and makes comparison of results of research investigating aspects such as consistency and congruence difficult if different codes are used to classify the same occupation. Various methods of assigning Holland codes to occupations have been suggested (Viernstein, 1972). More recently Holland and Gottfredson (1992) developed a brief inventory to classify any occupation. Studies comparing the congruence of codes assigned according to different methods to same-named occupations have been undertaken (Harrington, 1993; Harrington, Feller & O'Shea, 1993).

3.2.11 Six further assumptions

The following **principles** as further assumptions to the theory were stated by Holland (1985, pp. 7-10):

(1) *The choice of vocation is an expression of personality.*

(2) *Interest inventories are personality inventories.*

(3) *Vocational stereotypes have reliable and important psychological and sociological meanings.*

Holland (1985) summarized American research findings confirming this assumption. In the South African black population this probably would not be true. Due to limited access to education and training the number of different occupations represented in the black community until now has been limited to a small number of occupations

such as labourer, domestic, teacher, nurse and priest. A limited range of occupational role models and inadequate access to career information probably has resulted in black youth not developing a wide range of vocational stereotypes.

(4) *The members of a vocation have similar personalities and similar histories of personal development.*

(5) *Because people in a vocational group have similar personalities, they will respond to many situations and problems in similar ways, and they will create characteristic interpersonal environments.*

(6) *Vocational satisfaction, stability, and achievement depend on the congruence between one's personality and the environment in which one works.*

3.3 PRACTICAL USE OF HOLLAND'S THEORY

3.3.1 Career counselling and career development as an aspect of student development

A major aspect of student development is the attainment of sufficient career maturity to make a suitable career choice.

Holland's theory explains and interprets vocational data and vocational behaviour and provides a cognitive structure for understanding and organizing information about self and occupational alternatives. The organization of occupational information, which is vast and complex, into one simple system that is readily comprehended by users and yet accommodates the complexity of occupations, makes the information more accessible and more easily understood. This assists the student in self-exploration which enhances career maturity. If the student is assisted by a counsellor, both can share and use the concepts of the theory.

Career interventions are helpful because the average person has little career knowledge and may not have a clear vocational identity. Career programmes could benefit personal and career development. These programmes could provide assessment opportunities, career information classified according to the theory,

information on education and training opportunities, and even information on job opportunities. Such programmes could be presented in group format by, for example, student counselling services and/or through computerized career guidance systems (Pickworth, 1991).

The use of instruments such as the SII, VPI and SDS which are closely modelled on the theory help to clarify self-knowledge. Holland (1985) suggested that the following three aspects be used as diagnostic criteria:

- The congruence between the personal code and the occupation and/or field of study the person is engaged in or intends to pursue.
- The consistency of the first two letters of the personal code.
- The differentiation of the personal profile.

Many positive signs such as high congruence, high consistency and a well differentiated profile, would indicate that the person needs less assistance with a career decision. The SDS, for example, was developed as a self-help instrument and its use, or the use of computerized career guidance systems, could help in making career interventions more easily accessible to more people. Counselling resources could be conserved for persons with remedial or complex requirements such as limited education and/or financial restraints.

Betz, Harmon and Borgen (1996) developed a measure of perceived self-efficacy or confidence with respect to the RIASEC types using college student and employed adult samples. High self-efficacy scores indicate an individual's confidence in his or her ability to perform in academic subjects or in occupational activities related to each RIASEC type. The authors indicated the possible use of such information in career counselling. High interest-high confidence themes are obvious areas for the client to explore, whereas low interest-low confidence themes could be rejected. In the case of high interest-low confidence themes the counsellor could possibly raise efficacy in the client thus providing additional areas to explore that might otherwise have been rejected. The authors felt that combining vocational interest measures with a confidence measure has potential in increasing educational and occupational options

to clients.

3.3.2 Education

Although Holland's theory evolved within the context of career assistance, it could be applied in wider contexts such as education, business and industry. Holland (1985) suggested that during the school years curricula and non-curricula experiences should aim to provide pupils with a wide range of activities representative of the six types to help children to understand themselves and their future options.

Claxton and Murrell (1987) noted that a teaching strategy could be seen as a classroom "environment". As research on Holland's theory indicated, people prefer particular environments. Faculty should be sensitive to this and not limit learning opportunities to any one mode. Even though an instrument such as the SDS does not easily translate into teaching strategies, the authors advocated faculty complete such an inventory to make them aware that certain teaching methodologies are more appropriate for some students than for others. A variety of learning activities is needed rather than the reliance on any one approach.

The theory suggests that teaching may be more effective if students and teachers are paired according to type, or if teaching styles could be adapted to accommodate student types (Holland, 1985).

3.4 CRITICISM OF THE THEORY

Hackett *et al.* (1991) noted that Holland has been exemplary for continual revision and refinement of the theory in response to substantive criticisms and disconfirmatory research findings. Holland published major revisions of the theory in 1973 and 1985.

A criticism levelled at the SDS in particular and at the theory in general is that the instrument and theory are sexist (Brown, 1990; Weinrach and Srebalus, 1990). This criticism has been addressed in section 3.2.1 and relates to the fact that men tend to score higher than women on the Realistic scale and women tend to score higher on the Social scale. Weinrach and Srebalus stated that this phenomena is a reflection of cultural influences and not an indictment of the SDS. Holland (1987a) stated that

he did not believe that women's careers required a separate theory.

Holland's description of the development of personality types given in 3.2.1.1 is seen to be inadequate and a major shortcoming of the theory (Brown, 1990; Weinrach & Srebalus, 1990). Holland (1987a) did not believe that adding more detail on personality theory and development would be useful. Krumboltz and Nichols (1990) suggested that the general learning model proposed by the social learning theory of career decision making (see 2.3.2.3) could adequately explain how people come to develop any combination of Holland's six personality types.

Holland is also criticized for not addressing the process of career decision making apart from indicating that persons with certain personality types seek environments in which they can implement values and perform tasks that they will find rewarding. The impact of environmental and economic factors on the process has also not been spelt out. Brown (1990) stated that some clarification of the decision-making process would make the theory more complete.

Holland (1987a) indicated that he is not inclined to pursue a developmental life-stage account of career development. This is seen by Brown (1990) to be a shortcoming.

One of the more recent criticisms of the theory concerns the hexagonal structure and concepts defined by the hexagon such as consistency and congruence. Holland has conceded that the dimensions of the hexagon are not regular, but the operationalization of the constructs consistency and congruence, which are defined in terms of an equilateral hexagon, have not been modified. Hansen (1992) proposed that the theory be modified in this respect to accommodate the individual differences of diverse populations. Subich (1992, p. 204) stated that *"the search for a single hexagon applicable to all persons may be too simplistic."* Swanson (1992b) also thought more work was needed on the constructs of congruence and consistency. The theory needed to be expanded by adding moderating variables such as the processes of occupational compromise, perceptions of career-related barriers, racial identity attitudes, degree of acculturation, and existing opportunity structure. Schwartz (1992) took a more extreme view and felt that as the literature did not fully support the congruence hypothesis, that it was time to move beyond Holland's theory.

In an investigation of the structure of basic interests, Rounds (1995) concluded that strong support for Holland's structural hypothesis was obtained when assessment instruments developed to measure the six types were used. However, when instruments developed to measure a wide variety of occupational interests and basic interests, such as the Jackson Vocational Interest Survey, were used a poor fit of basic interests to Holland's model was found. Although Holland's ordered hypothesis could not be rejected, a linear order hypothesis was just as viable as the circular hypothesis for representing the internal relations of basic interest scales. Structural similarities and differences were found between men and women's vocational interests. Rounds acknowledged the advantages of the simplicity and generality of models such as those of Holland and Roe, but felt that *"six categories may not constitute the best representation of the vocational interest domain"* (Rounds, 1995, p. 226).

In pursuit of modifying the structure for greater accuracy Tracey and Rounds (1996) proposed a spherical model of vocational interest which resulted when they combined the RIASEC circumplex with a prestige hierarchy. Occupational prestige was incorporated in the model as they postulated that vocational interests declined in importance as interest in the prestige of an occupation increased. Hansen (1996) found the spherical model intriguing from a theoretical and scientific perspective, but thought it was too complex for implementation in career counselling with clients.

Hackett and Lent (1992) noted that studies on the personality pattern clarity hypotheses involving the constructs of differentiation and consistency have tended to yield disappointing results. Neither of these constructs has been found to uniformly predict choice stability which according to the theory they should. Consistency is related to the hexagon and is defined according to distances on it. The problems associated with the hexagon described above and in 3.2.5 probably strongly influence the usefulness of this construct. Brown (1990) proposed Holland drop the construct differentiation as its restricted definition in terms of the difference between the minimum and maximum scores on an instrument such as the VPI did not address the complexity of the entire personality pattern. Holland (1985) introduced the construct identity to improve the ability of the theory to describe clarity of a personality pattern, but Brown thought the construct was poorly defined and unlikely to compensate for the inability of differentiation and consistency to account for career behaviour.

Although Prediger and Vansickle (1992b, p. 217) believed that Holland's theory had stagnated, they preferred to "*build on*" rather than "*moving on*". These authors concluded that *"useful theories are those that can be improved."* (p. 218).

3.5 SUMMARY

In this chapter an overview of John Holland's person-environment theory is given. The six vocational personality types (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) are described and research findings relating to the personality types are cited. The assumptions underlying the theory are presented and key constructs of the theory, namely differentiation, consistency, identity and congruence are elucidated. A hexagonal model is used to illustrate the relationships within and between types and environments. The major application of the theory is in the field of career counselling, but Holland has suggested that it could be applied in wider contexts such as education, business and industry.

The theory does not address the nature of the development of personality types, the process of career development or the career decision-making process. However, the theory provides a framework for organizing and interpreting personal and vocational information which has been found useful by counsellors and individuals making career choices for nearly three decades. The theory currently remains one of the most influential and widely researched career development theories and represents in this study one approach to career development as an aspect of student development.

In the following chapter David Kolb's theory of experiential learning and learning styles will be described. In this study it represents one approach to academic development as an aspect of student development.

CHAPTER FOUR

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.

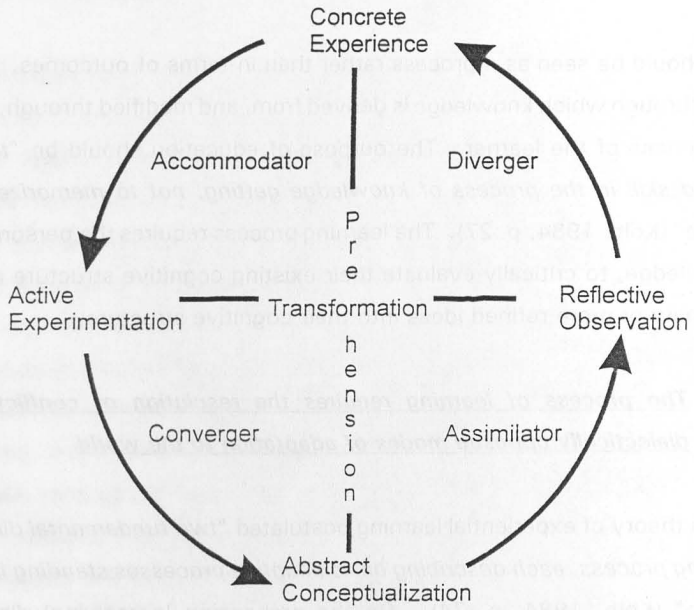

FIGURE 4.1 KOLB'S MODEL OF EXPERIENTIAL LEARNING

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

Concrete Experience (CE) 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.	**Learning from feeling** * Learning from specific experiences * Relating to people * Being sensitive to feelings and people
Reflective Observation (RO) 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.	**Learning by watching and listening** * Carefully observing before making judgments * Viewing issues from different perspectives * Looking for the meaning of things
Abstract Conceptualization (AC) 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.	**Learning by thinking** * Logical analysing ideas * Systematic planning * Acting on an intellectual understanding of a situation
Active Experimentation (AE) 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.	**Learning by doing** * 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.

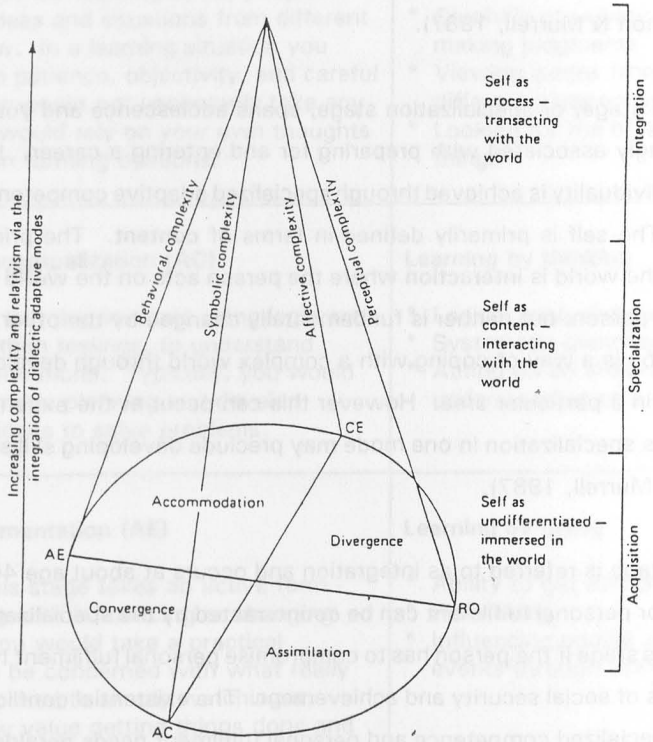

FIGURE 4.2 THE EXPERIENTIAL LEARNING THEORY OF GROWTH AND DEVELOPMENT

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 THE FOUR LEARNING ABILITIES

CONCRETE EXPERIENCE (CE)	REFLECTIVE OBSERVATION (RO)	ABSTRACT CONCEPTUALIZATION (AC)	ACTIVE EXPERIMENTATION (AE)
FOCUSES ON: being involved in experiences and dealing with immediate human situations in a personal way.	FOCUSES ON: understanding the meaning of ideas and situations by carefully observing and impartially describing them.	FOCUSES ON: using logic, ideas and concepts.	FOCUSES ON: actively influencing people and changing situations.
EMPHASIZES: - 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	EMPHASIZES: - 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)	EMPHASIZES: - 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	EMPHASIZES: - 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)
ENJOY AND ARE GOOD AT: - relating to others - intuitive decision makers - function well in unstructured situations	ENJOY AND ARE GOOD AT: - 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	ENJOY AND ARE GOOD AT: - systematic planning - manipulation of abstract symbols - quantitative analysis	ENJOY AND ARE GOOD AT: - getting things accomplished - taking some risks to achieve their objectives
VALUES: - relating to people - being involved in real situations - having an open-minded approach to life	VALUES: - patience, impartiality and considered, thoughtful judgement	VALUES: - precision - the rigour and discipline of analysing ideas - the aesthetic quality of a neat conceptual system	VALUES: - 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
GREATEST STRENGTH LIES IN: - problem solving - decision making - practical application of ideas	GREATEST STRENGTH LIES IN: - imaginative ability - awareness of meaning and values	GREATEST STRENGTH LIES IN: - inductive reasoning and the ability to create theoretical models - assimilating disparate observations into an integrated explanation	GREATEST STRENGTH LIES IN: - doing things - carrying out plans and tasks - getting involved in new experiences
OTHER CHARACTERISTICS Do best in situations like conventional intelligence tests where there is a single correct answer or solution to a question or problem. Knowledge is organized in such a way that through hypothetical-deductive reasoning it can be focused on specific problems. Controlled in their expression of emotion. Prefer technical tasks and problems rather than social and interpersonal issues.	OTHER CHARACTERISTICS Do best in situations that call for generation of alternative ideas and implications such as brainstorming. View concrete situations from many perspectives. Organize many relationships into a meaningful "gestalt". Emphasis on observation rather than action. Interested in people and tend to be imaginative and feeling oriented.	OTHER CHARACTERISTICS Less focused on people and more concerned with ideas and abstract concepts. Ideas are judged less by their practical value - it is more important that the theory be logically sound and precise. Where the theory or plans do not fit the facts more likely to disregard or reexamine the facts than the theory.	OTHER CHARACTERISTICS Do best in situations where one must adapt oneself to changing immediate circumstances. Emphasis on opportunity seeking, risk taking and action. Solve problems in an intuitive trail-and-error manner. Rely heavily on others for information rather than their own analytic ability. At ease with people but sometimes seen as impatient and "pushy". Where the theory or plans do not fit the facts more likely to discard the plan or theory than the facts.

TABLE 4.4a: CHARACTERISTICS OF THE FOUR LEARNING STYLES

CONVERGER	DIVERGER
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.	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.
STRENGTHS Problem-solving Decision-making Deductive reasoning Defining problems TOO MUCH: Solving the wrong problem Hasty decision-making NOT ENOUGH: Lack of focus No shifting of ideas Scattered thoughts	STRENGTHS Imaginative ability Understanding people Recognizing problems Brainstorming TOO MUCH: Paralysed by alternatives Can't make decisions NOT ENOUGH No ideas Can't recognize problems and opportunities
<u>To develop your Convergent learning skills, practice</u>: Creating new ways of thinking and doing Experimenting with new ideas Choosing the best solution Setting goals Making decisions	<u>To develop your Divergent learning skills, practice</u>: 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
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.	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.
STRENGTHS Planning Creating models Defining problems Developing theories TOO MUCH: Castles in the air No practical application NOT ENOUGH: Unable to learn from mistakes No sound basis for work No systematic approach	STRENGTHS Getting things done Leadership Risk-taking TOO MUCH: Trivial improvements Meaningless activity NOT ENOUGH: Work not completed on time Impractical plans Not directed to goals
<u>To develop your Assimilative learning skills, practice</u>: Organizing information Building conceptual models Testing theories and ideas Designing experiments Analysing quantitative data	<u>To develop your Accommodative learning skills, practice</u>: Committing yourself to objectives Seeking new opportunities Influencing and leading others Being personally involved Dealing with people

4.2.3 Assessment of learning styles: The Learning Styles Inventory (LSI)

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 Convergers. 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. Convergers 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 Convergers 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 Convergers 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 ± 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 Convergers, 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 Convergers 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 Convergers.

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 Convergers, 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 Convergers. In the fourth study involving medical students and practising physicians, nearly half the sample were Convergers 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 Convergers.

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 Convergers 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).

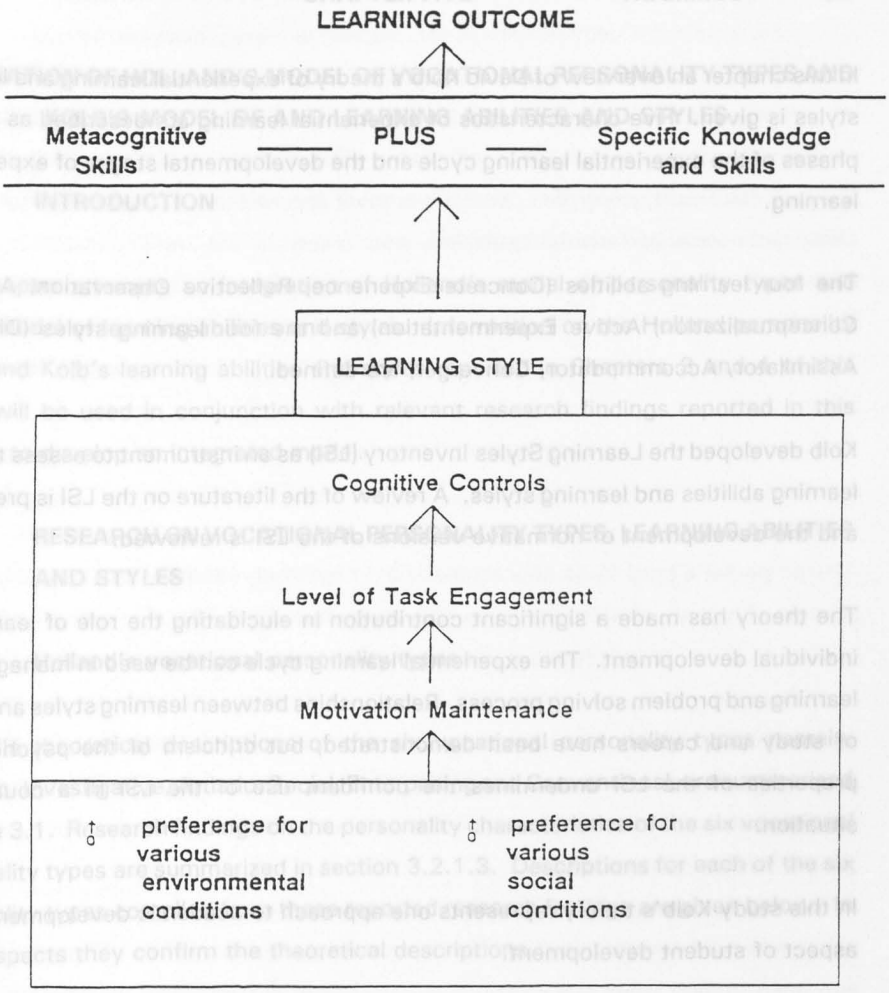

FIGURE 4.3 LEARNING STYLE TAXONOMY AND CONTRIBUTIONS OF LEARNING STYLE TO LEARNING OUTCOMES

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).

4.5 SUMMARY

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.

CHAPTER FIVE

INTEGRATION OF HOLLAND'S MODEL OF VOCATIONAL PERSONALITY TYPES AND KOLB'S MODEL OF AND LEARNING ABILITIES AND STYLES

5.1 INTRODUCTION

This chapter attempts an integration of Holland's model of personality types and Kolb's model of learning abilities and styles. Information on the Holland personality types and Kolb's learning abilities and styles reported in Chapters 3 and 4 of this study will be used in conjunction with relevant research findings reported in this chapter to develop an integrated model.

5.2 RESEARCH ON VOCATIONAL PERSONALITY TYPES, LEARNING ABILITIES AND STYLES

5.2.1 Holland's vocational personality types

Holland's theoretical descriptions of the six vocational personality types namely, Realistic, Investigative, Artistic, Social, Enterprising and Conventional, are summarized in Table 3.1. Research findings on the personality characteristics of the six vocational personality types are summarized in section 3.2.1.3. Descriptions for each of the six personality types compiled from these reported research findings are given below. In most aspects they confirm the theoretical descriptions.

Realistic

Realistic persons are generally somewhat introverted, tough-minded, objective, self-reliant, realistic and practical. They are careful, conventional, conservative, controlled and socially precise. They are reserved, detached and critical and have little anxiety or apprehension. They have high spatial aptitude and form perception.

They appear self-assured and relatively free from worry, and may come across as somewhat reserved or interpersonally distant. They may focus on the function and purpose of objects and not place much value on aesthetic qualities.

Investigative

Investigative persons tend to be more intelligent with good reasoning skills, introverted, reserved, detached, independent, self-sufficient and resourceful. They are emotionally stable, trusting and adaptable with a liberal outlook. They are self-assured, confident, controlled, socially precise and relaxed. They have high verbal ability, numerical and spatial aptitude.

They appear interpersonally reserved and tend to be objective and unsentimental. They have good reasoning ability and are curious and open-minded about new approaches.

Artistic

Artistic persons tend to be characterised by emotional reactivity and sensitivity, and tension. They are imaginative, experimenting, expedient, liberal in outlook and open to change. They are easily upset, suspicious, self-opinionated, undisciplined, careless, apprehensive, worrying, tense and driven. Indications of both introversion and extraversion have been reported and artistic persons have been described as both reserved, detached, independent, self-sufficient, resourceful and self-reliant, as well as dominant, assertive and socially bold. They have high verbal ability, clerical perception and spatial aptitude.

Artistic persons are sensitive and interested in aesthetic matters. They are curious and open to new ideas and experiences, but can also be critical. Being preoccupied with their ideas and thoughts, they tend not to be practical. They are independent and socially bold, enjoying social situations. They are also expedient choosing to operate by their own rules, rather than those of their culture.

Social

Social persons tend to be extroverted, group oriented and group dependent. They are outgoing, warm, receptive and personally open. They are lively and socially bold and have also been described as independent. They have good reasoning skills and have been found to have good motor coordination.

They prefer doing things with a group rather than alone. They are open to new ideas and are prepared to reveal personal matters about themselves.

Enterprising

Enterprising persons are extroverted. They are described as group dependent as well as independent. They are outgoing and participating, enthusiastic, dominant, venturesome and socially bold. They are emotionally stable, self-assured and relaxed. They are conscientious, persevering, shrewd, controlled, socially precise, tough minded and objective.

They are gregarious and enjoy social interaction, but are also assertive and venturesome. They can also be tough-minded, focusing on objective and utilitarian issues. Typically they are not anxious, handling life's challenges in a self-assured manner.

Conventional

Conventional persons tend to be accommodating, conforming, self-reliant and realistic. They are conscientious, self-controlled, perfectionistic, tough-minded, objective and practical.

They are self-disciplined and abide by society's rules. They focus on utilitarian and practical matters, preferring to adhere to traditional methods and ideas than experimenting with new ideas or experiences.

5.2.2 Kolb's learning abilities and styles

Kolb's theoretical descriptions of the personal characteristics associated with the four learning abilities (Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation) are given in Table 4.2, and those for the four learning styles (Diverger, Assimilator, Converger, Accommodator) are given in Tables 4.3 and 4.4.

Most studies have focused on the relationship between learning abilities or learning

styles and field of study or career choice (see 4.3.1). Few studies have investigated the relationship between learning abilities or styles and personal characteristics. Kolb provided concurrent validity of measurement of his learning abilities and styles by using the Jungian personality dimensions as measured by the Myers-Briggs Type Indicator (MBTI) (Furnham, 1992). Kolb (1984) presented empirical findings to substantiate his theoretical descriptions of learning abilities and styles. He reported unpublished data from three studies conducted in the 1970s by different investigators of three populations (undergraduates, MBAs and educational administration) using the LSI-1976 and MBTI. The data tends to support his hypotheses, but not consistently in all groups. The strongest and most consistent relationships appeared to link CE with feeling, AC with thinking, AE with extrovert and RO with introvert.

In a study by Lewis and Margerison (1979) 220 managers and work experienced MBA students completed the LSI-1976 and the MBTI. It was found that AC was related to the Jungian dimensions of thinking, intuition and judging, whereas CE was related to feeling and sensing. The AE scale was related to the extrovert dimension and RO to the introvert dimension.

West (1982) administered the LSI-1976, the MBTI, the Survey of Interpersonal Values and the Omnibus Personality Inventory to a small sample of first-year medical students. Principal axis factor analysis followed by varimax rotation yielded seven factors: theoretical orientation, social acceptability, benevolence, internal control, extroversion, aestheticism and independence. A median test was used to examine group differences between the seven factors and the Converger/Diverger and Assimilator/Accommodator learning styles. The only significant difference found was that Convergers scored higher on the social adaptability factor than did Divergers, a result that was in the opposite direction than predicted by theory. Furthermore, only five of the 14 comparisons of medians exhibited differences consistent with theoretical predictions. As has been pointed out (see 4.2.3) factor analysis of an ipsative instrument's scores is not advisable.

In a doctoral study by Penn (1992) army nurses completed the LSI-1985 and the MBTI. A significant correlation between the extrovert-introvert dimension of the MBTI and learning styles was found. Accommodators tended to be extrovert and Assimilators tended to be introvert.

5.2.3 Research using both Holland and Kolb measures

Highhouse and Doverspike (1987) administered the LSI-1985, the Group Embedded Figures Test (GEFT) and the Vocational Preference Inventory (VPI) to 111 introductory psychology students. No significant correlations were found between the LSI-1985 and the GEFT. Correlations between the LSI-1985 and the VPI are given in Table 5.1. As can be seen from the table the CE scale was significantly correlated with the Artistic scale. The AE scale was significantly correlated with the Realistic, Social, Conventional and Enterprising scales. The AE scale represents extroversion and the Realistic person is described above (see 5.2.1) as introverted. 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.

TABLE 5.1 INTERCORRELATIONS FOR THE LSI-1985 AND VPI AS REPORTED BY HIGHHOUSE AND DOVERSPIKE (1987)

	CE	RO	AC	AE
Realistic	.00	- .21*	.07	.31**
Investigative	- .09	- .00	.12	.09
Artistic	.28**	- .07	- .12	.07
Social	- .12	.08	- .05	.20*
Enterprising	.11	- .27**	- .00	.33**
Conventional	- .06	- .22**	.09	.25**

* $p \leq .05$

** $p \leq .01$

Atkinson, Murrell and Winters (1990) investigated the correspondence between Holland's personality types and Kolb's learning styles. Kolb's LSI-1976 and Holland's SDS-1979 were administered to 169 first-year students aged between 19 and 22 years at a small liberal arts college. There were 76 men and 93 women. The primary Holland personality codes obtained were Social (38.5%), Artistic (16.6%) and

Investigative (24.9%), and 68.6% of the students were either Divergers (40.2%) or Assimilators (28.4%). These findings were consistent with the arts, humanities and basic sciences study directions of the college. The relationship between personality type and learning style is given in the table below:

TABLE 5.2 FREQUENCIES OF HOLLAND PERSONALITY TYPES AND KOLB LEARNING STYLE TYPES AS REPORTED BY ATKINSON *et al.* (1990)

Learning Style	Self-Directed Search: Holland personality type						
	R	I	A	S	E	C	Σ
Diverger	2	10	16	27	7	6	68
Assimilator	2	17	7	17	2	3	48
Converger	1	9	4	5	5	0	24
Accommodator	2	6	1	16	1	3	29
Σ	7	42	28	65	15	12	169

The authors concluded that despite some inconsistencies there were several promising findings. With respect to Kolb's learning styles Divergers had predominantly Social (39.7%) and Artistic (23.5%) codes and 14.7% of the Investigative types were Divergers. Divergers have affective (CE) and reflective (RO) learning preferences and the Social and Artistic types have similar affective preferences, while the Investigative types share the reflective preference.

Assimilators had 35.4% Investigative and 35.4% Social codes. While the abstract (AC) and reflective (RO) learning preferences of the Assimilator are compatible with the Investigative type, the high number of Social types is inconsistent with theoretical expectations.

Convergers had 37.5% Investigative, 20.8% Social and 20.8% Enterprising codes. The abstract (AC) learning preference of the Converger is compatible with the Investigative type and the active (AE) learning preference of the Converger is compatible with the energetic, outgoing nature of the Enterprising, and to a lesser

extent the Social, types.

Accommodators had 55.2% Social and 20.7% Investigative codes. The feelings (CE) and active (AE) learning preferences of the Accommodator are compatible with the Social type, but incompatible with the Investigative type.

From the perspective of the Holland personality types, the Investigative type included 40.5% Assimilators, 23.8% Divergers and 21.4% Convergers. The Investigative type shares a reflective (RO) preference with the Divergers and Assimilators and an abstract (AC) preference with the Assimilators and Convergers.

The Artistic type included 57.1% Divergers and 25% Assimilators. The Artistic type shares a feelings (CE) preference with the Divergers and a reflective (RO) preference with Divergers and Assimilators.

The Social type included 41.5% Divergers, 26,2% Assimilators and 24.6% Accommodators. The Social type shares a feelings (CE) preference with the Divergers and Accommodators, a reflective (RO) preference with the Divergers and Assimilators and an active (AE) preference with the Accommodators.

The Enterprising type included 46.7% Divergers and 33.3% Convergers. The Enterprising type shares a feelings (CE) preference with the Divergers and an active (AE) preference with the Convergers.

There were some inconsistent findings. For example, 50% of Conventional types were Divergers and 35.4% of Assimilators were Social types. The authors suggested that the size and narrowness of the sample may account for these results.

5.3 AN INTEGRATED MODEL OF VOCATIONAL PERSONALITY TYPES, LEARNING ABILITIES AND STYLES

It is proposed that the vocational personality types, learning abilities and styles are related in the following ways.

The Investigative personality type's logical, analytic, reflective and introverted nature

(see Table 3.1a and 5.2.1) has the most in common with the AC and RO learning abilities (see Table 4.2), and thus with the Assimilator learning style (see Table 4.3). The **Investigative** personality type is thus associated with the **Assimilator** quadrant in Figure 5.1. In research by Atkinson *et al.* (1990) (see Table 5.2) the Investigative personality type was associated most frequently with the Assimilator learning style.

The **Artistic** personality type (see Table 3.1a and 5.2.1) characterised by emotionality and creativity has the most in common with the CE learning ability (see Table 4.2). Both introversion and extroversion characteristics have been reported for Artistic types. Introspective, imaginative, daydreaming traits correspond to RO abilities and expressive, assertive and socially bold traits correspond to AE abilities (see Table 4.2), thus linking them with both the **Diverger** and **Accommodator** learning styles as depicted in Figure 5.1. In research by Highhouse and Doverspike (1987) (see Table 5.1) the Artistic type was significantly correlated with the CE scale and in research by Atkinson *et al.* (1990) (see Table 5.2) the Artistic type was associated most frequently with the Diverger learning style.

The Social personality type is people-oriented and likes to help others (see Table 3.1b). Karol (1994) noted that this is one of the least distinctive of the personality types in research using the 16 Personality Factor Questionnaire (16PF) as most of the traits fall at or near the mean. Social types have been found to be extroverted and both independent and group-dependent. Characteristics of warmth and empathy are confirmed by low tough-poise scores and high A scores on the 16PF (Karol, 1994). This "feelings" component corresponds to the CE learning ability and the extroversion to the AE learning ability (see Table 4.2). Many elements of the RO learning ability (see Table 4.2) and Diverger learning style (see Table 4.3) correspond to the description of the Social type (see Table 3.1b). The Social type values ethical activities and RO emphasizes a concern with what is true and values impartiality and considered, thoughtful judgement. Divergers are aware of meaning and values, are interested in people and tend to be imaginative and feeling oriented. The **Social** type is thus depicted in Figure 5.1 as being associated with both the **Diverger** and **Accommodator** learning styles. In research by Highhouse and Doverspike (1987) (see Table 5.1) the Social type was significantly correlated with the AE scale and in research by Atkinson *et al.* (1990) (see Table 5.2) the Social type was most frequently associated with the Diverger learning style.

The **Enterprising** personality type is people-oriented, dominant, assertive and extroverted (see Table 3.1b and 5.2.1) thus corresponding strongly with the AE learning ability (see Table 4.2). The Enterprising type also has a stronger objective and utilitarian aspect to their nature, as opposed to the warmth and empathy of the Social type. The people-oriented, extroverted and utilitarian characteristics are seen to correspond most strongly with the **Accommodator** learning style and to some extent with the **Converger** learning style (see Table 4.3). This is indicated in Figure 5.1 by a broken line extending towards the Converger quadrant. In research by Highhouse and Doverspike (1987) (see Table 5.1) the Enterprising type was significantly correlated with the AE learning ability and negatively correlated with the RO learning ability. In research by Atkinson *et al.* (1990) on learning style and personality type (see Table 5.2) there was a low frequency of Enterprising types and a clear pattern did not emerge.

The Conventional personality type is conscientious, perfectionistic, objective and practical. They are data-oriented rather than people-oriented (see Table 3.1b and 5.2.1). Karol (1994) noted that this is the least distinctive type in terms of personality traits in research using the 16PF with most scores falling at or near the mean. The Conventional type's characteristics correspond with aspects of the AE learning ability which emphasize practical applications and a pragmatic concern with what works, as well as aspects of the AC learning ability such as being good at systematic planning and valuing precision, the rigour and discipline of analysing ideas, and the aesthetic quality of a neat conceptual system (see Table 4.2). The **Conventional** type is thus associated with the **Converger** learning style in Figure 5.1. In research by Highhouse and Doverspike (1987) (see Table 5.1) the Conventional type was significantly correlated with the AE learning ability and negatively correlated with the RO learning ability. In research by Atkinson *et al.* (1990) on learning style and personality type (see Table 5.2) there was a low frequency of Conventional types and a clear pattern did not emerge.

The **Realistic** personality type is things-oriented rather than people-oriented. They have practical and unsentimental characteristics and have been described as reserved (see Table 3.1a and 5.2.1). The **Converger** learning style (see Table 4.3) emphasises a practical approach above social and interpersonal involvement and is seen to have the most in common with the Realistic type as depicted in Figure 5.1. In research by

Highhouse and Doverspike (1987) (see Table 5.1) the Realistic type was significantly correlated with the AE learning ability and negatively correlated with the RO ability. In research by Atkinson *et al.* (1990) on learning style and personality type (see Table 5.2) there was a low frequency of Realistic types and a clear pattern did not emerge.

The results of the empirical part of this study are reported in Chapter 7. A discussion of the results pertaining to the proposed integrated model is given in section 7.5.

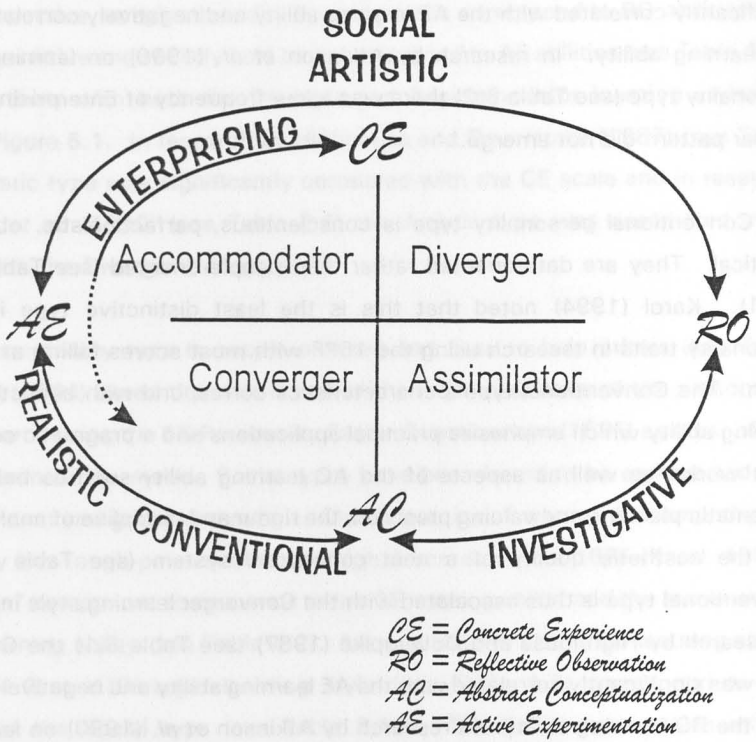

FIGURE 5.1 AN INTEGRATED MODEL OF HOLLAND PERSONALITY TYPES AND KOLB LEARNING ABILITIES AND STYLES

5.4 SUMMARY

In this chapter an integration of Holland's model of personality types and Kolb's model of learning abilities and learning styles was undertaken. Information on Holland's personality types and Kolb's learning abilities and styles was brought together. Research results in which both Holland and Kolb measurement instruments were used were reported and discussed in terms of the proposed integrated model. A description and visual representation of an integrated model of vocational personality types, learning abilities and styles was then presented.

In the following two chapters the empirical part of this study will be described and the results will be reported. Research results of this study relevant to the integrated model proposed in this chapter will be discussed in Chapter seven.

METHOD OF INVESTIGATION

6.1 PROBLEM FORMULATION AND MOTIVATION FOR THE INVESTIGATION

The first year at university marks an important transitional phase for students in their career development. Research shows that the first year is crucial to success in higher education and graduating (Banning, 1989; Jewler, 1989; Levitz & Noel, 1989). Information on students' personality styles and learning ability and styles can assist in the placement of students through career counselling and in planning and implementing optimum learning opportunities for them.

In Chapter 5 a theoretical integration of Holland's vocational personality types and Kolb's learning abilities and styles was proposed. Only a few studies, reported in Chapter 5, investigating the interaction between Holland's and Kolb's models have been done. The interaction between these two models will be further investigated in this empirical study.

6.2 AIM OF THE STUDY

The primary aim of the empirical study is to investigate the interaction of vocational personality type, and the learning ability and learning style of first-year students registered for courses presented in English and studying for either a science degree or a human sciences degree.

A secondary aim is to investigate the psychometric properties of the two measures of learning style used in the empirical study. Although this is a secondary aim, information relating to the psychometric properties of the two measures of learning style will be given first, followed by information on the interaction of vocational personality type, and learning ability and style. This method will be followed in this chapter as well as in the following chapter where the research results will be reported and discussed. The research results can then be interpreted in the light of the findings pertaining to the psychometric properties of the instruments.

6.3 RESEARCH DESIGN

6.3.1 Description of the total sample and subsamples used for analysis

All subjects were full-time, first-year students at the University of Pretoria. The official medium of instruction at the university is Afrikaans, but many courses are offered in both Afrikaans and English. As the two learning style inventories used in this study were only available in English it was decided to use only students registered for English courses at the university.

A testing programme to standardize new instruments developed for admission purposes at the university was run during the orientation week at the end of January in 1995 and 1996. The researcher was granted permission to test students registered for courses presented in English in the faculty of Biological and Agricultural Sciences during the 1995 programme. A group of 304 students participated in the university's standardization testing programme and the remaining 99 students completed the instruments for this study. During the second phase of the university's testing programme in 1996 there were no "excess" students from the faculty of Biological and Agricultural Sciences so the 1995 sample could not be increased as planned. A small group of 38 students, registered for Engineering degree courses presented in English, participated in the researcher's study, these being the "excess" students of the university's 1996 test programme for the Engineering faculty.

In 1996 the Department of Psychology at the University of Pretoria granted the researcher permission to test students registered for the two English classes for the first-year Psychology course. Out of a possible total of 441 students, 327 participated in the study, these being the students who attended the class periods during which testing took place. The majority of these students were registered for a BA degree, however some were registered for science degrees such as MBChB, BChD, Nursing, Occupational Therapy and Dietetics. There were also a few students registered for commerce or law degrees. These students were excluded from the sample as only the sciences and human sciences fields of study were of interest in this study. (See Table 6.1 on the following page.).

TABLE 6.1 DISTRIBUTION OF THE TOTAL SAMPLE AND SUBSAMPLES USED FOR ANALYSIS

	TOTAL SAMPLE N = 464	SDS N = 236	LSI N = 419	LSQ N = 415	SDS + LSI N = 230	SDS + LSQ N = 231	SDS + LSI + LSQ N = 226
Gender	(14)*	(2)*	(2)*	(2)*	(2)*	(2)*	(2)*
Male	150	83	135	135	82	81	81
Female	300	151	282	278	146	148	143
Home language	(10)*						
English	170	87	145	145	85	87	85
Afrikaans	8	1	3	3	1	1	1
English + Afrikaans	21	10	20	20	10	10	10
African language(s)	152	73	150	147	71	68	67
English + African language(s)	57	35	57	56	34	35	34
English + other	27	17	27	27	17	17	17
Other	19	13	17	17	12	13	12
Cultural group	(23)*		(1)*	(1)*			
White	177	98	159	159	97	98	97
African	217	112	212	208	107	107	103
Coloured	3	1	3	3	1	1	1
Indian	43	24	43	43	24	24	24
Asian	1	1	1	1	1	1	1
Degree	(4)*						
BSc (Biological & Agricultural Sciences)	99	82	95	93	79	81	79
BA (Psychology class)	253	97	226	225	95	94	92
BEngineering	38	34	38	38	34	34	34
BSc (Psychology class)	63	23	60	59	22	22	21
Law (Psychology class)	5	-	-	-	-	-	-
BCom (Psychology class)	2	-	-	-	-	-	-

* Numbers in brackets indicate the number of missing records.

Evaluation of the psychometric properties of the two measures of learning style, the Learning Style Inventory (LSI) and the Learning Style Questionnaire (LSQ)

As the Self-Directed Search (SDS), used as a measure of vocational personality, is not relevant to this part of the study the subsample sizes for this analysis are larger than the subsample used for the investigation of the interaction of the three instruments in the following section. All completed answer sheets for the LSI and LSQ were used for the evaluation of the psychometric properties of these two instruments. The sample sizes for the LSI and LSQ, as well as the distribution for gender, home language, cultural group and field of study for these two instruments are given in Table 6.1. The mean age for both the LSI and LSQ subsamples is 19.2 years, ranging from 16.2 to 36.8 years.

The sample sizes for the LSI (N = 419) and for the LSQ (N = 415) are very similar (see Table 6.1). There is a higher proportion of females than males in these samples (approximately two-thirds females to one-third males). Regarding home language, 145 (35%) students are English first language speakers and for the rest English is probably a second language. The african cultural group comprises 50% of the LSI and LSQ samples and the white group 38% of these samples. The other cultural groups are under-represented. The two fields of study (BSc and BA) are fairly evenly represented in the samples for both the LSI and the LSQ. The BSc field of study comprises the BSc (Biological & Agricultural Sciences), BEngineering and BSc (Psychology class) students and in total represents 46% of the sample, whereas the BA field of study represents 54% of the sample.

Investigation of the interaction of the Self-Directed Search (SDS), the Learning Style Inventory (LSI) and the Learning Style Questionnaire (LSQ) for the BSc and BA groups

The subsample used for this analysis (N = 226) comprises subjects who completed all three the instruments (SDS, LSI, LSQ) (See Table 6.1). Two subgroups were formed. One subgroup consists of the BSc (Biological and Agricultural Sciences) students, BSc students tested in the Psychology class, as well as the BEngineering students. This subgroup (N = 134) is referred to as the BSc group. The other subgroup consists of the BA students tested in the Psychology class. This subgroup (N = 92) is referred to as the BA group. The gender, cultural and language

composition of this sample can be seen in Tables 6.2 to 6.4 on the following pages. There is a higher proportion of females than males in the sample and males are under-represented in the BA group (see Table 6.2). Whereas the white and african cultural groups are fairly equally represented in the sample, the coloured, Indian and Asian cultural groups are under-represented (see Table 6.3). In the BA group 52 students (56.5%) are from the african cultural group. In the sample only 85 students (37.6%) are primarily English mother tongue speakers (see Table 6.4). For the rest of the students English is probably a second language. The BA group consists of predominantly English second language speakers. The mean age for the BSc group is 18.6 years, ranging from 16.2 to 24 years, and the mean age for the BA group is 19 years, ranging from 16.2 to 27 years.

TABLE 6.2 COMPOSITION OF THE ANALYSIS SAMPLE ACCORDING TO FIELD OF STUDY AND GENDER

GENDER	FIELD OF STUDY		N
	BSc	BA	
Males	66	15	81
Females	66	77	143
TOTAL	132	92	224

Two students in the BSc group did not indicate their gender.

TABLE 6.3 COMPOSITION OF THE ANALYSIS SAMPLE ACCORDING TO FIELD OF STUDY AND CULTURAL GROUP

CULTURAL GROUP	FIELD OF STUDY		
	BSc	BA	N
White	60	37	97
African	51	52	103
Coloured	0	1	1
Indian	23	1	24
Asian	0	1	1
TOTAL	134	92	226

TABLE 6.4 COMPOSITION OF THE ANALYSIS SAMPLE ACCORDING TO FIELD OF STUDY AND HOME LANGUAGE

LANGUAGE GROUP	FIELD OF STUDY		
	BSc	BA	N
English	65	20	85
Afrikaans	1	0	1
English + Afrikaans	4	6	10
African language(s)	28	39	67
English + African languages	22	12	34
English + other	9	8	17
Other	5	7	12
TOTAL	134	92	226

6.3.2 Data collection

A total of 464 students were tested. The 99 BSc students in the faculty of Biological and Agricultural Sciences, and the 38 BSc Engineering students were tested during one session. The two Psychology classes were only available for single lecture periods at a time and test administration required two lecture periods. The students therefore completed the Biographical Information questionnaire and the two learning style instruments during one lecture period and the SDS during another lecture period. The four test sessions for these two groups took place during a one week period at the end of March 1996. Not all the students tested attended both sessions resulting in incomplete datasets. The researcher conducted all the test sessions.

The assessment instruments were coded and the data computerized. Only complete SDS questionnaires were scored. In the case of scoring the LSI and LSQ, missing or ambiguous responses were substituted with the group average score for the relevant item, for a maximum of two items on a questionnaire. For the LSI the group average score was substituted for one item in 43 cases and for two items in 9 cases. For the LSQ the group average score was substituted for one item in 39 cases and for two items in 4 cases. Due to incomplete questionnaires that could not be scored the numbers of usable questionnaires thus differs from instrument to instrument. The total number of students tested and the final numbers of scored questionnaires are given in Table 6.1.

The order in which the instruments were completed was as follows: first the Biographical Information questionnaire, followed by the two learning style instruments, and finally the SDS. The order in which the LSI and LSQ were completed was varied to control for a possible effect due to answering two measures of learning abilities and styles at the same test session. Two groups were formed. Group 1 first answered the LSI followed by the LSQ, and Group 2 first answered the LSQ followed by the LSI. The method used to investigate a possible effect due to the order in which the LSI and LSQ were answered is described in section 6.4.3.1.

Subjects were assigned learning styles based on the two composite scores AC-CE and AE-RO of the LSI and LSQ. If a zero score was obtained for one of the composite scores (i.e. a zero score on one bipolar axis), then the subject was allocated two

learning styles. If zero scores were obtained for both composite scores (i.e. zero scores on both axes), then the subject was not allocated a learning style. The distributions of learning styles for the BSc and BA groups for the LSI and LSQ are reported in sections 7.3.7 and 7.4.

6.3.3 Measurement instruments

The test battery consisted of a Biographical Information questionnaire, the Self-Directed Search (SDS), the Learning Style Inventory (LSI) (a normative, Likert scale version of Kolb's LSI-1985) developed by Geiger *et al.* (1993)) and the Learning Style Questionnaire (LSQ) developed by Marshall and Merritt (Marshall & Merritt 1985, 1986; Merritt & Marshall, 1984).

6.3.3.1 The biographical information questionnaire

A short biographical questionnaire was compiled for the purposes of this study to obtain background information on the students (see Appendix A). Information on gender, age, home language, cultural group and degree for which the student was registered was requested.

6.3.3.2 The Self-Directed Search (SDS)

The SDS was developed as a *"self-administered, self-scored and self-interpreted vocational counseling tool"* (Holland & Rayman, 1986, p. 55) for adolescents and adults. The American version consists of two booklets: an assessment booklet and an occupational classification booklet. The SDS developed over a long period of time from Holland's theory, his experience as a vocational counsellor and his ongoing research. It was first published in 1971 and was revised several times, the latest version being that of 1985. Holland stated that the SDS is an interest inventory as well as a personality inventory, a values inventory and a competency inventory.

The SDS used in this study was published by the Human Sciences Research Council in 1987 and is an adaptation of Holland's 1977 and 1985 versions. The South African version is available in an English and an Afrikaans form and was standardized using Standard 7, 8, 9 and 10 pupils representative of all the cultural groups in South

Africa during the period 1985 to 1987. The original American structure was retained and the items were predominantly from the 1985 revised American edition. Only nine items were amended or replaced (Gevers *et al.*, 1992) and the South African version is thus very similar to the American SDS. The instrument yields six scores (Realistic, Investigative, Artistic, Social, Enterprising and Conventional) from the following four scales: Activities (11 items for each of the six personality types), Competencies (11 items for each of the six personality types), Occupations (14 items for each of the six personality types) and two Self-Ratings of abilities or skills (two 6-point scales for each of the six personality types). Each of the six scores is the sum of the four scale scores for a specific personality type. A three-letter Holland code is then assigned from the ordinal relationship of the three highest total scores. Test-retest reliability coefficients (8-week interval) of between 0,57 and 0.85 and reliability coefficients of between 0,77 and 0,88 for the six personality scores are reported in the SDS manual (Gevers *et al.*, 1992). Intercorrelations of the six fields provided evidence that supported Holland's theoretical hexagonal model. These results are similar to those for the American 1985 revised version of the SDS reported by Krieshok (1987). Alpha coefficient values for the six summary scales range from .59 to .92 with most falling in the .70 and .80 range. Test-retest reliabilities are reported as correlations between the 1977 and 1985 editions, administered from 1 to 14 days apart. Scale-to-scale correlations range from .81 to .93 which indicates good reliability for a measure of interests.

In a study by du Toit (1988) on a large sample of black standard 10 pupils (N = 5994) intercorrelations and factor analysis confirmed relationships between the six personality types and the hexagonal/circular structure as proposed by Holland. Reliability coefficients were satisfactory and compared favourably with those obtained by Holland and others. Most of the pupils resembled the Social personality type. The Realistic, Enterprising and Investigative fields were identified as making a small contribution to the prediction of academic achievement. Du Toit concluded that the SDS has utility for use with black pupils.

A study conducted on a group of black adolescents by Brand *et al.* (1994) found the SDS to be an effective assessment technique in a non-western cultural environment lending support to the view that Holland's theory and the SDS is applicable to most cultures.

As the American and South African versions of the SDS are very similar comment on the American version pertains to the South African one.

The SDS has been translated or adapted for use in many countries such as Australia, New Zealand, Canada, Japan, the Netherlands, Switzerland, Italy, Nigeria and Guyana. Research has shown construct validity and reliability results similar to those obtained in the United States providing evidence of the instrument's transportability across cultures (Holland & Rayman, 1986). The SDS has proved itself as a useful instrument applicable to many cultures and client populations, including the mentally ill (Loughead & Black, 1990) and the learning disabled (Cummings & Maddux, 1987), in paper and pencil as well as computer form (McKee & Levinson, 1990).

Kimball, Sedlacek and Brooks (1973) compared black and white vocational interests using the SDS and found that blacks and whites were equally satisfied with their codes. They reported a greater number of Social codes for blacks compared to more Realistic and Investigative first choices by whites. Similar results in the South African context were reported by du Toit (1988). In a summary of the literature on African American and Anglo differences in patterns of interests, Carter and Swanson (1990) found that African Americans tended to have more Social-Enterprising-Conventional interests, whereas Anglos tended to have more Realistic-Investigative-Artistic interests.

Gottfredson and Holland (1975) reported on a study using large samples of college students (894 men and 989 women) in which it was demonstrated that each section of the SDS (activities, competencies, occupations, self-ratings and vocational aspirations) had predictive validity with respect to occupational choices one or three years after completing the SDS. The results indicated that divergent content could be used to assess the types. Current vocational choice was the best predictor of later choice and scores based on sex-specific norms were less efficient predictors than raw scores. Holland (Holland & Rayman, 1986, p. 71) reported that construct, predictive, content and concurrent validity research results for the SDS *"appear to be as positive and clear as that for similar inventories."* A study by Dumenci (1995) supported the convergent and discriminant validity of the SDS. Research on the effects of the SDS commonly find that the SDS increases self-understanding and satisfaction with a vocational aspiration, and increases the number of vocational options a person is

considering.

Daniels (1989) stated that the SDS is widely used as the vocational instrument of choice with adolescent, young adult and adult populations in the United States as well as in several other countries. It is his opinion that Holland successfully addressed most of the criticisms levelled at the SDS in the 1985 revision. Daniels indicated a remaining problem in that the scales do not have the same number of items and thus contribute unequally to the total scores. The Occupations scale contributes more to the total than the other scales, and the Self-Ratings of abilities or skills contributes more than either Activities or Competencies. According to Daniels this places undue emphasis on fantasy as opposed to experience. However Daniels (1989) concluded *"the SDS remains an excellent vocational counseling tool that can be used with most adolescents and adults"* (p. 330).

6.3.3.3 Two measures of learning style

As pointed out in Chapter 4 the psychometric properties of Kolb's LSI have been investigated in several studies and have been criticized by several authors. The ipsative scoring format of the LSI presents statistical problems which make the unequivocal interpretation of procedures such as factor analysis of the results problematic. The researcher therefore decided to use normative rather than ipsative measures of learning style to avoid the limitations an ipsative instrument places on statistical analysis of data.

6.3.3.3.1 Learning Style Inventory (LSI)

The development of the Learning Style Inventory (LSI) by Geiger *et al.* (1993) is described in Chapter 4. It contains the same stimulus material as Kolb's LSI-1985, but the twelve sentence items with four word endings are randomly presented as complete sentences. The instrument thus has 48 items, 12 items for each of the four scales. The four scales consist of the same items as for the LSI-1985, the LSI being a normative version of the LSI-1985. Whereas Geiger *et al.* used a seven-point Likert scale, the researcher has used a five-point scale. A copy of the LSI can be found in Appendix B. The researcher wrote to the main author and obtained from him the instrument and permission to use it for research purposes. Scores are obtained for

the four scales (CE, RO, AC, AE), as well as for the two composite scores AC-CE and AE-RO. Based on the two composite scores subjects were assigned to one of four learning styles (Diverger, Assimilator, Converger, Accommodator). Geiger *et al.* (1993) reported internal consistency reliabilities based on alpha coefficient as follows: CE = .83, RO = .77, AC = .86, AE = .84. Adjusted scale correlations for the four scales ranged from .466 to .615. Factor analysis of the LSI did not produce bipolar dimensions, but strong support for the four separate learning abilities was obtained.

6.3.3.3.2 Learning Style Questionnaire (LSQ)

The development of the normative Learning Style Questionnaire (LSQ) (Merritt & Marshall, 1984; Marshall & Merritt, 1985, 1986) is described in Chapter 4. The instrument consists of 40 items, 10 items for each of the four scales (CE, RO, AC, AE). Each item consists of a word pair on a five-point semantic differential scale. Each of the two words in an item represent opposing learning abilities. A copy of the LSQ can be found in Appendix C. The researcher wrote to the authors and obtained from them the instrument and permission to use it for research purposes. Scores are obtained for the four scales, as well as for the two composite scores AC-CE and AE-RO. Based on the two composite scores subjects were assigned to one of four learning styles (Diverger, Assimilator, Converger, Accommodator). Marshall and Merritt (1986) reported internal consistency reliabilities based on alpha coefficient as follows: CE = .78, RO = .86, AC = .85, AE = .88, CE-AC = .90 and RO-AC = .93. Factor analysis showed that items loaded on bipolar factors in accordance with Kolb's proposed learning abilities and styles, thus providing construct validity for these dimensions.

6.4 DATA PROCEDURE

6.4.1 Introduction

The hypotheses investigated in this study focus on determining the relationships between two fields of study, vocational personality and learning abilities with a view to investigating possible relationships between vocational personality type and learning ability. Psychometric properties of the LSI and LSQ are also investigated. Specific hypotheses are formulated in further sections of this chapter.

6.4.2 Variables

The variables used in this study are as follows:

(i) Dependent variables

The dependent variables used in this study are as follows:

- six vocational personality types (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) as measured by the SDS;
- four learning abilities (Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation) as measured by the LSI and the LSQ;
- four learning styles (Diverger, Assimilator, Converger, Accommodator) as measured by the LSI and LSQ.

(ii) Independent variables

The independent variables used in this study are as follows:

- two fields of study: science (BSc) and human sciences (BA)

It was not possible to include gender as a variable in this study as there are only 15 males in the BA group (see Table 6.2). It is generally recommended that there be at least twice, but preferably three times, the number of subjects than variables for analysis (Edens, 1987). As 14 variables were used it was not possible to differentiate between gender in the analysis sample. Culture could also not be used as a variable for the same reason.

Differences in Holland personality type scores according to gender have been reported (Tokar & Swanson, 1995). Dumenci (1995) found I types and S types over-represented in males and females, respectively. The SDS manual (Gevers *et al.*, 1992) reported that gender differences occur on the R, A and S fields with girls obtaining lower mean scores than boys on the R field and higher mean scores on the A and S fields. While some research (Hickcox, 1990) reported no gender differences with respect to learning styles, other studies reported women tended to get higher

scores on CE and men tended to score higher on AC (Garvey *et al.*, 1984; Hickcox, 1990).

With respect to culture, research on the personality types has shown africans and african Americans tended to have more Social-Enterprising-Conventional interests, whereas whites and anglos tended to have more Realistic-Investigative-Artistic interests (Carter & Swanson, 1990; Du Toit, 1988; Kimball *et al.*, 1973). Yuen and Lee (1994) investigated the applicability of Kolb's learning styles to non-Western final-year Singaporean university students. It was hypothesized that the Singaporean students representing the Arts, Science, Law, Computer Science, Medicine and Business Administration faculties would score high on Abstract Conceptualization due to the influence of the local educational system and the traditional Chinese culture influenced by Confucian ethics which place a high value on intellectual development. The Singaporean students obtained much higher mean scores on AC and lower mean scores on AE on the LSI-1985 when compared with data reported in the literature for American students.

6.4.3 Data processing procedure

The data was analyzed using the SAS (SAS Institute Inc., 1990) and BMDP (BMDP Statistical Software Inc., 1993) statistical packages. The computer program and procedures used will be named where appropriate.

6.4.3.1 SECTION 1: Evaluation of the psychometric properties of the two measures of learning style, the Learning Style Inventory (LSI) and the Learning Style Questionnaire (LSQ)

As the reliability and validity of the LSI and LSQ are unknown for South African use it was decided to investigate the psychometric properties of these two measurements for first-year South African students who are English mother tongue or second language speakers.

(i) Description of the sample

The sample size for the LSI and LSQ, as well as the distribution for gender, home

language, cultural group and field of study for these two instruments are given in Table 6.1. The subsamples are described in section 6.3.1.

The order in which the LSI and LSQ were completed was varied to control for a possible effect due to answering two measures of learning abilities and styles at the same test session. Two groups were formed. Group 1 first answered the LSI followed by the LSQ, and Group 2 first answered the LSQ followed by the LSI. The distribution of gender, language, cultural group and field of study for the LSI and LSQ subsamples according to the order in which the two instruments were completed (Group 1 and Group 2) is given in Table 6.5 on the following page.

There is a higher proportion of females than males in the total sample (approximately two-thirds females to one-third males), but the distribution of females and males for Group 1 and Group 2, for both the LSI and the LSQ, is fairly evenly balanced (see Table 6.5). Regarding home language, 145 (35%) students are English first language speakers and for the rest English is probably a second language (see Table 6.5). The different categories of home language are fairly evenly represented in Group 1 and Group 2, for both the LSI and the LSQ (see Table 6.5). The african cultural group represents 50% of the total sample and the white group 38% of the total sample for both the LSI and the LSQ (see Table 6.5). The other cultural groups are under-represented. The different cultural groups are fairly evenly represented in Group 1 and Group 2. The two fields of study (BSc and BA) are fairly evenly represented in the total sample as well as within Group 1 and Group 2, for both the LSI and the LSQ. The BSc field of study comprises the BSc (Biological & Agricultural Sciences), BEngineering and BSc (Psychology class) and in total represents 46% of the sample, whereas the BA field of study represents 54% of the sample (see Table 6.5).

The existence of a possible effect due to the order in which the LSI and LSQ were completed was investigated. Hotelling's T test was used to test the statistical significance of the differences between the means of the four scales of the LSI and LSQ for Group 1 and Group 2 using the BMDP3D t-test statistical package (BMDP Statistical Software Inc., 1993). The following hypothesis was tested:

Ho1: Group 1 and Group 2 have equal vector of means for the four scales of the LSI and LSQ.

TABLE 6.5 DISTRIBUTION OF THE LSI AND LSQ SUBSAMPLES ACCORDING TO THE ORDER IN WHICH THE TWO LEARNING STYLE INSTRUMENTS WERE COMPLETED (GROUP 1 AND GROUP 2)

	Learning Style Inventory (LSI) N = 419			Learning Style Questionnaire (LSQ) N = 415		
	Group 1	Group 2	Total	Group 1	Group 2	Total
Gender (2)*						
Male	77	58	135	77	58	135
Female	137	145	282	133	145	278
			417			413
Home language						
English	75	70	145	74	71	145
Afrikaans	2	1	3	2	1	3
English + Afrikaans	7	13	20	7	13	20
African language(s)	86	64	150	84	63	147
English + African language(s)	30	27	57	29	27	56
English + other	8	19	27	8	19	27
Other	7	10	17	7	10	17
			419			415
Cultural group (1)*						
White	66	93	159	65	94	159
African	119	93	212	116	92	208
Coloured	2	1	3	2	1	3
Indian	26	17	43	26	17	43
Asian	1	0	1	1	0	1
			418			414
Degree						
BSc (Biological & Agricultural Sciences)	48	47	95	47	46	93
BA (Psychology class)	123	103	226	121	104	225
BEngineering	22	16	38	22	16	38
BSc (Psychology class)	22	38	60	21	38	59
			419			415

* Numbers indicated in brackets indicate the number of missing records.

Hi1: Group 1 and Group 2 do not have equal vector of means for the four scales of the LSI and LSQ.

The results are reported in the following chapter.

(ii) Item analysis of the LSI and the LSQ

Item analysis for the LSI and LSQ was done using the ITEMAN Conventional Item Analysis Program (Assessment Systems Corporation, 1993). The mean and standard deviation as well as the item-scale correlation for each item are reported in the following chapter.

(iii) Reliability of the LSI and the LSQ

For a measure to be **reliable** it must be free of measurement errors (Sirkin, 1995). A reliability coefficient varies from zero to one where zero indicates no reliability and one indicates complete reliability. If important decisions are to be made concerning peoples' lives and futures, then reliability is important so that consistent diagnoses or predictions can be made. (It must be remembered reliability only indicates the accuracy of a measure, not its validity.) In such circumstances Owen and Taljaard (1995) stated that the reliability of a measure should be of the order of 0.90 or higher, especially if only one measure is available. However in general a measure with a reliability coefficient of the order of 0.60 can provide useful information provided the results are interpreted with caution and the required expertise. Different techniques are used to determine the reliability of a measure such as test-retest reliability, using parallel forms of the measurement instrument, and measures of internal consistency such as split-half reliability (Spearman-Brown formula), the Kuder-Richardson formulae and Cronbach's alpha coefficient. The alpha coefficient is used to estimate the reliability of a measure when a testee's score can vary from item to item (and is not 0 or 1) such as is the case with a Likert or semantic differential scale (Owen & Taljaard, 1995).

The internal consistency of the LSI and LSQ was investigated using the alpha coefficient which was calculated for the four learning abilities (AC, CE, AE, RO) using the ITEMAN Conventional Item Analysis Program (Assessment Systems Corporation,

1993). The results are reported in the following chapter.

(iv) Construct validity of the LSI and the LSQ

Validity is *"the extent to which the concept one wishes to measure is actually being measured by a particular scale or index"* (Sirkin, 1995, p. 69). **Construct validity** is a form of validity testing used in theory validation and is *"the extent to which a test measures a particular theoretical construct"* (Neale & Liebert, 1980, p. 40). When there is no definite criterion against which the construct can be validated indirect measures are used. Empirical investigation of construct validity makes use of correlation measures of the association between the construct under investigation and variables theoretically related to the construct. In this study the results of the discriminant analysis and factor analysis, as well as the distribution of frequency of learning styles for the BSc and BA groups were used to investigate the construct validity of the LSI and the LSQ. The FREQ procedure of the SAS statistical package (SAS Institute Inc., 1990) was used to calculate the frequency distribution of learning styles for the two fields of study for the LSI and the LSQ. The FREQ procedure was also used to calculate the Chi-square test of significance for the frequencies. The results are reported in the following chapter.

6.4.3.2 SECTION 2: Investigation of the interaction of the SDS, LSI and LSQ for the BSc and BA groups

(i) Description of the sample

As described in section 6.3.1, the sample consisted of first-year students registered for English courses in two fields of study, namely BSc and BA. The composition of the sample is given in Tables 6.2 to 6.4. The following were calculated for the dependent variables (see 6.4.2) using the Univariate Procedure statistical package (SAS Institute Inc., 1990):

(1) arithmetic mean;
(2) standard deviation;
(3) skewness;
(4) kurtosis.

These descriptive statistics are given in table form in the next chapter.

(ii) Hotelling's T test

Hotelling's T test was used to test the statistical significance of the differences between the average profiles of the BSc and BA groups using the BMDP3D t-tests statistical package (BMDP Statistical Software Inc., 1993). The following hypothesis was tested:

Ho2: The Bsc and BA groups have equal vector of means for all dependent variables.

Hi2: The Bsc and BA groups do not have equal vector of means for all dependent variables.

The results are reported in the next chapter.

(iii) Discriminant analysis

Using discriminant analysis the differences between two or more groups with respect to a number of variables can be studied either to **interpret** group differences or to **classify** cases or subjects into groups (Klecka, 1980). It is a statistical technique that identifies which dependent variables are relevant to and which discriminate between a number of criterion groups (Schoeman, 1978). Dependent variables that have been measured for two or more criterion groups are combined in a discriminant function that aims to maximally discriminate between the criterion groups (Edens, 1987). The discriminant function can then be used to decide to which criterion group a subject belongs. Discriminant analysis is thus used as a descriptive and a predictive technique.

Discriminant analysis was used as an initial step in the statistical investigation of the general hypothesis stated in 6.4.1. The aim was to determine which of the dependent variables best discriminated between the groups. The sample was divided in two homogeneous subgroups according to field of study (BSc and BA). Thereafter a stepwise discriminant analysis was carried out using the BMDP7M statistical

package (BMDP Statistical Software Inc., 1990) on the two groups.

During the first step discriminant analysis was carried out for the two groups using the following dependent variables:

- six personality types (R I A S E C) measured by the SDS;
- four learning abilities (CE RO AC AE) measured by the LSI;
- four learning abilities (CE RO AC AE) measured by the LSQ.

The hypotheses tested were as follows:

Ho3: It is not possible to discriminate between fields of study using personality type as measured by the SDS.

Hi3: It is possible to discriminate between fields of study using personality type as measured by the SDS.

Ho4: It is not possible to discriminate between fields of study using learning abilities as measured by the LSI.

Hi4: It is possible to discriminate between fields of study using learning abilities as measured by the LSI.

Ho5: It is not possible to discriminate between fields of study using learning abilities as measured by the LSQ.

Hi5: It is possible to discriminate between fields of study using learning abilities as measured by the LSQ.

Lastly, a discriminant analysis was carried out using a combination of the SDS, LSI and LSQ to determine if a combined interaction between all the variables could discriminate between the fields of study.

Ho6: It is not possible to discriminate between fields of study using personality type as measured by the SDS together with learning ability as measured by the LSI

and LSQ.

Hi6: It is possible to discriminate between fields of study using personality type as measured by the SDS together with learning ability as measured by the LSI and LSQ.

The results of these stepwise discriminant analyses are given in the following chapter.

(iv) Factor analysis

Factor analysis is not one, simple statistical method, but rather a broad category of approaches concerned with grouping variables (Nunnally, 1978). When a group of variables has a great deal in common a factor is said to exist and the related variables are found using the correlational technique (Child, 1990). The main objective of factor analysis is to determine the minimum number of factors that would satisfactorily produce the correlations among the observed variables (Kim & Mueller, 1994). According to Schepers (1990) factor analysis has a twofold aim, namely to describe a large number of intercorrelated variables in terms of a small number of independent constructs or factors, and to describe individuals in the sample using a small number of factors.

According to Child (1990) most kinds of distributions can be used for factor analysis provided they are not excessively skewed, truncated or multimodal. A variable used in factor analysis should not be created from the manipulation (addition, subtraction, etc.) of variables already in the analysis (Child, 1990). For this reason the composite scores for the LSI and LSQ (AC-CE and AE-RO) were not included in the factor analysis. Three types of factors, namely general, bipolar and group factors, are found. Factors with eigenvalues greater than one can be interpreted and factor loadings of .30 or higher are noted (Nunnally, 1978). The pattern of factor loadings leads to the naming and interpreting of factors. Variables with unusually high loadings give clues as to the nature of the factor and loadings are considered in descending order of magnitude as a guide to interpretation (Child, 1990; Lemke & Wiersma, 1976).

In this study the principal factor method was used to extract factors followed by a direct quartimin (oblique) rotation of factors. This procedure was applied to the

combined BSc and BA group, as well as to the individual BSc and BA groups using the BMDP4M factor analysis statistical package (BMDP Statistical Software Inc., 1993). Rotational procedures are used in research that focuses on the psychological meaning of the grouping of variables embedded in the matrix of intercorrelations of the variables as opposed to non-rotational procedures that focus on the meaning of the first centroid (general) factor such as in research on intelligence tests (Lemke & Wiersma, 1976). Tables of the oblique rotated factor loadings for the BSc, the BA and the combined BSc and BA groups are given in the following chapter.

(v) Intercorrelations for Holland personality types and Kolb learning abilities

Intercorrelations for Holland personality types as measured by the SDS and Kolb learning abilities as measured by the LSI and the LSQ were calculated for the BSc and the BA groups using the CORR procedure of the SAS statistical package (SAS Institute Inc., 1990). The intercorrelation tables appear in the following chapter.

(vi) Frequencies of Holland personality types and Kolb learning style types

Frequency distributions for Holland personality types as measured by the SDS and Kolb learning abilities as measured by the LSI and the LSQ were calculated for the BSc and the BA groups using the FREQ procedure of the SAS statistical package (SAS Institute Inc., 1990). The frequency distribution tables appear in the following chapter.

6.5 SUMMARY

In this chapter the sample and subsamples used for analysis, and the measurement instruments used (SDS, LSI and LSQ) are described. The procedure to investigate the aims of the study is described.

Firstly, the psychometric properties of the two measures of learning style (LSI and LSQ) are investigated using subsamples of subjects who completed these instruments. Item analysis of each instrument will be carried out and the internal reliability of the four ability scales will be reported using the alpha coefficient. The distribution of the frequency of the four learning styles for the BSc and BA subgroups will be reported

to investigate the construct validity of these two instruments and the results of the discriminant and factor analysis will also be taken into account.

Secondly, the interaction of the SDS, LSI and LSQ is investigated. The subsample of subjects who completed all three instruments will be divided into BSc and BA subgroups. Hotelling's T test will be used to test for significant differences between the average profiles of these two subgroups. The subgroups will further be investigated with respect to a number of dependent variables (vocational personality type and learning ability) using discriminant and factor analysis. To further facilitate the validation of the integrated model of Holland's vocational personality types and Kolb's learning abilities and styles proposed in Chapter 5, intercorrelations for the vocational personality types and learning abilities for the subgroups will be determined. Likewise, the frequency distribution of learning styles for the subgroups will be determined.

The results of the above investigations are reported in the following chapter.

CHAPTER SEVEN

RESULTS AND DISCUSSION

7.1 INTRODUCTION

The results of the empirical study described in the previous chapter are presented, interpreted and discussed in this chapter. The presentation will proceed as follows:

SECTION 1: EVALUATION OF THE PSYCHOMETRIC PROPERTIES OF THE TWO MEASURES OF LEARNING STYLES, THE LEARNING STYLE INVENTORY (LSI) AND THE LEARNING STYLE QUESTIONNAIRE (LSQ)

- The results of the evaluation of the psychometric properties of the two measures of learning style (LSI and LSQ) will be reported. It was decided that the instruments should be evaluated before the results of the investigation of the interaction of the SDS, LSI and LSQ are presented. As the construct validity of the LSI and LSQ can only be meaningfully discussed once all the results have been presented, the construct validity is reported on in section 7.4.

- Firstly, a description of the sample will be given. The order in which the two measures of learning styles was completed was varied to control for a possible effect due to answering two measures of learning styles at the same test session. Hotelling's T test will be used to test for such an effect and the results will be reported.

- Secondly, the following procedure will be followed for the LSI and the LSQ:

  · Item analysis will be done and the item means, standard deviations and item-scale correlations will be reported.

  · Intercorrelations for the four learning ability scales (AC, CE, AE, RO) will be reported.

  · The alpha coefficients for the four learning ability scales will be reported.

the model.

7.2 SECTION 1: EVALUATION OF THE PSYCHOMETRIC PROPERTIES OF THE TWO MEASURES OF LEARNING STYLE, THE LEARNING STYLE INVENTORY (LSI) AND THE LEARNING STYLE QUESTIONNAIRE (LSQ)

7.2.1 Description of the sample

As the SDS results are not required for the evaluation of the psychometric properties of the LSI and LSQ the subsample sizes used in SECTION 1 are larger than for the subsample used in SECTION 2. All completed and usable answer sheets for the LSI and LSQ were used for the evaluation of the psychometric properties of these two instruments. As explained in section 6.3.2 when scoring the LSI and LSQ missing or ambiguous responses were substituted with the group average score for the relevant item, for a maximum of two items on a questionnaire. For the LSI the group average score was substituted for one item in 43 cases and for two items in 9 cases. For the LSQ the group average score was substituted for one item in 39 cases and for two items in 4 cases. The sample sizes for the total sample tested and for the LSI and LSQ, as well as the distribution for gender, home language, cultural group and field of study (degree) for these two instruments are given in Table 6.1. The subsamples are described in Chapter 6 (see 6.3.1).

The order in which the instruments were completed was as follows: first the Biographical Information questionnaire, followed by the two learning style instruments, and finally the SDS. The order in which the LSI and LSQ were answered was varied to control for a possible effect due to answering two measures of learning abilities and styles at the same test session. Two groups were formed. Group 1 first answered the LSI followed by the LSQ, and Group 2 first answered the LSQ followed by the LSI. The distribution of gender, language, cultural group and field of study (degree) for the LSI and LSQ subsamples according to the order in which the two instruments were completed (Group 1 and Group 2) is given in Table 6.5. The subsamples for Group 1 and Group 2 are described in Chapter 6 (see 6.4.3.1).

Hotelling's T test was used to test the statistical significance of the differences between the means of the four scales of the LSI and LSQ for Group 1 and Group 2.

The following hypothesis was tested:

Ho1: Group 1 and Group 2 have equal vector of means for the four scales of the LSI and LSQ.

Hi1: Group 1 and Group 2 do not have equal vector of means for the four scales of the LSI and LSQ.

The results are reported in Table 7.1.

TABLE 7.1 HOTELLING'S T TEST FOR GROUP 1 AND GROUP 2

Hotelling T square	7.45
F value	0.92
Degrees of freedom	8, 419
Critical value	1.94 at the 5% level of significance

The null hypothesis as stated above was accepted. It would appear that the order in which the LSI and LSQ were completed did not effect the scores obtained for the two instruments.

Subjects were assigned learning styles based on the two composite scores AC-CE and AE-RO. If a zero score was obtained for one of the composite scores (i.e. a zero score on one bipolar axis), then the subject was allocated two learning styles. If zero scores were obtained for both composite scores (i.e. zero scores on both axes), then the subject was not allocated a learning style. The distributions of learning styles for the BSc and BA groups for the LSI and the LSQ are reported in section 7.4.

7.2.2 Item analysis of the LSI

Item analysis was done for the LSI (see Appendix B) and the item means, standard deviations and item-scale correlations are given in Table 7.2. A total of 419 answer

sheets were available for analysis (see Table 6.1). However the N per item in Table 7.2 varies according to the number of students who completed each item. As a rule of thumb an item-scale correlation of at least .30 is deemed acceptable. Most of the items have item-scale correlations >.30, but there are a few items with item-scale correlations at about the .30 level. For example, for the AC scale item 10 (.34), for the CE scale items 18 (.29) and 22 (.31), for the AE scale item 17 (.33), and for the RO scale item 8 (.30). Furthermore, for item 18 (*I learn best when I am receptive and open minded.*) 86% of respondents endorsed options 4 and 5 (Somewhat like me and Very much like me) and for item 17 (*I learn best when I work hard to get things done.*) 85% of respondents endorsed options 4 and 5.

High item-scale correlations provide evidence of high reliability and the above items could be inspected with a view to possibly improving or replacing items. However, high item-scale correlations do not necessarily provide evidence of high test validity.

A five-point Likert scale was used for the LSI where:

1 = Not at all like me
2 = Somewhat unlike me
3 = Neutral
4 = Somewhat like me
5 = Very much like me

Options 1 and 2 were endorsed at most by 35% of respondents. For 28 out of 48 items options 1 and 2 where used by 10% or less of respondents. The relatively high item means (see Table 7.2) reflect this. This could indicate a response bias with respondents favouring socially acceptable responses.

The scale intercorrelations for the LSI are given in Table 7.3. All are positive and range from 0.254 to 0.454. Theoretically the AC and CE scales and the AE and RO scales are bipolar so one would expect negative correlations between AC and CE, and between AE and RO.

TABLE 7.2 ITEM ANALYSIS FOR THE LSI

SCALE	ITEM	N per item	Item mean	Item var.	Item-scale correlation
Abstract Conceptualisation	4	418	4.057	1.040	.49
	6	418	3.978	0.916	.57
	10	418	3.689	1.066	.34
	11	417	3.664	1.115	.44
	19	416	3.947	0.867	.61
	24	417	3.695	1.344	.49
	25	416	3.464	1.201	.53
	26	417	3.964	1.382	.56
	29	417	4.000	0.892	.59
	32	416	3.868	0.951	.46
	43	412	4.180	0.798	.60
	47	412	3.990	0.980	.59
Concrete Experience	1	418	3.179	1.669	.55
	7	418	3.620	1.312	.44
	14	417	2.983	1.662	.61
	15	418	3.718	1.322	.50
	18	417	4.386	0.616	.29
	22	416	3.272	1.256	.31
	28	416	2.971	1.658	.59
	31	417	3.065	1.317	.58
	33	416	3.387	1.261	.56
	38	414	4.251	0.739	.39
	42	413	4.157	0.859	.45
	45	414	3.418	0.847	.42
Active Experimentation	5	418	4.091	1.064	.49
	12	417	4.132	0.915	.45
	13	418	4.043	1.242	.52
	17	417	4.393	0.747	.33
	20	417	4.189	0.854	.43
	34	417	3.902	0.957	.44
	35	417	3.986	1.180	.54
	37	414	4.316	0.791	.51
	39	413	4.126	0.933	.56
	41	414	4.169	0.971	.62
	44	414	3.773	1.330	.56
	48	413	4.743	0.360	.44
Reflective Observation	2	418	4.299	0.966	.46
	3	418	3.651	1.600	.47
	8	418	4.053	0.978	.30
	9	417	3.796	1.237	.36
	16	417	4.122	0.889	.50
	21	416	3.950	1.029	.37
	23	417	3.779	0.915	.43
	27	417	3.674	1.390	.50
	30	416	4.070	1.060	.57
	36	417	4.000	0.892	.55
	40	413	3.969	0.917	.59
	46	412	3.104	1.428	.44

TABLE 7.3 INTERCORRELATIONS FOR THE SCALES OF THE LSI

	AC	CE	AE	RO
AC	1.000	0.335	0.439	0.411
CE	0.335	1.000	0.454	0.254
AE	0.439	0.454	1.000	0.305
RO	0.411	0.254	0.305	1.000

7.2.3 Reliability of the LSI

The alpha coefficients for the four scales of the LSI are given in Table 7.4. Geiger *et al.* (1993) reported internal consistency reliabilities based on alpha coefficient for the LSI as follows: CE = .83, RO = .77, AC = .86, AE = .84. Coefficients in the order of 0.7 are deemed acceptable for use in research and based on the results of this study the LSI could be said to demonstrate sufficient internal consistency for use as a research instrument. Internal consistency is only one measure of reliability and the construct validity of the instrument is also important when considering the use of an instrument.

TABLE 7.4 ALPHA COEFFICIENTS FOR THE SCALES OF THE LSI

	AC	CE	AE	RO
Alpha	0.799	0.741	0.799	0.717

7.2.4 Item analysis of the LSQ

Item analysis was done for the LSQ and the item means, standard deviations and item-scale correlations are given in Table 7.5. A total of 415 answer sheets were available for analysis (see Table 6.1). However the N per item in Table 7.5 varies according to the number of students who completed each item. Item-scale correlations are well above the rule of thumb .30 level providing evidence of high reliability.

Each item of the LSQ (see Appendix C) consists of a word pair on a five-point semantic differential scale. Each of the two words in an item represent opposite learning abilities. In the list of word pairs below the item number is given and the word highlighted was endorsed by less than 20% of the respondents using one of the two response options GENERALLY (Most of the time) or OVER HALF THE TIME:

The Abstract Conceptualisation scale

15	consider	**impulsive**
17	reason	**hunch**
26	careful	**emotional**
27	logical	**sentimental**
29	thinking	**instinctive**
34	resolving	**feeling**
36	intellectual	**emotional**

The Concrete Experience scale

4	**sensing**	thinking
5	**premonition**	reason
12	**perceptual**	intellectual
18	**impulsive**	planning
25	**intuitive**	reasoning
30	**hunch**	logical

The Active Experimentation scale

6	active	**reserved**
23	involved	**distant**
39	solve	**reflect**
40	exercise	**view**

The Reflective Observation scale

31	**passive**	active
37	**reflective**	productive

The above could reflect a response bias in which "logical" (Abstract Conceptualization) words are favoured over "feelings" (Concrete Experience) words, and "active" (Active Experimentation) words are favoured over "passive/reflective" (Reflective Observation) words. The "logical" and "active" words may be perceived to be more socially correct in a learning context. It must also be remembered that the majority of the students are not English first language speakers (see Table 6.1) and may have experienced difficulty with the meanings of some of the words. The words more commonly endorsed may be words they are more familiar with.

The scale intercorrelations for the LSQ are given in Table 7.6. Negative correlations between the AC and CE scales, as well as between the AE and RO scales are in line with the theoretical proposal that these scales are bipolar. The remaining correlations are small.

TABLE 7.5 ITEM ANALYSIS FOR THE LSQ

SCALE	ITEM	N per item	Item mean	Item var.	Item-scale correlation
Abstract Conceptualisation	10	412	3.061	1.217	.41
	15	408	3.706	1.100	.50
	17	410	4.034	0.887	.50
	24	411	3.384	1.555	.66
	26	410	3.734	1.366	.63
	27	413	3.731	1.475	.66
	29	411	3.723	1.276	.52
	34	410	3.471	1.298	.57
	36	408	3.461	1.307	.68
	38	411	3.117	1.621	.52
Concrete Experience	1	410	2.717	1.671	.47
	4	406	2.328	1.619	.63
	5	410	2.098	1.254	.62
	12	409	2.518	1.159	.57
	14	408	2.765	1.601	.47
	18	411	2.241	1.404	.54
	21	408	2.426	1.666	.69
	25	410	2.315	1.299	.66
	28	408	2.517	1.431	.54
	30	412	2.170	1.112	.59
Active Experimentation	6	408	3.811	1.374	.60
	7	406	3.475	1.772	.64
	11	412	3.260	1.352	.54
	13	408	2.904	1.748	.50
	16	407	2.875	1.569	.62
	19	407	3.359	1.473	.54
	23	409	3.814	1.286	.61
	32	407	3.523	1.468	.70
	39	410	3.863	1.142	.44
	40	412	3.595	1.537	.62
Reflective Observation	2	408	2.777	1.913	.66
	3	408	2.645	1.518	.60
	8	409	2.973	1.840	.70
	9	410	2.766	1.823	.72
	20	410	3.054	1.387	.50
	22	411	2.489	1.661	.48
	31	411	2.277	1.359	.60
	33	410	3.027	1.407	.49
	35	409	2.545	1.285	.57
	37	408	2.488	1.186	.55

TABLE 7.6 INTERCORRELATIONS FOR THE SCALES OF THE LSQ

	AC	CE	AE	RO
AC	1.000	-0.424	0.265	0.033
CE	-0.424	1.000	0.077	0.252
AE	0.265	0.077	1.000	-0.521
RO	0.033	0.252	-0.521	1.000

7.2.5 Reliability of the LSQ

The alpha coefficients for the four scales of the LSQ are given in Table 7.7. Marshall and Merritt (1986) reported internal consistency reliabilities based on alpha coefficient for the LSQ as follows: CE = .78, RO = .86, AC = .85, AE = .88. Coefficients in the order of 0.8 are deemed acceptable for clinical use and the LSQ could thus be said to demonstrate sufficient internal consistency for use as a clinical instrument in, for example, career counselling. Internal consistency is only one measure of reliability and the construct validity of the instrument is also important when considering the use of an instrument.

TABLE 7.7 ALPHA COEFFICIENTS FOR THE SCALES OF THE LSQ

	AC	CE	AE	RO
Alpha	0.823	0.801	0.839	0.812

7.3 SECTION 2: INVESTIGATION OF THE INTERACTION OF THE SELF-DIRECTED SEARCH (SDS), THE LEARNING STYLE INVENTORY (LSI) AND THE LEARNING STYLE QUESTIONNAIRE (LSQ) FOR THE BSc AND BA GROUPS

7.3.1 Description of the sample

The analysis sample as described in Chapter 6 consists of first-year university students registered for English courses at the University of Pretoria. The sample is divided into two broad fields of study referred to as BSc and BA. The composition of the analysis sample according to gender and cultural group given in Tables 6.2 and 6.3 is given here again for convenience in Tables 7.8 and 7.9. It will be noted that the N for the analysis sample is less than for the total sample (N = 464) that appears in Table 6.1. The reason for the loss of data is that some subjects either did not complete all the measurement instruments, or only partially completed or incorrectly completed some of the instruments.

TABLE 7.8 COMPOSITION OF THE SAMPLE ACCORDING TO FIELD OF STUDY AND GENDER

GENDER	FIELD OF STUDY		N
	BSc	BA	
Males	66	15	81
Females	66	77	143
TOTAL	132	92	224

Two students in the BSc group did not indicate their gender.

TABLE 7.9 COMPOSITION OF THE SAMPLE ACCORDING TO FIELD OF STUDY AND CULTURAL GROUP

CULTURAL GROUP	FIELD OF STUDY		N
	BSc	BA	
White	60	37	97
African	51	52	103
Coloured	0	1	1
Indian	23	1	24
Asian	0	1	1
TOTAL	134	92	226

7.3.1.1 Analysis of the test characteristics

The arithmetic mean, standard deviation, skewness and kurtosis for each of the 18 variables for the combined sample as well as for the two fields of study (BSc and BA) are given in Tables 7.10 to 7.12. These descriptive statistics are given so that the results that follow can be interpreted within this context.

The codes used for the variables are provided below.

The codes for the SDS questionnaire are as follows:

R - Realistic
I - Investigative
A - Artistic
S - Social
E - Enterprising
C - Conventional

The codes used for the LSI are as follows:

LSI-AC	-	Abstract Conceptualization
LSI-CE	-	Concrete Experience
LSI-AE	-	Active Experimentation
LSI-RO	-	Reflective Observation
LSI-VERT	-	AC-CE
LSI-HOR	-	AE-RO

The codes used for the LSQ are as follows:

LSQ-AC	-	Abstract Conceptualization
LSQ-CE	-	Concrete Experience
LSQ-AE	-	Active Experimentation
LSQ-RO	-	Reflective Observation
LSQ-VERT	-	AC-CE
LSQ-HOR	-	AE-RO

TABLE 7.10 MEANS, STANDARD DEVIATIONS, SKEWNESS AND KURTOSIS FOR THE DISTRIBUTION OF VARIABLES FOR THE COMBINED GROUP

Variable	N	Mean	* SD	Skewness	Kurtosis
R	226	14.70	8.48	0.85	0.37
I	226	28.63	8.54	-0.40	-0.47
A	226	20.59	10.83	0.39	-0.74
S	226	29.77	8.78	-0.31	-0.43
E	226	21.73	8.73	0.17	-0.43
C	226	15.83	6.64	0.69	0.21
LSI-AC	226	46.35	6.69	-0.33	0.06
LSI-CE	226	42.22	6.41	-0.13	0.01
LSI-AE	226	50.03	5.86	-0.40	-0.09
LSI-RO	226	46.28	5.90	-0.36	0.18
LSI-VERT	226	4.14	8.00	-0.05	0.88
LSI-HOR	226	3.75	7.43	0.61	0.77
LSQ-AC	226	35.92	6.65	-0.55	0.60
LSQ-CE	226	24.06	7.06	0.60	0.26
LSQ-AE	226	35.02	7.82	-0.32	-0.50
LSQ-RO	226	27.04	7.98	0.18	-0.43
LSQ-VERT	226	11.86	12.38	-0.42	0.37
LSQ-HOR	226	7.97	14.50	-0.27	-0.19

* Standard deviation

TABLE 7.11 MEANS, STANDARD DEVIATIONS, SKEWNESS AND KURTOSIS FOR THE DISTRIBUTION OF VARIABLES FOR THE BSc GROUP

Variable	N	Mean	* SD	Skewness	Kurtosis
R	134	16.90	9.14	0.63	-0.13
I	134	33.04	5.81	-0.25	-0.07
A	134	17.65	10.18	0.69	-0.27
S	134	26.45	7.89	-0.23	-0.48
E	134	20.92	8.34	0.16	-0.36
C	134	14.65	6.14	0.79	0.67
LSI-AC	134	48.27	5.60	-0.26	-0.16
LSI-CE	134	41.78	6.38	-0.16	-0.35
LSI-AE	134	50.49	5.71	-0.48	0.07
LSI-RO	134	46.22	6.27	-0.41	0.09
LSI-VERT	134	6.49	7.44	-0.09	1.19
LSI-HOR	134	4.28	8.20	0.59	0.52
LSQ-AC	134	37.38	6.30	-0.97	1.71
LSQ-CE	134	22.58	6.77	0.56	0.12
LSQ-AE	134	35.55	7.59	-0.20	-0.81
LSQ-RO	134	26.37	8.14	0.22	-0.70
LSQ-VERT	134	14.80	11.86	-0.57	0.36
LSQ-HOR	134	9.19	14.66	-0.17	0.73

* Standard deviation

TABLE 7.12 MEANS, STANDARD DEVIATIONS, SKEWNESS AND KURTOSIS FOR THE DISTRIBUTION OF VARIABLES FOR THE BA GROUP

Variable	N	Mean	* SD	Skewness	Kurtosis
R	92	11.51	6.21	0.67	-0.38
I	92	22.22	7.80	0.25	-0.40
A	92	24.88	10.35	0.09	-0.81
S	92	34.61	7.73	-0.81	0.83
E	92	22.91	9.19	0.13	-0.53
C	92	17.55	7.00	0.51	-0.18
LSI-AC	92	43.57	7.17	-0.01	0.09
LSI-CE	92	42.85	6.44	-0.11	0.57
LSI-AE	92	49.36	6.05	-0.27	-0.19
LSI-RO	92	46.38	5.37	-0.21	0.25
LSI-VERT	92	0.72	7.50	0.05	1.57
LSI-HOR	92	2.98	6.10	0.31	0.13
LSQ-AC	92	33.80	6.61	-0.05	0.60
LSQ-CE	92	26.22	6.95	0.74	0.32
LSQ-AE	92	34.24	8.11	-0.43	-0.26
LSQ-RO	92	28.03	7.67	0.17	0.13
LSQ-VERT	92	7.59	11.92	-0.31	1.07
LSQ-HOR	92	6.21	14.16	-0.48	0.63

* Standard deviation

7.3.1.2 Discussion of the test characteristics: means, standard deviations, skewness and kurtosis

The coefficient of skewness = 0 for perfectly symmetrical curves, such as the normal distribution (Spiegel, 1988). The coefficient of kurtosis = 3, but "*kurtosis is sometimes defined by (b_2 - 3), which is positive for a leptokurtic distribution, negative for a platykurtic distribution, and zero for the normal distribution.*" (Spiegel, 1988, p. 112). Steyn, Smit and du Toit (1984) define the coefficient of kurtosis as follows:

$b_2 = 0$ *Normal kurtosis*
$b_2 < 0$ *Negative kurtosis*
$b_2 > 0$ *Positive kurtosis*

The Univariate Procedure statistical package (SAS Institute Inc., 1990) used to calculate the kurtosis equates the coefficient of kurtosis with zero for a normal distribution. Given that for a normal distribution the coefficient of skewness = 0 and the coefficient of kurtosis = 0, the following conclusions can be drawn from Tables 7.10 to 7.12.

Skewness and kurtosis

For the combined sample the distributions for some of the variables such as R, C, LSI-HOR, and LSQ-CE are positively skewed indicating that more students obtained scores in the low range on these variables. For the BSc group the distributions for some variables such as R, A, C, LSI-HOR and LSQ-CE are positively skewed. The distributions for other variables such as LSQ-AC and LSQ-VERT are negatively skewed indicating that more students in this group obtained scores in the high range on these variables. These tendencies are in line with theoretical expectations for the BSc group. For the BA group the distributions for variables such as R and LSQ-CE are positively skewed and the distribution for the variable S is negatively skewed. Theoretically one would expect LSQ-CE scores for this group to be in the high score range and not the low score range as is the case here. Otherwise the tendencies are in line with theoretical expectations for this group.

Kurtosis indicates the degree of peakedness of a distribution relative to a normal distribution. A negative coefficient indicates a distribution which is flat-topped and

a positive coefficient indicates a distribution with a high peak.

7.3.3 HOTELLING'S T test

Hotelling's T test was applied to the BSc and BA groups to test the following hypothesis:

Ho2: The Bsc and BA groups have equal vector of means for all dependent variables.

Hi2: The Bsc and BA groups do not have equal vector of means for all dependent variables.

The results are given in Table 7.13.

TABLE 7.13 HOTELLING'S T TEST FOR THE BSc AND BA GROUPS

Hotelling T square	267.93
F value	18.03
Degrees of freedom	14, 211
Critical value	1.75 at the 5% level of significance

The alternate hypothesis as stated above was accepted and *post-hoc* pair comparisons of the means for the BSc and BA groups was carried out (Hays, 1994). The results are reported in Table 7.14 on the following page.

Post hoc pair comparison of the means for the two groups indicated that the BSc group obtained significantly higher means than the BA group for the following variables: R, I, LSI-AC and LSQ-AC. The BA group obtained significantly higher means for the following variables: A, S, C and LSQ-CE.

These results indicate that the BSc and BA groups differ according to certain vocational personality and learning ability characteristics.

The BSc group is characterized by Realistic and Investigative personality characteristics and by the Abstract Conceptualization learning ability. They are thus inclined to be more practically inclined and to prefer a logical, analytical orientation. They are more "thinking" oriented than "feeling" oriented.

The BA group on the other hand is characterized by Artistic, Social and Conventional personality characteristics and by the Concrete Experience learning ability. They are thus inclined to be more "feeling" and people oriented than "thinking" oriented.

TABLE 7.14 POST HOC: t TEST RESULTS FOR THE BSc AND BA GROUPS

	BSc		BA		
VARIABLE	**MEAN**	**SD §**	**MEAN**	**SD §**	**t VALUE**
R	16.90	9.14	11.51	6.21	5.27**
I	33.04	5.81	22.22	7.80	11.32**
A	17.65	10.18	24.88	10.35	-5.19**
S	26.45	7.89	34.61	7.73	-7.73**
E	20.92	8.34	22.91	9.19	-1.66
C	14.65	6.14	17.55	7.00	-3.22*
LSI-AC	48.27	5.60	43.56	7.17	5.28**
LSI-CE	41.78	6.38	42.85	6.44	-1.23
LSI-AE	50.49	5.71	49.36	6.05	1.42
LSI-RO	46.22	6.27	46.38	5.37	-0.21
LSQ-AC	37.38	6.30	33.80	6.61	4.07**
LSQ-CE	22.58	6.77	26.22	6.95	-3.90**
LSQ-AE	35.55	7.59	34.24	8.11	1.23
LSQ-RO	26.37	8.14	28.03	7.67	-1.57

§ Standard deviation

* $p \leq 0.01$

** $p \leq 0.001$

7.3.4 DISCRIMINANT ANALYSIS

As described in Chapter 6 group membership for each subject was determined using discriminant analysis. The results of the discriminant analysis are reported as follows:

- Firstly the classification function is given in table form;
- This is followed by the F-test to indicate differences between fields of study;
- Lastly, the classification matrix in which the percentage subjects correctly and incorrectly classified is given.

The above steps were performed using the variables of the SDS, LSI and LSQ for the combined sample consisting of the BSc and BA groups.

After each presentation of discriminant analysis results for a specific instrument, the results are discussed in an attempt to answer the hypotheses posed in Chapter 6 regarding the relationships between students' field of study, personality type and learning ability type. A summary of the findings appears at the end of the chapter.

TABLE 7.15 DISCRIMINANT ANALYSIS OF THE COMBINED BSc AND BA GROUP WITH THE SDS AS VARIABLE: Classification function, F-Matrix and Classification matrix.

Classification function

VARIABLE	F-VALUE	CLASSIFICATION FUNCTIONS	
		BSc	BA
I	142.53	0.71	0.45
S	42.90	0.28	0.42
A	6.82	0.08	0.14
C	4.16	0.14	0.23
E	5.62	0.16	0.10
Constant		- 19.60	- 17.76

F-Matrix

GROUP	BSc
BA	48.45

Degrees of freedom = 5 ; 220

Critical value 2.21 at the 5% level of significance

Classification matrix

GROUP	PERCENT CORRECT	NUMBER OF CASES CLASSIFIED INTO GROUP	
		BSc	BA
BSc	87.3	117	17
BA	79.3	19	73
TOTAL	84.1	136	90

In terms of Table 7.15 the following deductions can be made:

The discriminant analysis indicates that five of the six Holland personality types (I S A C E) make a significant contribution in distinguishing between the two fields of study (BSc and BA). The five variables correctly classified 87.3% of the BSc students and 79.3% of the BA students. The null hypothesis is thus rejected as a result of the discriminant analysis:

Ho3: It is not possible to discriminate between fields of study using personality type as measured by the SDS.

The alternate hypothesis is accepted:

Hi3: It is possible to discriminate between fields of study using personality type as measured by the SDS.

TABLE 7.16 DISCRIMINANT ANALYSIS OF THE COMBINED BSc AND BA GROUP WITH THE LSI AS VARIABLE: Classification function, F-Matrix and Classification matrix.

Classification function

VARIABLE	F-VALUE	CLASSIFICATION FUNCTIONS	
		BSc	BA
LSI-AC	30.53	1.00	0.86
LSI-CE	8.30	0.72	0.79
Constant		- 39.74	- 36.19

F-Matrix

GROUP	BSc
BA	19.91

Degrees of freedom = 2 ; 223

Critical value 3.00 at the 5% level of significance

Classification matrix

GROUP	PERCENT CORRECT	NUMBER OF CASES CLASSIFIED INTO GROUP	
		BSc	BA
BSc	67.2	90	44
BA	68.5	29	63
TOTAL	67.7	119	107

In terms of Table 7.16 the following deductions can be made:

The discriminant analysis indicates that two of the four learning abilities of the LSI (AC and CE) make a significant contribution in distinguishing between the two fields of study (BSc and BA). The two variables correctly classified 67.2% of the BSc students and 68.5% of the BA students. The null hypothesis is thus rejected as a result of discriminant analysis:

Ho4: It is not possible to discriminate between fields of study using learning abilities as measured by the LSI.

The alternate hypothesis is accepted:

Hi4: It is possible to discriminate between fields of study using learning abilities as measured by the LSI.

Klecka (1980) stated that within two groups one can expect to get 50% of the predictions correct by pure random assignment. Therefore although the correct predictions in the high sixty percent range of the discriminant function are statistically significant, for practical purposes they are not a large improvement on random assignment. It would thus not be recommended to use the LSI for selection or career guidance purposes.

TABLE 7.17 DISCRIMINANT ANALYSIS OF THE COMBINED BSc AND BA GROUP WITH THE LSQ AS VARIABLE: Classification function, F-Matrix and Classification matrix.

Classification function

VARIABLE	F-VALUE	CLASSIFICATION FUNCTIONS	
		BSc	BA
LSQ-AC	16.89	0.91	0.82
Constant		- 17.61	- 14.53

F-Matrix

GROUP	BSc
BA	16.89

Degrees of freedom = 1 ; 224

Critical value 3.84 at the 5% level of significance

Classification matrix

GROUP	PERCENT CORRECT	NUMBER OF CASES CLASSIFIED INTO GROUP	
		BSc	BA
BSc	65.7	88	46
BA	63.0	34	58
TOTAL	64.6	122	104

In terms of Table 7.17 the following deductions can be made:

Of the four learning abilities of the LSQ, only the AC variable was able to discriminate meaningfully between the BSc and BA groups. The AC-scale correctly classified 65.7% of the BSc students and 63% of the BA students.

The null hypothesis is thus rejected as a result of discriminant analysis:

Ho5: It is not possible to discriminate between fields of study using learning abilities as measured by the LSQ.

The alternate hypothesis is accepted:

Hi5: It is possible to discriminate between fields of study using learning abilities as measured by the LSQ.

As was stated in the case of the LSI, in practical terms correct predictions in the sixty

percent range are a small improvement on random assignment and it is recommended that the LSQ not be used for selection or career counselling purposes.

TABLE 7.18 DISCRIMINANT ANALYSIS OF THE COMBINED BSc AND BA GROUP WITH THE SDS, LSI AND LSQ AS VARIABLES: Classification function, F-Matrix and Classification matrix.

Classification function

VARIABLE	F-VALUE	CLASSIFICATION FUNCTIONS	
		BSc	BA
I	142.53	0.45	0.20
S	42.90	0.25	0.38
A	6.82	0.01	0.08
LSI-AC	6.64	1.02	0.94
C	4.49	0.12	0.21
E	4.46	0.09	0.04
Constant		- 37.98	- 33.36

F-Matrix

GROUP	BSc
BA	42.22

Degrees of freedom = 6 ; 219

Critical value 2.10 at the 5% level of significance.

Classification matrix

GROUP	PERCENT CORRECT	NUMBER OF CASES CLASSIFIED INTO GROUP	
		BSc	BA
BSc	87.3	117	17
BA	81.5	17	75
TOTAL	85.0	134	92

In terms of Table 7.18 the following deductions can be made:

The discriminant analysis indicates that five of the six Holland personality types (I S A C E) and one of the learning abilities of the LSI (AC) make a significant contribution in distinguishing between the two fields of study (BSc and BA). The six variables correctly classified 87.3% of the BSc students and 81.5% of the BA students. The learning abilities as measured by the LSQ did not contribute to the discriminant function. The null hypothesis is thus partially rejected as a result of the discriminant analysis:

Ho6: It is not possible to discriminate between fields of study using personality type as measured by the SDS together with learning ability as measured by the LSI and LSQ.

The alternate hypothesis is partially accepted:

Hi6: It is possible to discriminate between fields of study using personality type as measured by the SDS together with learning ability as measured by the LSI and LSQ.

It will be noted that the results in Table 7.18 are a very minor improvement over the results of Table 7.15. The two learning styles inventories do not make much of a contribution in discriminating between the two groups whereas personality type as measured by the SDS succeeds in discriminating between the two groups.

7.3.5 FACTOR ANALYSIS

The principal factor method was used to extract factors followed by a direct quartimin (oblique) rotation of factors. This procedure was applied to the combined BSc and BA group, as well as to the individual BSc and BA groups, using the BMDP4M factor analysis statistical package (BMDP Statistical Software Inc., 1993). The oblique rotated factor loadings that were obtained for the three groups are given in Tables 7.19 to 7.21. Factors with eigenvalues greater than 1.00 were interpreted. Factor loadings greater than 0.3 were used in the interpretation of factors (Child, 1990). An interpretation of the factor matrix is given after each table.

TABLE 7.19 FACTOR ANALYSIS OF THE COMBINED BSc AND BA GROUP

Oblique rotated factor loadings on all the variables

VARIABLE	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
R	-0.031	-0.068	0.114	-0.006	**0.638**
I	0.196	0.057	-0.111	0.217	**0.329**
A	-0.145	0.069	0.283	0.073	-0.182
S	0.015	-0.119	**0.455**	0.102	**-0.575**
E	-0.039	-0.112	**0.953**	-0.127	**0.307**
C	0.073	0.033	**0.387**	0.049	-0.066
LSI-AC	**0.353**	0.057	0.122	**0.476**	0.229
LSI-CE	**-0.300**	-0.136	0.121	**0.652**	-0.046
LSI-AE	0.045	**-0.423**	-0.081	**0.561**	0.007
LSI-RO	0.185	**0.354**	-0.035	**0.426**	-0.074
LSQ-AC	**1.039**	-0.017	0.058	-0.045	-0.097
LSQ-CE	**-0.623**	0.161	0.020	0.050	-0.079
LSQ-AE	0.154	**-0.722**	0.048	0.093	-0.042
LSQ-RO	-0.040	**0.926**	0.015	-0.019	-0.057
EIGENVALUE	1.812	1.771	1.414	1.242	1.058

Five factors are interpreted for the factor matrix for the combined group.

The **first factor** is a bipolar factor representing the vertical axis (AC versus CE) of the two learning style measures (LSI and LSQ) and the **second factor** is a bipolar factor representing the horizontal axis (RO versus AE) of the two learning style measures. The bipolar learning dimensions as theorized by Kolb (see Figure 4.1) are confirmed for the two normative measures of learning style used in this study.

The **third factor** is a group factor consisting of the Holland personality pattern ESC and is interpreted to represent a people-oriented factor. The Enterprising component of the factor is the strongest and this would seem to indicate that this factor represents a group of students who are extroverted, gregarious, assertive and venturesome. The Enterprising personality type tends to be characterized by tough mindedness, rather than empathy. (See 5.2.1).

The **fourth factor** is a group or mixed factor consisting of the four learning abilities (CE AE AC RO) as measured by the LSI. This could possibly reflect a diversity of learning abilities in the combined BSc and BA group.

The **fifth factor** is a bipolar factor consisting of the Holland personality pattern REI versus S. This factor would appear to differentiate between two groups of students who differ in the way in which they are people-oriented. Students who are characterized by the R and I personality types tend to be people-oriented in an Enterprising way versus students who are people-oriented in a Social way. As was stated above, the Enterprising type is typically more tough minded, whereas the Social type is more empathic. The REI grouping represents an occupational code similar to the occupational codes (RIE or IRE) usually assigned to engineering, technology, science and biological sciences occupations (Taljaard & von Mollendorf, 1987). This factor is interpreted to represent the BSc versus the BA components of this composite group.

The five factors extracted for the combined BSc and BA group can be summarized as follows:

- two bipolar factors confirm the bipolar learning dimensions (AC versus CE) and (RO versus AE) theorized by Kolb for the two measures of learning styles;

- one group factor represents a diversity of learning abilities in the group and consists of all the learning abilities as measured by the LSI;

- one group factor represents a people-oriented personality pattern ESC with strong Enterprising characteristics;

- one bipolar factor represents two opposite personality patterns (REI versus S): one personality pattern with practical, scientific and enterprising characteristics possibly representing the BSc group; and another personality pattern with social, empathic and caring characteristics, possibly representing the BA group.

None of the factors represent an interaction between vocational personality and learning ability and thus do not contribute to the validation of the integrated model proposed in Chapter 5.

TABLE 7.20 FACTOR ANALYSIS OF THE BSc GROUP

Oblique rotated factor loadings on all the variables

VARIABLE	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
R	-0.179	0.031	**0.319**	-0.166
I	0.027	0.213	-0.029	0.038
A	0.151	-0.075	0.248	0.052
S	-0.064	0.010	0.272	0.203
E	-0.181	-0.028	**0.973**	-0.111
C	0.046	0.059	**0.373**	0.041
LSI-AC	0.129	**0.616**	0.267	0.206
LSI-CE	-0.132	-0.079	0.054	**0.966**
LSI-AE	**-0.452**	0.080	-0.036	**0.349**
LSI-RO	**0.436**	0.290	-0.066	0.119
LSQ-AC	-0.006	**0.812**	0.001	-0.269
LSQ-CE	0.187	**-0.800**	0.017	0.100
LSQ-AE	**-0.792**	-0.031	0.016	0.026
LSQ-RO	**0.924**	-0.088	-0.047	-0.123
EIGENVALUE	2.039	1.839	1.407	1.295

Interpretation of the factor matrix for the BSc group

Four factors are interpreted for the factor matrix for the BSc group.

The **first factor** is a bipolar factor representing the horizontal axis (RO versus AE) of the two learning style measures (LSI and LSQ). The **second factor** is a bipolar factor representing the vertical axis (CE versus AC) for the LSQ. However, whereas the AC

dimension of the LSI is included in this factor, LSI-CE is not included. The bipolar learning dimensions as theorized by Kolb (see Figure 4.1) are confirmed for the LSQ and partially confirmed for the LSI for this group. (Only the RO-AE bipolar dimension for the LSI is confirmed for this group.)

The **third factor** is a group factor consisting of the Holland personality pattern ECR. The Enterprising type forms the strongest component of this factor and would appear to represent a people-oriented group of students who are extroverted, gregarious, assertive and venturesome. The Enterprising personality type tends to be characterized by tough mindedness, rather than empathy. (See 5.2.1). Theoretically one would expect an Investigative component (see Table 3.1a), rather than the strong Enterprising component, in a factor from the BSc group. However, the C and R elements in the factor (see Tables 3.1a and 3.1b) represent preferences for the manipulation of data, as well as mechanically, agriculturally and technically related activities. These preferences are in line with preferences associated with the BSc group.

The **fourth factor** consists of the CE and AE dimensions of the LSI possibly representing an Accommodator learning style (see Tables 4.3 and 4.4b). An Accommodator's greatest strengths lie in doing things, carrying out plans and tasks, and getting involved with new experiences. The people-oriented, extrovert AE dimension corresponds to the Enterprising component of the third factor described above. Theoretically one would expect a Converger learning style (see Table 4.3) for the BSc group. A Converger learning style emphasizes problem solving and the practical application of ideas, and is associated with technology careers (see Table 4.4a). The Accommodator learning style represented by this factor is associated with careers in marketing and sales (see Table 4.4b).

The four factors extracted for the BSc group can be summarized as follows:

- one bipolar factor confirms the RO versus AE bipolar learning dimension theorized by Kolb for the two measures of learning style;

- one bipolar factor confirms the CE versus AC bipolar learning dimension theorized by Kolb for the LSQ;

- one group factor represents a people-oriented personality pattern ECR with strong Enterprising characteristics, but also includes Conventional and Realistic components;

- one group factor consists of the CE and AE learning abilities as measured by the LSI and is seen to represent the Accommodator learning style.

None of the factors represent an interaction between vocational personality and learning ability and thus do not contribute to the validation of the integrated model proposed in Chapter 5.

TABLE 7.21 FACTOR ANALYSIS OF THE BA GROUP

Oblique rotated factor loadings on all the variables

VARIABLE	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
R	-0.003	-0.165	0.002	-0.037
I	**0.346**	0.098	0.105	-0.027
A	0.022	0.015	-0.114	0.274
S	0.079	0.019	-0.041	**0.624**
E	-0.215	-0.091	-0.010	**0.756**
C	0.011	0.033	0.136	**0.347**
LSI-AC	**0.658**	-0.103	0.100	0.085
LSI-CE	**0.483**	-0.091	**-0.331**	**0.301**
LSI-AE	**0.727**	**-0.452**	-0.074	-0.050
LSI-RO	**0.632**	0.101	0.009	-0.074
LSQ-AC	**0.312**	0.023	**0.911**	0.100
LSQ-CE	0.034	0.159	**-0.580**	0.042
LSQ-AE	0.195	**-0.575**	0.163	0.220
LSQ-RO	0.156	**0.989**	-0.053	-0.067
EIGENVALUE	1.928	1.615	1.365	1.328

Interpretation of the factor matrix for the BA group

Four factors are interpreted for the factor matrix for the BA group.

The **first factor** consists of the four learning abilities (AE AC RO CE) as measured by the LSI, as well as the I personality type and the AC learning ability as measured by the LSQ. This factor is similar to the fourth factor for the combined BSc and BA

group (see Table 7.19) and could indicate that the BA group is more diverse in learning ability attributes than the BSc group. For the BA group this factor has an logical, analytical, thinking component represented by the I personality type and the AC learning ability as measured by the LSQ (see Tables 3.1a and 4.2). Theoretically one would not associate the Investigative personality type or the AC learning ability with the BA group. One would expect people-oriented characteristics as represented by the Social and Enterprising personality types and the CE and AE learning abilities (see Tables 3.1b and 4.2).

The **second factor** is a bipolar factor representing the horizontal axis (RO versus AE) for the LSQ. However, whereas the AE dimension of the LSI is included in this factor, LSI-RO is not included. The **third factor** is a bipolar factor representing the vertical axis (AC versus CE) for the LSQ. However, whereas the CE dimension of the LSI is included in this factor, the LSI-CE is not included. The bipolar learning dimensions as theorized by Kolb (see Figure 4.1) are confirmed for the LSQ and partially confirmed for the LSI for this group.

The **fourth factor** is a group factor consisting of the Holland personality pattern ESC, as well as the CE learning ability of the LSI. It is interpreted to represent a people-oriented factor similar to the third factor for the combined BSc and BA group (see Table 7.19 and the discussion which follows). The CE learning ability focuses on being involved in experiences and dealing with immediate human situations in a personal way (see Table 4.2). It thus complements the people-oriented interpretation of this factor.

The four factors extracted for the BA group can be summarized as follows:

- one group factor represents all the learning styles as measured by the LSI, all associated with the Investigative personality type as well as the AC learning ability as measured by the LSQ;
- one bipolar factor confirms the RO versus AE bipolar learning dimension theorized by Kolb for the LSQ;
- one bipolar factor confirms the AC versus CE bipolar learning dimension theorized

by Kolb for the LSQ;

- one general factor represents a people-oriented personality pattern ESC associated with the CE learning ability as measured by the LSI.

Two factors in the factor matrix for the BA group represent an interaction between vocational personality and learning ability. The first factor associates the Investigative personality type with a diversity of learning abilities and therefore does not contribute to the validation of the integrated model proposed in Chapter 5. The fourth factor associates a people-oriented personality pattern (ESC) with the CE learning ability. In the integrated model proposed in Chapter 5 (see 5.3 and Figure 5.1) the Enterprising personality type is associated with the Accommodator learning style which includes the CE learning ability. The Social personality type is strongly associated with the CE learning ability. The fourth factor of the factor matrix for the BA group thus confirms this aspect of the integrated model.

Comparison of the three factor matrices for the combined BSc and BA group, the BSc group and the BA group

The bipolar CE versus AC learning dimension theorized by Kolb (see Figure 4.1) was confirmed for the LSQ by bipolar factors in all three the matrices (see Tables 7.19 to 7.21). This dimension was confirmed for the LSI by a bipolar factor only for the combined BSc and BA group (see Table 7.19).

The bipolar RO versus AE learning dimension theorized by Kolb (see Figure 4.1) was confirmed for the LSQ by bipolar factors in all three the matrices (see Tables 7.19 to 7.21). This dimension was confirmed for the LSI by a bipolar factor for the combined BSc and BA group, and for the BSc group, but not for the BA group (see Tables 7.19 to 7.21).

Geiger *et al.* (1993) reported that principal factor analysis with varimax rotation procedures applied to the items of the normative version of Kolb's LSI-1985 (also used in this study) did not yield any bipolar dimensions, but strong support was obtained for the four separate learning abilities. Scale scores were used in the factor analysis of this study. Marshall and Merritt (1986), the authors of the LSQ used in this study, reported that least squares factor analysis with varimax rotation performed

on the items of the LSQ yielded two bipolar factors representing the two learning dimensions and four learning abilities as theorized by Kolb. Studies (other than those referred to in this paragraph) reported on in section 4.2.3 used the LSI-1976 and the LSI-1985 which are ipsative measures. When factor analysis was done in these studies ipsative data was treated normatively and it is felt that it is inappropriate to compare such results with the results of the normative instruments of this study.

Two group factors representing personality patterns emerged. For the combined BSc and BA group a factor representing an ESC personality pattern emerged (see Table 7.19). This factor is similar to the fourth factor for the BA group which also includes the CE learning ability (see Table 7.21). For the BSc group a factor representing an ERC personality pattern emerged (see Table 7.20). In all cases the Enterprising personality type constituted a strong component of the factor. These factors are discussed above in the interpretation section following the relevant factor matrix.

A bipolar factor representing the personality patterns REI versus S emerged for the combined BSc and BA group (see Table 7.20). This factor is discussed above in the interpretation section following Table 7.20.

Two group factors combining learning abilities emerged. For the combined BSc and BA group a mixed factor consisting of all four the learning abilities (CE AE AC RO) as measured by the LSI emerged (see Table 7.19). This is similar to the first factor for the BA group which also includes the Investigative personality type and the LSQ-AC learning ability (see Table 7.21). For the BSc group a factor combining the CE and AE learning abilities emerged (see Table 7.20) and this was interpreted to represent the Accommodator learning style. These factors are discussed above in the interpretation section following the relevant factor matrix.

This empirical study anticipated an interaction between vocational personality type and learning ability. The results of the factor analysis do not provide strong support for such an interaction. Only two factors in the factor matrix for the BA group (see Table 7.21) represent such an interaction. The first factor associates a diversity of learning abilities with the Investigative personality type. The fourth factor associates a people-oriented personality pattern ESC with the CE learning ability as measured by the LSI. These factors are discussed above in the interpretation section following Table 7.21.

7.3.6 INTERCORRELATIONS FOR HOLLAND PERSONALITY TYPES AND KOLB LEARNING ABILITIES

The Spearman correlation coefficients for Holland personality types as measured by the SDS and Kolb learning abilities as measured by the LSI and the LSQ for the BSc and BA groups are given in Tables 7.22 to 7.25. The correlations in all cases are small and are of the order of those reported by Highhouse and Doverspike (1987) (see Table 5.1).

In the case of the BSc group with the LSI as measurement instrument (see Table 7.22) the CE scale was significantly correlated with the Social scale. The RO scale was significantly negatively correlated with the Enterprising scale, and the AC scale was significantly correlated with the Artistic, Investigative and Enterprising scales. With the LSQ as measurement instrument (see Table 7.24) the RO scale was significantly negatively correlated with the Enterprising and Realistic scales, and the AE scale was significantly correlated with the Enterprising scale.

In the case of the BA group with the LSI as measurement instrument (see Table 7.23) the CE scale was significantly correlated with the Artistic and Enterprising scales. Both the AC and AE scales were significantly correlated with the Investigative scale. With the LSQ as measurement instrument (see Table 7.25) the AC scale was significantly correlated with the Investigative scale and the AE scale was significantly correlated with the Enterprising scale.

The significant intercorrelations reported here and their relationship with the proposed integrated model (see Chapter 5) are discussed in section 7.5.

7.3.7 FREQUENCY DISTRIBUTIONS OF HOLLAND PERSONALITY TYPES AND KOLB LEARNING STYLES

In SECTION 2 where the results of the investigation into the interaction of the SDS, LSI and LSQ are reported, only the four scales of **learning abilities** (CE, RO, AC, AE) were used in the various procedures. It was decided to look at the frequency distribution of personality types and **learning style** types for the LSI and LSQ, for the two fields of study.

TABLE 7.22 INTERCORRELATIONS FOR HOLLAND PERSONALITY TYPES AND KOLB LEARNING ABILITIES AS MEASURED BY THE LSI FOR THE BSc GROUP

	CE	RO	AC	AE
Realistic	- 0.07	- 0.11	0.04	0.11
Investigative	0.07	0.10	0.21*	0.01
Artistic	0.08	- 0.01	0.25**	- 0.08
Social	0.27**	- 0.00	0.11	0.15
Enterprising	0.10	- 0.21*	0.18*	0.12
Conventional	0.10	0.07	0.06	0.12

* $p \leq .05$

** $p \leq .01$

TABLE 7.23 INTERCORRELATIONS FOR HOLLAND PERSONALITY TYPES AND KOLB LEARNING ABILITIES AS MEASURED BY THE LSI FOR THE BA GROUP

	CE	RO	AC	AE
Realistic	- 0.06	0.11	0.04	0.03
Investigative	- 0.07	0.04	0.26**	0.27**
Artistic	0.27**	- 0.04	0.05	- 0.00
Social	0.18	0.06	0.03	0.12
Enterprising	0.21*	- 0.08	0.02	0.01
Conventional	0.12	0.00	0.14	0.06

* $p \leq .05$

** $p \leq .01$

TABLE 7.24 INTERCORRELATIONS FOR HOLLAND PERSONALITY TYPES AND KOLB LEARNING ABILITIES AS MEASURED BY THE LSQ FOR THE BSc GROUP

	CE	RO	AC	AE
Realistic	- 0.05	- 0.19*	- 0.02	0.04
Investigative	- 0.08	- 0.01	0.11	0.00
Artistic	0.16	0.06	- 0.13	- 0.05
Social	- 0.01	- 0.13	0.01	0.14
Enterprising	- 0.05	- 0.30**	- 0.01	0.23**
Conventional	- 0.04	- 0.02	0.05	0.04

* $p \leq .05$

** $p \leq .01$

TABLE 7.25 INTERCORRELATIONS FOR HOLLAND PERSONALITY TYPES AND KOLB LEARNING ABILITIES AS MEASURED BY THE LSQ FOR THE BA GROUP

	CE	RO	AC	AE
Realistic	- 0.04	- 0.16	- 0.01	0.19
Investigative	- 0.15	0.07	0.25*	0.10
Artistic	0.10	0.04	- 0.09	0.09
Social	0.07	- 0.06	0.06	0.19
Enterprising	0.06	- 0.19	- 0.10	0.22*
Conventional	- 0.12	- 0.06	0.13	0.05

* $p \leq .05$

The method of allocating a learning style to a subject is described in section 6.3.2. Due to the method used a subject could be allocated two learning styles and therefore the totals reflected in Tables 7.26 to 7.29 differ somewhat from the totals for the analysis sample (see Tables 6.1, 7.8 and 7.9)

The frequencies of Holland personality types as measured by the SDS and Kolb learning style types as measured by the LSI and the LSQ for the BSc and BA groups were calculated using the FREQ procedure of the SAS statistical package (SAS Institute Inc., 1990) and the results are reported in Tables 7.26 to 7.29. Due to the low frequencies in most cells a Chi-square test was deemed to be invalid and a test for significance cannot be reported. The results thus cannot be interpreted, but patterns in the results will be commented on.

For the BSc group, for both the LSI (see Table 7.26) and the LSQ (see Table 7.28) data, a similar pattern emerged. The most frequent personality type was the Investigative type (LSI 63%, LSQ 65%), followed by the Social personality type (LSI 22%, LSQ 21%). Only small numbers of the remaining personality types occurred. Investigative personality types tended to be associated most frequently with the Converger learning style, followed by the Assimilator learning style. The Social personality type in the BSc group tended to be associated most frequently with the Converger learning style. Theoretically Social types have more in common with the people-oriented Diverger and Accommodator learning styles.

For the BA group, for both the LSI (see Table 7.27) and the LSQ (see Table 7.29), the most common personality type was the Social type (LSI 64%, LSQ 66%). For the LSI all four the learning styles were associated with the Social type. For the LSQ the Social type was most frequently associated with the Converger learning style and to a lesser extent with the Assimilator and Accommodator learning styles. None of the Social types in the BA group had a Diverger learning style and this learning style had the lowest frequency for the LSQ in the BA group.

TABLE 7.26 FREQUENCIES OF HOLLAND PERSONALITY TYPES AND KOLB LEARNING STYLE TYPES AS MEASURED BY THE LSI FOR THE BSc GROUP

Learning style	Self-Directed Search: Holland personality type						
	R	I	A	S	E	C	Σ
Diverger	0	4	0	0	0	0	4 (2.6%)
Assimilator	1	33	5	8	2	0	49 (32.7%)
Converger	4	48	2	18	6	0	78 (52%)
Accommodator	1	10	1	7	0	0	19 (12.7%)
Σ	6 (4%)	95 (63.4%)	8 (5.3%)	33 (22%)	8 (5.3%)	0	150 (100%)

TABLE 7.27 FREQUENCIES OF HOLLAND PERSONALITY TYPES AND KOLB LEARNING STYLE TYPES AS MEASURED BY THE LSI FOR THE BA GROUP

Learning style	Self-Directed Search: Holland personality type						
	R	I	A	S	E	C	Σ
Diverger	0	0	6	10	2	0	18 (15.6%)
Assimilator	1	2	2	14	0	0	19 (16.5%)
Converger	1	8	6	29	2	1	47 (40.9%)
Accommodator	0	1	5	21	4	0	31 (27%)
Σ	2 (1.7%)	11 (9.6%)	19 (16.5%)	74 (64.3%)	8 (7%)	1 (0.9%)	115 (100%)

TABLE 7.28 FREQUENCIES OF HOLLAND PERSONALITY TYPES AND KOLB LEARNING STYLE TYPES AS MEASURED BY THE LSQ FOR THE BSc GROUP

Learning style	Self-Directed Search: Holland personality type						
	R	I	A	S	E	C	Σ
Diverger	0	2	0	2	0	0	4 (2.6%)
Assimilator	2	26	3	8	1	0	40 (26.3%)
Converger	4	66	2	17	7	0	96 (63.2%)
Accommodator	0	4	3	5	0	0	12 (7.9%)
Σ	6 (3.9%)	98 (64.5%)	8 (5.3%)	32 (21%)	8 (5.3%)	0	152 (100%)

TABLE 7.29 FREQUENCIES OF HOLLAND PERSONALITY TYPES AND KOLB LEARNING STYLE TYPES AS MEASURED BY THE LSQ FOR THE BA GROUP

Learning style	Self-Directed Search: Holland personality type						
	R	I	A	S	E	C	Σ
Diverger	0	0	4	0	1	0	5 (4.4%)
Assimilator	0	4	5	19	1	0	29 (25.9%)
Converger	0	6	8	41	4	1	60 (53.6%)
Accommodator	0	1	1	14	2	0	18 (16.1%)
Σ	0	11 (9.8%)	18 (16.1%)	74 (66.1%)	8 (7.1%)	1 (0.9%)	112 (100%)

7.4 CONSTRUCT VALIDITY OF THE LSI AND THE LSQ

7.4.1 Construct validity of the LSI

Post hoc pair comparisons of the means for the BSc and BA groups for the LSI demonstrated that the BSc group obtained a significantly higher mean score for the AC learning ability than did the BA group (see section 7.3.3 and Table 7.14). This is in line with theoretical predictions.

Discriminant analysis of the combined BSc and BA group with the LSI as variable demonstrated that two of the four learning abilities of the LSI, namely AC and CE, were able to distinguish between the two fields of study in a theoretically predicted way (see Table 7.16). This lends some support for the validity of the two learning abilities and the theoretically proposed AC-CE bipolar axis.

Factor analysis for the combined BSc and BA group (see Table 7.19) provided support for the AC-CE and AE-RO bipolar learning dimensions as theorized by Kolb (see Figure 4.1) for the LSI. In the case of factor analysis of the BSc group (see Table 7.20) only the bipolar AE-RO axis appeared as a factor for the LSI. Neither bipolar axes were demonstrated for the LSI by factor analysis for the BA group (see Table 7.21). Only partial support for the bipolar theory was obtained for the LSI. A factor representing a personality pattern combining the ESC personality types with the LSI-CE learning ability emerged for the BA group (see Table 7.21). The two components of this factor are both people-orientated and this lends some support to the validity of the CE learning ability. A factor combining the CE and AE learning types and thus representing the Accommodator learning style emerged for the BSc group (see Table 7.20) and this lends some support to the validity of the Accommodator learning style for the LSI.

Discriminant and factor analysis was done using the four learning **abilities** as variables. It was decided to look at the distribution of learning **styles** to see if a pattern consistent with theoretical predictions occurred. The subsamples used for determining the distribution of learning styles are described in section 7.2.1. The frequency of learning styles as measured by the LSI for the BSc and BA fields of study is given in Table 7.30. The method of allocating a learning style to a subject is

described in section 6.3.2 and accounts for the small discrepancies between the sample sizes reported in Table 6.1 and those reflected in Table 7.30. The Chi-square statistic was calculated and has a value of 27.184 with three degrees of freedom which is significant at the 5% level of significance. There is thus a strong association between field of study and learning style as measured by the LSI. There are more Divergers in the BA group, more Convergers in the BSc group and more Accommodators in the BA group. Assimilators are fairly equally represented in the BSc and BA groups. Except that one would have expected more Assimilators in the BSc group than the BA group, these results are in line with the theoretical descriptions of the learning styles (see Tables 4.3, 4.4a and 4.4b) and thus provide some evidence of validity for the learning style constructs for the LSI.

TABLE 7.30 FREQUENCY OF LEARNING STYLES AS MEASURED BY THE LSI FOR THE BSc AND BA FIELDS OF STUDY

LEARNING STYLE	BSc	BA	TOTAL
Diverger			
Frequency	7	33	40
Column %	3.45%	14.16%	9.17%
Assimilator			
Frequency	56	55	111
Column %	27.59%	23.61%	25.46%
Converger			
Frequency	109	85	194
Column %	53.69%	36.48%	44.50%
Accommodator			
Frequency	31	60	91
Column %	15.27%	25.75%	20.87%
TOTAL	203	233	436
	46.56%	53.44%	100%

The Chi-square has a value of 27.184 with three degrees of freedom which is significant at the 5% level of significance.

7.4.2 Construct validity of the LSQ

Post hoc comparisons of the means for the BSc and BA groups for the LSQ demonstrated that the BSc group obtained a significantly higher mean score for the AC learning ability, whereas the BA group obtained a significantly higher mean score for the CE learning ability (see section 7.3.3 and Table 7.14). This is in line with theoretical predictions.

Discriminant analysis of the combined BSc and BA group with the LSQ as variable demonstrated that only the AC learning ability was able to distinguish between the two fields of study in a theoretically predicted way (see Table 7.17). This lends some support for the validity of the AC learning ability scale.

Factor analysis of the combined BSc and BA groups (see Table 7.19), as well as for the BSc group (see Table 7.20) and the BA group (see Table 7.21), consistently demonstrated both the AC-CE and AE-RO bipolar learning dimensions for the LSQ as theorized by Kolb (see Figure 4.1) providing support for their validity. The only other instance of a LSQ variable contributing to a factor was in the case of the BA group (see Table 7.21) where a group factor emerged combining the four learning abilities of the LSI, the AC learning ability of the LSQ and the Investigative personality type. The combination of the AC learning ability with the Investigative personality type is in accordance with theoretical predictions.

Discriminant and factor analysis was done using the four learning **abilities** as variables. It was decided to look at the distribution of learning **styles** to see if a pattern consistent with theoretical predictions occurred. The sample used for determining the distribution of learning styles is described in section 7.2.1. The frequency of learning styles as measured by the LSQ for the BSc and BA fields of study is given in Table 7.31. The method of allocating a learning style to a subject is described in section 6.3.2 and accounts for the small discrepancies between the sample sizes reported in Table 6.1 and those reflected in Table 7.31. The Chi-square statistic was calculated and has a value of 8.238 with three degrees of freedom which is significant at the 5% level of significance. There is thus an association between field of study and learning style as measured by the LSQ. There are more Accommodators in the BA group than the BSc group. Divergers, Assimilators and Convergers are about equally

represented in the BSc and BA groups. The association of Accommodators with the BA group is in line with the theoretical descriptions of the learning style (see Tables 4.3 and 4.4b) and corresponds with the results for the LSI (see Table 7.30). The differences in distribution of the various learning styles between the two fields of study are less pronounced for the LSQ than for the LSI.

TABLE 7.31 FREQUENCY OF LEARNING STYLES AS MEASURED BY THE LSQ FOR THE BSc AND BA FIELDS OF STUDY

LEARNING STYLE	BSc	BA	TOTAL
Diverger			
Frequency	7	12	19
Column %	3.70%	5.43%	4.63%
Assimilator			
Frequency	45	50	95
Column %	23.81%	22.62%	23.17%
Converger			
Frequency	125	127	252
Column %	66.14%	57.47%	61.46%
Accommodator			
Frequency	12	32	44
Column %	6.35%	14.48%	10.73%
TOTAL	189	221	410
	46.10%	53.90%	100%

The Chi-square has a value of 8.238 with three degrees of freedom which is significant at the 5% level of significance.

7.4.3 Comparison of the LSI and the LSQ

The results of the investigation in this study into the psychometric properties of the LSI and the LSQ would appear to indicate that the internal reliability of the LSQ is somewhat higher than that of the LSI. The alpha coefficients for the learning ability

scales of the LSQ ranged from 0.801 to 0.839 and those for the LSI ranged from 0.717 to 0.799 (see Tables 7.4 and 7.7).

The results of the factor analysis consistently yielded the two bipolar AC-CE and AE-RO learning dimensions as theorized by Kolb (see Figure 4.1) for the LSQ for the combined BSc and BA group (see Table 7.19), the BSc group (see Table 7.20) and the BA group (see Table 7.21). The two bipolar learning dimensions were only demonstrated for the LSI in the combined BSc and BA group (see Table 7.19) and only the AE-RO dimension was demonstrated for the BSc group (see Table 7.20).

Kolb has retained the rank ordering format through two revisions of his Learning Style Inventory because he strongly believes people make choices in learning situations between the four learning abilities and he feels that the instrument should reflect this (see Chapter 4). In this light the semantic differential of the LSQ used in this study retains an element of forcing respondents to make choices while providing a normative rather than an ipsative instrument.

The presence of a response bias on both instruments was suspected (see 7.2.2 and 7.2.4) and this would have to be investigated further.

From the results of this study it would appear that the LSI was more successful than the LSQ in differentiating learning abilities and styles in the sample used.

- Discriminant analysis of the combined BSc and BA group with the LSI as variable indicated that two of the four learning abilities (AC and CE) made a significant contribution in distinguishing between the two fields of study (see Table 7.16), whereas with the LSQ as variable only the AC learning ability made a significant contribution in distinguishing between the two fields of study (see Table 7.17).

- Factor analysis yielded only one factor that could be interpreted as a learning style. The factor, seen to represent the Accommodator learning style, consisted of a combination of the CE and AE learning abilities as measured by the LSI (see Table 7.20).

- Intercorrelations for Holland personality types and Kolb learning abilities as

measured by the LSI yielded more significant correlations than for the LSQ (see Tables 7.22 to 7.25).

- Frequency distributions of Holland personality types and Kolb learning styles demonstrated more differentiated patterns for the LSI than for the LSQ (see Tables 7.30 and 7.31).

It is difficult to make recommendations concerning the use of the LSI and the LSQ on the limited results of this study. The reliability and validity of the instruments should be investigated further. Suffice it to say the instruments show promise for both research and clinical applications.

7.5 SECTION 3: DISCUSSION OF RESULTS PERTAINING TO THE PROPOSED INTEGRATED MODEL OF VOCATIONAL PERSONALITY TYPES, AND LEARNING ABILITIES AND STYLES

The research results of this study relevant to the integrated model proposed in Chapter 5 will be discussed. The integrated model is described in section 5.3 and depicted in Figure 5.1.

The **Investigative** personality type is associated with the **Assimilator** quadrant in Figure 5.1. In the empirical part of this study factor analysis yielded only one factor that combined the Investigative personality type with learning abilities. The factor occurred in the factor matrix for the BA group (see Table 7.21) and consisted of all four the learning abilities (AE AC RO CE) as measured by the LSI, together with the AC learning ability as measured by the LSQ and the Investigative personality type. The association of the Investigative personality type with all four the learning abilities as measured by the LSI does not provide validation for the integrated model. However, the association of the Investigative personality type with the AC learning ability as measured by the LSQ is in line with the integrated model depicted in Figure 5.1.

Intercorrelations for personality types and learning abilities are reported in Tables 7.22 to 7.25. The Investigative personality type was significantly correlated with the AC learning ability for the BSc group with the LSI as measure of learning ability, as well as for the BA group with both the LSI and LSQ as measure of learning ability. This

confirms the association of the Investigative personality type with the AC learning ability as depicted in the integrated model in Figure 5.1. The Investigative type was also significantly correlated with the AE learning ability for the BA group with the LSI as measure of learning ability. This is not in line with the proposed integrated model in Figure 5.1 and this finding is not accommodated by the integrated model.

Frequency distributions of personality types and learning styles are given in Tables 7.26 to 7.29. These results cannot be interpreted, but there was a tendency for the Investigative type to be associated with the Converger and Assimilator learning styles for the BSc group with both the LSI and the LSQ as measure of learning style. The Converger learning style shares the AC learning ability with the Assimilator style. As the Investigative type is associated with the Assimilator learning style and the AC learning ability in the proposed integrated model in Figure 5.1, this result is not seen to disconfirm the model.

The **Artistic** personality type is associated with both the **Diverger** and **Accommodator** learning style quadrants in Figure 5.1. Intercorrelations for personality types and learning abilities are reported in Tables 7.22 to 7.25. The Artistic type was significantly correlated with the AC learning ability for the BSc group with the LSI as measure of learning ability. This result is contrary to the proposed integrated model in Figure 5.1 and is not accommodated by the integrated model. The Artistic type was also significantly correlated with the CE learning ability for the BSc group with the LSI as measure of learning ability. This confirms the association of the Artistic type with the CE learning ability as depicted in the integrated model in Figure 5.1.

The **Social** personality type is associated with both the **Diverger** and **Accommodator** quadrants in Figure 5.1. In the empirical part of this study factor analysis yielded a factor that combined the Social personality type with a learning ability. The factor occurred in the factor matrix for the BA group (see Table 7.21) and consisted of the personality pattern ESC together with the CE learning ability as measured by the LSI. This confirms the association of the Social type with the CE learning ability in the proposed integrated model in Figure 5.1.

Intercorrelations for personality types and learning abilities are reported in Tables 7.22 to 7.25. The Social type was significantly correlated with the CE learning ability for

the BSc group with the LSI as measure of learning ability. This again confirms the association of the Social type with the CE learning ability in the proposed integrated model in Figure 5.1.

Frequency distributions of personality types and learning styles are given in Tables 7.26 to 7.29. These results cannot be interpreted, but there was a tendency for the Social type to be associated with the Converger learning style for the BSc group with both the LSI and the LSQ as measure of learning style. This result is contrary to the proposed integrated model in Figure 5.1 and is not accommodated by the integrated model. The Social type was associated with all four the learning styles for the BA group with the LSI as measure of learning style, and with the Converger, Assimilator and Accommodator learning styles with the LSQ as measure of learning style. This diverse result does not provide validation for the integrated model.

The **Enterprising** personality type is associated most strongly with the **Accommodator** quadrant and to some extent with the **Converger** quadrant in Figure 5.1. In the empirical part of this study factor analysis yielded a factor that combined the Enterprising personality type with a learning ability. The factor occurred in the factor matrix for the BA group (see Table 7.21) and consisted of the personality pattern ESC together with the CE learning ability as measured by the LSI. The Accommodator learning style combines the CE and AE learning abilities. As the Enterprising type is associated with the Accommodator learning style and the CE learning ability in the proposed integrated model in Figure 5.1, this result is not seen to disconfirm the model.

Intercorrelations for personality types and learning abilities are reported in Tables 7.22 to 7.25. The Enterprising type was significantly negatively correlated with the RO learning ability for the BSc group with both the LSI and the LSQ as measure of learning ability. The Enterprising type was significantly correlated with the AE learning ability for both the BSc and BA groups with the LSQ as measure of learning ability. The Enterprising type was significantly correlated with the CE learning ability for the BA group with the LSI as measure of learning ability. All these results are seen to confirm the association of the Enterprising type with the Accommodator learning style in the proposed integrated model in Figure 5.1. The Enterprising type was also significantly correlated with the AC learning ability for the BSc group with the LSI as

measure of learning ability. This result is contrary to the proposed integrated model in Figure 5.1 and is not accommodated by the integrated model.

The **Conventional** personality type is associated with the **Converger** quadrant in Figure 5.1. In the empirical part of this study factor analysis yielded a factor that combined the Conventional personality type with a learning ability. The factor occurred in the factor matrix for the BA group (see Table 7.21) and consisted of the personality pattern ESC together with the CE learning ability as measured by the LSI. The association of the Conventional type with the CE learning ability is not in line with the proposed integrated model in Figure 5.1 and this finding is not accommodated by the model.

The Conventional type showed no significant correlations with any learning ability scales (see Tables 7.22 to 7.29). There is no evidence in this study that confirms the proposed association of the Conventional type with the Converger learning style in the integrated model in Figure 5.1.

The **Realistic** personality type is associated with the **Converger** quadrant in Figure 5.1. Intercorrelations for personality types and learning abilities are reported in Tables 7.22 to 7.25. The Realistic personality type was significantly negatively correlated with the RO learning ability for the BSc group with the LSQ as measure of learning ability. This result is seen to confirm the association of the Realistic type with the AE learning ability in Figure 5.1.

In the findings reported above there are more results confirming the proposed integrated model described in section 5.3 and depicted in Figure 5.1. than disconfirming it. Those results which cannot be accommodated by the model are directly opposed to the arguments used for the theoretical integration of the model (see section 5.3). For example, the Investigative type correlated with the AE learning ability, the Artistic and Enterprising types correlated with the AC learning ability and the Conventional type correlated with the CE learning ability. It was decided not to modify the proposed integrated model in the light of the present research findings. More research is needed to explore the validity of the proposed model.

7.6 SUMMARY

The following is a summary of the results obtained in the investigation.

(i) Evaluation of the psychometric properties of the LSI and LSQ

- Item analysis of the LSI yielded item-scale correlations in the range .29 to .62. Under-utilisation of options 1 and 2 (*Not at all like me* and *Somewhat unlike me*) of the five-point Likert scale could indicate the presence of a response bias favouring socially acceptable responses.

- Intercorrelations for the four learning ability scales (CE RO AC AE) of the LSI are all positive and range from 0.254 to 0.454.

- Alpha coefficients for the four learning ability scales of the LSI range from 0.717 to 0.799.

- The frequency distribution of learning styles for the LSI for the BSc and BA groups demonstrated more Divergers in the BA group, more Convergers in the BSc group and more Accommodators in the BA group. Assimilators are fairly equally represented in the BSc and BA groups.

- Item analysis of the LSQ yielded item-scale correlations in the range .41 to .72. A preference in endorsing words representing the AC and AE scales could indicate the presence of a response bias favouring responses perceived to be more socially correct in a learning context or it could indicate that the subjects, many of whom are not English first language speakers, experienced difficulty in understanding some of the words used in the semantic differential scale.

- Intercorrelations for the four learning ability scales (CE RO AC AE) of the LSQ range from -0.424 to 0.265. Negative correlations were obtained between the AC and CE, as well as between the AE and RO scales.

- Alpha coefficients for the four learning ability scales of the LSQ range from 0.801 to 0.839.

- The frequency distribution of learning styles for the LSQ for the BSc and BA groups demonstrated more Accommodators in the BA group. Divergers, Assimilators and Convergers are about equally represented in the BSc and BA groups.

(ii) Interaction of the SDS, LSI and LSQ

- Post hoc pair comparisons of the means for the BSc and BA groups indicated that the BSc group obtained significantly higher means than the BA group for the following variables: R, I, LSI-AC and LSQ-AC. The BA group obtained significantly higher means for the following variables: A, S, C and LSQ-CE.

- Discriminant analysis of the combined BSc and BA group with the SDS as variable indicated that five of the six Holland personality types (I S A C E) made a significant contribution in distinguishing between the two fields of study.

- Discriminant analysis of the combined BSc and BA group with the LSI as variable indicated that two of the four learning abilities (AC and CE) made a significant contribution in distinguishing between the two fields of study.

- Discriminant analysis of the combined BSc and BA group with the LSQ as variable indicated that one of the four learning abilities (AC) made a significant contribution in distinguishing between the two fields of study.

- Discriminant analysis of the combined BSc and BA group with the SDS, LSI and LSQ as variables indicated that five of the six Holland personality types (I S A C E) and one of the four learning abilities (LSI-AC) made a significant contribution in distinguishing between the two fields of study.

- Factor analysis of the combined BSc and BA group yielded five factors:

  - two bipolar factors representing the AC-CE and RO-AE learning abilities axes of the two learning style instruments;
  - a people-oriented factor consisting of the personality pattern ESC;
  - a group factor comprising the four learning abilities (AC CE AE RO) of the LSI;
  - and a bipolar personality pattern factor REI versus S.

- Factor analysis of the BSc group yielded four factors:

  - a bipolar factor representing the AE-RO learning abilities axis for both learning style instruments;
  - a bipolar factor representing the AC-CE learning abilities axis for the LSQ
  - a group factor representing a personality pattern ERC;
  - and a group factor representing the Accommodator learning style (CE and AE) for the LSI.

- Factor analysis of the BA group yielded four factors:

  - a group factor consisting of the four learning abilities (AC CE AE RO) of the LSI, the AC learning ability of the LSQ and the I personality type;
  - a bipolar factor representing the AE-RO learning abilities axis for both learning style instruments;
  - a bipolar factor representing the AC-CE learning abilities axis for the LSQ;
  - and a personality pattern factor combining a ESC personality pattern with the CE learning ability of the LSI.

- Intercorrelations for Holland personality types and Kolb learning abilities as measured by the LSI for the BSc group demonstrated the following:

  - the CE learning ability was significantly correlated with the Social personality type;
  - the RO learning ability was significantly negatively correlated with the Enterprising personality type;
  - the AC learning ability was significantly correlated with the Artistic, Investigative and Enterprising personality types.

- Intercorrelations for Holland personality types and Kolb learning abilities as measured by the LSI for the BA group demonstrated the following:

  - the CE learning ability was significantly correlated with the Artistic and Enterprising personality types;
  - both the AC and AE learning abilities were significantly correlated with the

Investigative personality type.

- Intercorrelations for Holland personality types and Kolb learning abilities as measured by the LSQ for the BSc group demonstrated the following:
  - the RO learning ability was significantly negatively correlated with the Enterprising and Realistic personality types;
  - the AE learning ability was significantly correlated with the Enterprising personality type.
- Intercorrelations for Holland personality types and Kolb learning abilities as measured by the LSQ for the BA group demonstrated the following:
  - the AC learning ability was significantly correlated with the Investigative personality type;
  - the AE learning ability was significantly correlated with the Enterprising personality type.

A comparison of the psychometric properties of the LSI and the LSQ is given in section 7.4.3. Results pertaining to the proposed integrated model of vocational personality types, and learning abilities and styles are discussed in section 7.5. Although there are some findings contrary to the proposed integrated model, most of the findings reported in this chapter confirm the model. It was decided not to modify the model as proposed in Chapter 5 in the light of the present research findings.

In the following chapter a summary of the research report will be given and recommendations based on the findings of the study will be made.

CHAPTER EIGHT

SUMMARY AND RECOMMENDATIONS

8.1 SUMMARY

Institutions of higher learning face a significant task in equipping large and diverse student populations as lifelong learners able to meet the needs of a challenging and changing labour market. The choice of a field of study and subsequent occupation is a major decision a student faces with implications not only for the student's success and well-being, but also for the country's economy. Institutions of higher education need to promote all aspects of student development, namely academic development, career development and personal development, in their task of providing high-level manpower.

The purpose of this study was to explore the relationship between vocational personality and learning style as aspects of student development and the broad aims of the study can be stated as follows:

- to integrate John Holland's model of vocational personalities and David Kolb's model of learning abilities and styles;
- to use subjects representing different cultural groups from two fields of study at the University of Pretoria in an empirical study to investigate the possible integration of the two models;
- to investigate the psychometric properties of two normative forms of Kolb's Learning Style Inventory.

The subjects used in the empirical part of the study were first-year university students registered for English courses for either a science or a human sciences degree. The study was thus placed in the context of student development. A literature study of student development was undertaken (see Chapter 2). Theories on student development were described and factors affecting student development were identified. Student development is represented by academic development, career

development and personal development. In this study Kolb's theory of experiential learning represents an aspect of academic development and Holland's theory of person-environment interaction represents an aspect of career development.

In order to develop a theoretical integration of Holland's model of vocational personalities and Kolb's model of learning abilities and styles a literature study on these two theories was done.

Holland's theory of vocational personalities and work environments was described in Chapter 3. The six personality types (Realistic, Investigative, Artistic, Social, Enterprising, Conventional) as well as concepts and assumptions central to the theory were described and some practical uses of the theory were highlighted. A criticism of the theory was given.

Kolb's theory of experiential learning and learning styles was described in Chapter 4. Characteristics of experiential learning and the four learning abilities (Concrete Experience, Reflective Observation, Abstract Conceptualization, Active Experimentation) and four learning styles (Diverger, Assimilator, Converger, Accommodator) were described. Some practical uses of the theory were highlighted and criticism of the theory was given. Special attention was paid to the literature on the Learning Styles Inventory (LSI), the instrument Kolb devised to assess learning abilities and styles. Kolb's theory has been well received, but criticism of the psychometric properties of the LSI, both the original 1976 version and the revised 1985 version, undermines the confident use of the LSI in research, educational and counselling situations. The LSI is an ipsative instrument. The usual statistical procedures used are not applicable to ipsative measures because of the lack of independence and negative correlations among items. 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. For these reasons two normative versions of the LSI were used in this study (see 6.3.3).

A theoretical integration of Holland's model of vocational personality types and Kolb's model of learning abilities and styles was proposed in Chapter 5. Information on Holland's personality types and Kolb's learning abilities and styles was brought

together. Research results in which both Holland and Kolb measurement instruments were used were reported and discussed in terms of the proposed integrated model. A description and visual representation of the integrated model was then presented (see 5.3 and Figure 5.1).

The research design and procedure for the empirical part of this study are described in Chapter 6. As stated above, the subjects used in the empirical part of the study were first-year university students registered for English courses for either a science (BSc) or a human sciences (BA) degree.

The psychometric properties of the two measures of learning style, the Learning Style Inventory (LSI) and the Learning Style Questionnaire (LSQ), were investigated. Item analysis of each instrument was done and the internal reliability of the four learning ability scales was determined using the alpha coefficient. The frequency distribution of the four learning styles for each instrument for the BSc and BA groups was determined.

The interaction of vocational personality type as measured by the Self-Directed Search (SDS) and learning abilities and styles as measured by the LSI and LSQ for the BSc and BA groups was investigated. Hotelling's T test was used to test for significant differences between the average profiles of these two groups. Discriminant analysis and factor analysis was then carried out. Intercorrelations for personality types and learning abilities for the two groups were determined. Frequency distributions of personality types and learning styles for the two groups were determined.

The results of the empirical study described in Chapter 6 were reported in Chapter 7.

The internal reliability of the LSI and LSQ was found to be relatively high. The bipolar dimensions (AC-CE and AE-RO) theorized by Kolb were confirmed for the LSQ and partially confirmed for the LSI. The presence of a response bias for both instruments was suspected. It would appear that the LSI was more successful than the LSQ in differentiating learning abilities and styles in the sample used.

Results pertaining to the proposed integrated model of vocational personality types, and learning abilities and styles were discussed in section 7.5. Although there were

some findings contrary to the proposed integrated model, most of the findings confirmed the model. It was decided not to modify the model as proposed in Chapter 5 in the light of the present research findings.

The theories and instruments used in this study show promise for use in further theory building, career counselling and academic advising. Recommendations arising from this study are presented in the following section.

8.2 RECOMMENDATIONS

The recommendations pertain to the two main aims of the study:

- to integrate John Holland's model of vocational personality types and David Kolb's model of learning abilities and styles; and
- to investigate the psychometric properties of two normative forms of Kolb's Learning Style Inventory, namely the Learning Style Inventory (LSI) and the Learning Style Questionnaire (LSQ).

Further research is needed to validate the proposed integrated model and to gather more information on the two normative measures of learning abilities and styles.

8.2.1 Further research to validate the proposed integrated model

The proposed integrated model of vocational personality types and learning abilities and styles (see Chapter 5) is based on the theories of John Holland (see Chapter 3) and David Kolb (see Chapter 4). These theories were developed in the context of North American cultures. In this study a multicultural student sample was used, but the under-representation of whites in the BA group (see Table 6.3) precluded an investigation of possible differences according to cultural group. The Coloured, Indian and Asian cultural groups were under-represented in both the BSc and BA groups. Gender could also not be used as a variable due to the under-representation of males in the BA group (see Table 6.2).

Further possible research should include sufficient subjects of diverse cultural groups

and both gender groups to investigate the validity of the model, particularly for the South African context. In this study only first-year students registered for English courses for degrees in science and the human sciences were included. Students in all fields of study and in different year groups need to be included as well. The LSI and LSQ would need to be translated to include Afrikaans-speaking students.

8.2.2 Further research to investigate the psychometric properties of the LSI and the LSQ

8.2.2.1 Suspected response bias

A five point Likert scale was used for the LSI (see Appendix B) where:

1 = Not at all like me
2 = Somewhat unlike me
3 = Neutral
4 = Somewhat like me
5 = Very much like me

Options 1 and 2 were endorsed at most by 35% of respondents. For 28 out of 48 items options 1 and 2 where used by 10% or less of respondents. The relatively high item means (see Table 7.2) reflect this. This could indicate a response bias with respondents favouring socially acceptable responses.

Each item of the LSQ (see Appendix C) consists of a word pair on a five-point semantic differential scale. Each of the two words in an item represent opposite learning abilities. A suspected response bias (see 7.2.4) favouring "logical" (Abstract Conceptualization) words above "feelings" (Concrete Experience) words, and favouring "active" (Active Experimentation) words above "passive/reflective" (Reflective Observation) words was noted.

Future possible research needs to monitor whether these normative instruments are susceptible to a response bias or whether this is a manifestation for this particular sample.

The majority of subjects in this study were not English first language speakers (see Table 6.1). These students may have experienced difficulty understanding the words used for the LSQ semantic differential scale, especially as the words are presented out of the context of a sentence. The relevance of the LSQ for subjects who are not English first language speakers needs to be established.

8.2.2.2 Reliability and validity

The same argument as stated in section 8.2.1 holds with respect to further possible research on the LSI and the LSQ. Further research should include sufficient subjects of diverse cultural groups and both gender groups to further investigate the reliability and validity of these instruments, particularly for the South African context. In this study only first-year students registered for English courses for degrees in science and the human sciences were included. Students in all fields of study and in different year groups need to be included as well. The LSI and LSQ would need to be translated to include Afrikaans-speaking students.

In this study the internal reliability of the two instruments was found to be relatively high. The test-retest reliability of the instruments needs to be established. Further investigation of the validity of the instruments for diverse samples needs to be undertaken.

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APPENDIX A

BIOGRAPHICAL INFORMATION

QUESTIONNAIRE

BIOGRAPHICAL INFORMATION

Student number _____

Today's date: Day _____
Month _____
Year _____

Gender: Male |___| Female |___|

Age: _____ years _____ months

Home language (mark only one with a cross):

English	
Afrikaans	
African language(s)	
English + Afrikaans	
English + African language	
English + other	
Afrikaans + African language	
Other	

Cultural group:

White	
African	
Coloured	
Indian	
Asian	

Faculty: Biological and Agricultural Sciences

Office use only

|__|__|__|__|__|__|__|__|
V332 1-8
Card number
V333 |0|7| 9-10
V334 |___|___| 11-12
V335 |___|___| 13-14
V336 |___|___| 15-16

V337 |___| 17

V338 |___|___| 18-19
V339 |___|___| 20-21

V340 |___| 22

V341 |___| 23

V343 |0|0|1| 24-26
Group 1 or 2:
V347 |1| 27

APPENDIX B

LEARNING STYLE INVENTORY (Normative version)

Obtained from:

Prof Marshall Geiger
Department of Accounting
College of Business Administration
University of Rhode Island
Kingston, Rhode Island 02881 - 0802
U.S.A.

LEARNING STYLE INVENTORY (Normative version)

Directions: For the following 48 items please indicate how well you think each one corresponds to your particular learning style. Using a rating scale of "5" being very much like you, to "1" being not at all like you. Please **circle** the appropriate rating for each item.

<---------- 5	---------- 4	---------- 3	---------- 2	---------- 1 ---------->
Very much like me	Somewhat like me	Neutral	Somewhat unlike me	Not at all like me

Student number _____

Office use only

|__|__|__|__|__|__|__|__|

V240 1-8

Card number

V241 |0|5| 9-10

1.	When I learn I like to deal with my feelings.	5 4 3 2 1	V242 | |11
2.	I learn best when I listen and watch carefully.	5 4 3 2 1	V243 | |12
3.	When I am learning I am quiet and reserved.	5 4 3 2 1	V244 | |13
4.	I learn by thinking.	5 4 3 2 1	V245 | |14
5.	When I learn I like to try things out.	5 4 3 2 1	V246 | |15
6.	When I am learning I am a logical person.	5 4 3 2 1	V247 | |16
7.	I learn best from personal relationships.	5 4 3 2 1	V248 | |17
8.	When I learn I look at all sides of issues.	5 4 3 2 1	V249 | |18
9.	When I learn I take my time before acting.	5 4 3 2 1	V250 | |19
10.	I learn best when I rely on my ideas.	5 4 3 2 1	V251 | |20
11.	When I am learning I am a rational person.	5 4 3 2 1	V252 | |21
12.	When I am learning I am a responsible person.	5 4 3 2 1	V253 | |22
13.	When I learn I like to be active.	5 4 3 2 1	V254 | |23
14.	I learn best when I rely on my feelings.	5 4 3 2 1	V255 | |24
15.	When I learn I feel personally involved in things.	5 4 3 2 1	V256 | |25

continue to next page

5	4	3	2	1
Very much like me	Somewhat like me	Neutral	Somewhat unlike me	Not at all like me

Office use only

16.	When I am learning I am an observing person.	5 4 3 2 1	V257 | | 26
17.	I learn best when I work hard to get things done.	5 4 3 2 1	V258 | | 27
18.	I learn best when I am receptive and open minded.	5 4 3 2 1	V259 | | 28
19.	When I learn I evaluate things.	5 4 3 2 1	V260 | | 29
20.	I learn best when I am practical.	5 4 3 2 1	V261 | | 30
21.	I learn best when I am careful.	5 4 3 2 1	V262 | | 31
22.	When I am learning I am an accepting person.	5 4 3 2 1	V263 | | 32
23.	I learn best when I rely on my observations.	5 4 3 2 1	V264 | | 33
24.	When I learn I like ideas and theories.	5 4 3 2 1	V265 | | 34
25.	I learn best from rational theories.	5 4 3 2 1	V266 | | 35
26.	When I learn I like to analyze things, break them down into their parts.	5 4 3 2 1	V267 | | 36
27.	I learn by watching.	5 4 3 2 1	V268 | | 37
28.	I learn by feeling.	5 4 3 2 1	V269 | | 38
29.	I learn best when I rely on logical thinking.	5 4 3 2 1	V270 | | 39
30.	When I learn I like to watch and listen.	5 4 3 2 1	V271 | | 40
31.	I learn best when I trust my hunches and feelings.	5 4 3 2 1	V272 | | 41
32.	When I learn I like to think about ideas.	5 4 3 2 1	V273 | | 42
33.	When I am learning I have strong feelings and reactions.	5 4 3 2 1	V274 | | 43
34.	When I am learning I am responsible about things.	5 4 3 2 1	V275 | | 44

continue to next page

<5 Very much like me — 4 Somewhat like me — 3 Neutral — 2 Somewhat unlike me — 1 Not at all like me>

Office use only

35.	When I am learning I am an active person.	5 4 3 2 1	V276 | | 45
36.	I learn best from observation.	5 4 3 2 1	V277 | | 46
37.	I learn best when I can try things out.	5 4 3 2 1	V278 | | 47
38.	When I learn I am open to new experiences.	5 4 3 2 1	V279 | | 48
39.	I learn by doing.	5 4 3 2 1	V280 | | 49
40.	When I learn I like to observe.	5 4 3 2 1	V281 | | 50
41.	I learn best from a chance to try out and practice.	5 4 3 2 1	V282 | | 51
42.	When I learn I get involved.	5 4 3 2 1	V283 | | 52
43.	When I am learning I tend to reason things out.	5 4 3 2 1	V284 | | 53
44.	When I learn I like to be doing things.	5 4 3 2 1	V285 | | 54
45.	When I am learning I am an intuitive person.	5 4 3 2 1	V286 | | 55
46.	When I am learning I am a reserved person.	5 4 3 2 1	V287 | | 56
47.	I learn best when I analyze ideas.	5 4 3 2 1	V288 | | 57
48.	When I learn I like to see results from my work.	5 4 3 2 1	V289 | | 58

APPENDIX C

LEARNING STYLE QUESTIONNAIRE, 1985

Authors:

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LEARNING STYLE QUESTIONNAIRE

Directions: Following is a list of 40 word pairs. For each pair, decide which one of the two words is more characteristic of your learning style when compared to the other word. Then decide if the word describes what you generally prefer. If it is most of the time, then mark the extreme response, A or E, whichever is appropriate. If it is over half the time but not most of the time, then mark the next response, B or D, whichever is appropriate. If you cannot decide between the two words, mark C. Please **circle** the appropriate rating for each item and only circle **one** letter per item.

Student number _____

Office use only

|__|__|__|__|__|__|__|__|

V290 1-8

Card number

V291 | 0 | 6 | 9-10

Which one of the two words is more characteristic of your learning style when compared to the other word?

The word to the left is characteristic of you — The word to the right is characteristic of you

< A — B — C — D — E >

A	B	C	D	E
GENERALLY (Most of the time)	OVER HALF THE TIME	ABOUT HALF THE TIME	OVER HALF THE TIME	GENERALLY (Most of the time)

1.	spontaneous	... A - B - C - D - E ...	questioning	V292	|__| 11
2.	observation	... A - B - C - D - E ...	participation	V293	|__| 12
3.	reserved	... A - B - C - D - E ...	demonstrative	V294	|__| 13
4.	sensing	... A - B - C - D - E ...	thinking	V295	|__| 14
5.	premonition	... A - B - C - D - E ...	reason	V296	|__| 15
6.	active	... A - B - C - D - E ...	reserved	V297	|__| 16
7.	participation	... A - B - C - D - E ...	observation	V298	|__| 17
8.	watching	... A - B - C - D - E ...	acting	V299	|__| 18
9.	observing	... A - B - C - D - E ...	doing	V300	|__| 19
10.	deliberative	... A - B - C - D - E ...	impulsive	V301	|__| 20

continue to next page

APPENDIX C

Which one of the two words is more characteristic of your learning style when compared to the other word?

The word to the left is characteristic of you — The word to the right is characteristic of you

< A	B	C	D	E >
GENERALLY (Most of the time)	OVER HALF THE TIME	ABOUT HALF THE TIME	OVER HALF THE TIME	GENERALLY (Most of the time)

				Office use only	
11.	acting	... A - B - C - D - E ...	reflecting	V302	|__| 21
12.	perceptual	... A - B - C - D - E ...	intellectual	V303	|__| 22
13.	perform	... A - B - C - D - E ...	examine	V304	|__| 23
14.	emotional	... A - B - C - D - E ...	rational	V305	|__| 24
15.	consider	... A - B - C - D - E ...	impulsive	V306	|__| 25
16.	operative	... A - B - C - D - E ...	watchful	V307	|__| 26
17.	reason	... A - B - C - D - E ...	hunch	V308	|__| 27
18.	impulsive	... A - B - C - D - E ...	planning	V309	|__| 28
19.	produce	... A - B - C - D - E ...	watch	V310	|__| 29
20.	witness	... A - B - C - D - E ...	exhibit	V311	|__| 30
21.	feeling	... A - B - C - D - E ...	thinking	V312	|__| 31
22.	ponder	... A - B - C - D - E ...	do	V313	|__| 32
23.	involved	... A - B - C - D - E ...	distant	V314	|__| 33
24.	analytical	... A - B - C - D - E ...	emotional	V315	|__| 34
25.	intuitive	... A - B - C - D - E ...	reasoning	V316	|__| 35
26.	careful	... A - B - C - D - E ...	emotional	V317	|__| 36
27.	logical	... A - B - C - D - E ...	sentimental	V318	|__| 37
28.	perception	... A - B - C - D - E ...	reason	V319	|__| 38
29.	thinking	... A - B - C - D - E ...	instinctive	V320	|__| 39
30.	hunch	... A - B - C - D - E ...	logical	V321	|__| 40
31.	passive	... A - B - C - D - E ...	active	V322	|__| 41
32.	doing	... A - B - C - D - E ...	watching	V323	|__| 42
33.	view	... A - B - C - D - E ...	execute	V324	|__| 43
34.	resolving	... A - B - C - D - E ...	feeling	V325	|__| 44
35.	reflecting	... A - B - C - D - E ...	performing	V326	|__| 45
36.	intellectual	... A - B - C - D - E ...	emotional	V327	|__| 46
37.	reflective	... A - B - C - D - E ...	productive	V328	|__| 47
38.	evaluative	... A - B - C - D - E ...	sensitive	V329	|__| 48
39.	solve	... A - B - C - D - E ...	reflect	V330	|__| 49
40.	exercise	... A - B - C - D - E ...	view	V331	|__| 50